

SEG 100 Conference: Celebrating a Century of Discovery

R1

Magmatic controls on metal endowments of porphyry Cu-Au deposits

Massimo Chiaradia

Department of Earth Sciences - University of Geneva, Geneva, Switzerland

In this review I illustrate the processes controlling magma fertility in the formation of porphyry Cu-Au deposits. By magma fertility I mean here all magmatic parameters (e.g., metal and volatile contents, magma and fluid volumes) that may result in higher amounts of metals which are exsolvable from the magma. Mantle source processes seem to play a fundamental role in the enrichment of primary melts with H₂O, S and Cl, all essential ingredients to form porphyry deposits, but no particular role in Cu enrichment. Cu-rich porphyry Cu-Au deposits (i.e., with Au/Cu $\sim 4 \cdot 10^{-6}$) are associated with large magmatic volumes accumulated in the lower thick crust of continental arcs during long-lived periods of compression in a syn-subduction environment. Mineralization occurs after such accumulations have reached significant volumes and is the result of the transfer of hydrous magmas from deep to shallower crustal levels, probably favored by tectonic stress changes. Au-rich porphyry Cu-Au deposits (i.e., with Au/Cu $\sim 80 \cdot 10^{-6}$) are associated with magmatic systems that have evolved at overall shallower crustal levels and for this reason can be found in geodynamic settings characterized by thinner crust (e.g., island arcs with intermediate crust thickness) and/or in variably extensional settings occurring above a slab-metasomatized mantle (post-subduction setting, extensional syn-subduction setting). The six largest Au-rich porphyry Cu-Au deposits ($> \sim 1300$ tons Au) are associated with variably alkaline magmas, that are typical of post-subduction and/or extensional settings, suggesting a petrogenetic control on the Au-rich nature of these deposits.