The Pataz gold province, Peru: new insights for exploration of Carboniferous mesothermal gold deposits in the Eastern Cordillera of the Central Andes.

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The Pataz gold province is situated 500 km north of Lima on the Eastern Cordillera of the North Peruvian Andes. The mineralized belt covers an area 160 km long and 1 to 3 km wide, extending first along the right side of the Marañón Valley from Bolívar to Pataz (Schreiber et al., 1990; Haeberlin et al., 1999), then striking southeastwards to Parcoy (Vidal et al., 1995; Macfarlane et al., 1999) and Buldibuyo. It includes numerous quartz-sulfide veins, located within the external part of the granodioritic Pataz Batholith close to the contact with a low-grade metamorphic Proterozoic basement overlain by early Paleozoic volcano-sedimentary units. The grades in the oreshoots vary between 7 to 15 Au g/t, exceptionally up to 120 Au g/t. The annual production of the province, including the operating mines in the Parcoy district, amounted in 1999 to 400'000 ounces, which represents one tenth of the gold supply of Peru.

The auriferous veins of the Pataz province are classified as structurally-hosted lode gold deposits, most commonly named mesothermal or orogenic gold deposits. The lodes share over the entire mineralized belt several common and typical field characteristics, including:

(1) strong lithological and in particular rheological control by the host-rock, as the lodes occur as continuous kilometric quartz veins if enclosed by the Carboniferous batholith, but as split and sheared saddle-reefs if hosted within the folded Ordovician slates.
(2) homogeneity in the strikes, in particular within the batholith, where they are predominantly oriented N-S to NW-SE with 30 to 60° dips to the E-NE. Subordinate, they occur exceptionally as subhorizontal and also as E-W south-dipping structures.
(3) spatial association with brecciated shear-zones and their related brittle-ductile features such as tension gashes, rocks slivers, laminated-sulfide textures and Riedel structures.
(4) simple two-stage sulfide-rich sequence, with a first paragenesis composed of pyrite and arsenopyrite, and a second one postdating a fracturation phase with galena, sphalerite, Sb-sulfosalts, electrum and native gold (∅ = 1 to 300 μ).
(5) pervasive low-temperature hydrothermal alteration of the wallrock, consisting in plutonic rocks, of sericitization with minor chloritization, carbonitization, and pyritization.

The auriferous mineralization, dated at 312 to 314 Ma by $^{40}Ar/^{39}Ar$ on sericite (Haeberlin et al., 1999), is significantly younger than its main host-rock, the 329 Ma old (Vidal et al., 1995) Pataz Batholith, thus excluding any genetic link between the two events. The batholith only served as a favorable rheological and chemical locus for the formation of economic and regular veins. The veins were emplaced along oblique-sinistral brittle-ductile shear zones resulting from a local NW-SE compression, within a regional extensional tectonic setting, characterized by molassic deposition in Carboniferous basins. In the Pataz province, neither magmatism nor metamorphism appear to be directly related to

the genesis of the mesothermal lodes. The paragenetic and structural homogeneity of the auriferous veins along this 160-km long province, coupled with stable and lead isotope determinations, argues for a large crustal-scale fluid migration event.

The Pataz province is the northernmost part of a mesothermal Au and Sb belt in the Eastern Andean Cordillera that extends down to northern Argentina (Haeberlin et al., 1999). The Pataz gold lodes display similar structural settings and paragenetic sequences as a large number of saddle-reef Au ±Sb deposits, such as La Rinconada and Santo Domingo in southeastern Peru, Yani-Aucapata in the Cordillera Real of Bolivia and Sierra de la Rinconada in northern Argentina. These saddle-reefs are systematically hosted by early Paleozoic turbidites, are structurally controlled by anticline axes, and contain a two-stage sulfide paragenesis, locally with a late antimony stage at shallower levels of the mineralizing system. Despite the absence of radiometric ages, field observations may constrain the timing of their emplacement after late Devonian folding but before intrusion of the large Permian batholiths. On a worldwide scale, the Carboniferous Andean gold belt shows more affinities with the shear-zone hosted gold deposits in the French Massif Central and in the Bohemian Massif, in particular in their tectonic contexts, ages and parageneses, than with the classical mesothermal Archean deposits of the Abitibi and Yilgarn provinces.

In contrast to the epithermal systems, only little attention has been devoted in the Andes to the potential of this mesothermal gold belt. If we consider the ubiquity of the Au-As-Sb-W occurrences, some of them known since the Inca epoch, and the size of the auriferous placers in the Madre de Dios and Beni basins, it should be emphasized that the Eastern Cordillera of the Central Andes offers stimulating perspectives for the discovery of new deposits and for the reevaluation of old mining works, either in Peru, Bolivia or northern Argentina. For mineral exploration, the brittle-ductile quartz veins in Carboniferous batholiths and the saddle-reefs in the Lower Paleozoic anticlines represent most promising targets for high-grade mesothermal lode gold deposits. From an economic viewpoint, the relatively high-grade intrusion-hosted deposits are fitted for medium-size mining (e.g. Pataz), and perhaps the turbidite-hosted deposits could represent candidates for open pit operations.

References

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