Orogenic gold systems in the Andes of South America

Corresponding author: Steffen Hagemann and G. Hagemann, UWA-CET, steffen.hagemann@uwa.edu.au

The Paleozoic Andean belt and associated orogenic (including intrusion related) gold systems stretches over 2500km from Columbia in the north to Argentina in the south. It has historically been undervalued with respect to orogenic gold systems (compared to porphyry and epithermal-related Au mineralisation in the western Andes), despite continuous exploitation of the world class (>8 Moz Au) orogenic Pataz-Parcoy gold district in north-central Peru and recent exploration success in southern Peru at the Ollachea orogenic gold deposit (>2.6 Moz Au indicated + inferred resources).

The Pataz-Parcoy gold district is hosted in Paleozoic (600 to 200 Ma) rocks which correspond to a major epoch of continental growth. During this period the tectonics and thermal evolution of convergent plate boundaries in accretionary and collisional orogens resulted in the concentrations of one billion or more ounces of gold, particularly in giant deposits (Muruntau and Kumtor in the Tien Shan mountain belt). Paleogeographic reconstruction of the Gondwana supercontinent demonstrates that in South America the Carboniferous Pataz-Parcoy Au-belt in northern Peru and the Sto. Domingo-Amayapampa belt in southern Peru and Bolivia correlate with mid-Ordovician turbidite hosted Au belts in northern Argentina and the Devonian Sierras Pampeanas Au belt in central Argentina. To the north of Peru the Paleozoic Andean belt ranges through Ecuador into Colombia.

Gold deposits in the Pataz – Parcoy gold district are characterized by quartz-carbonate-pyrite-arsenopyrite, ±sphalerite, ±galena) veins in the mainly granodioritic Pataz batholith (Haeberlin, 2010 and Witt et al., 2011). Mineralization is structurally controlled by a series of NNW trending shear zones and associated hydrothermally altered wallrock and vein system. In south Peru the Santo Domingo-Amayapampa Au belt contains largely shear zone and fold controlled, metasediment-hosted orogenic gold deposits. The recently discovered Ollachea orogenic gold deposit is hosted in slate, within a series of shear zones. Gold mineralization is controlled by locally boudinaged quartz-sulfide (pyrrhotite) veins within graphite rich black slates. The host rocks are hydrothermally sulfidized and silicified. In Argentina two major mineralization epochs contain orogenic gold systems (Fogliata and Hagemann, 2011): (1) Ordovician turbidite-hosted quartz-sulfide (mainly arsenopyrite and pyrite) veins, controlled by brittle-ductile shear zones and related folds, host mesozonal gold deposits (e.g., Minas Azules). (2) Devonian metamorphosed (greenschist to upper amphibolite facies) schist, granite and gneiss hosts gold mineralization, which is also controlled by ductile to brittle-ductile shear zones (e.g., Candelaria, Skirrow et al., 2000). In Colombia the Paleozoic El Carmen and La Ye deposits are classified as orogenic gold systems hosted in tonalites. The GranColombia gold deposits (> 5 Moz Au) in the Segovia-Remedios Au district displays typical orogenic/intrusion-related gold style mineralization, although Au mineralization is now interpreted to be Cretaceous in age. This young orogenic Au age, perhaps, points to an additional, younger orogenic gold style epoch.

Based on the favourable geological setting, including structures such as brittle-ductile shear zones that contain quartz-sulfide veins and spatially restricted hydrothermal alteration, the continental-
scale, Paleozoic Andean gold belt clearly has the potential to contain, besides the world-class Pataz-Parcroy gold district, additional multi-million ounces orogenic/intrusion-related gold systems.