

Precambrian orogens and their hypozonal orogenic gold ores

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High-temperature (hypozonal) orogenic gold deposits formed at conditions of 500–700°C and 2–7 kbar in syn- to post-peak metamorphic shear zones, and appear to be restricted to the Precambrian. Their formation occurred between ca. 3030 Ma (New Consort, South Africa) and ca. 550 Ma (Navachab, Namibia), at an apparent geothermal gradient of 40 – 80°C/km, which is similar to mesozonal orogenic gold deposits. The PT conditions of orogenic gold formation define a linear trend resembling terrane exhumation, largely below the granite wet solidus and in the 1-phase stability field for aqueous-carbonic ore fluid compositions (Kolb et al., 2015).

Phanerozoic mesozonal orogenic gold deposits formed predominantly in external accretionary orogens with only a few and smaller examples in collisional orogens. The gold deposits in external orogens are hosted by shear zone-controlled veins in accreted oceanic and island arc terranes.

In spite other models for hotter Precambrian orogens exist, hypozonal deposits are hosted by shear zones separating greenstone belts from granite-gneiss terranes and are locally around metamorphic core complexes (in a setting similar to Phanerozoic examples in accretionary orogens). Some Archaean and most Proterozoic hypozonal deposits are hosted in collisional orogens. A possible explanation for the lack of Phanerozoic hypozonal orogenic gold deposits is a different thermal regime of the Precambrian crust, where higher metamorphic grades are reached at higher crustal levels, which however did not result in fundamentally different orogenic processes. Hypozonal orogenic gold deposits formed in the centre or foreland of Precambrian orogens during the collision stage, when the terranes are uplifted.

References:

Kolb, J., Dziggel, A. and Bagas, L., 2015. Hypozonal lode gold deposits: a genetic concept based on a review of the New Consort, Renco, Hutti, Hira Buddini, Navachab, Nevoria and The Granites deposits. *Prec. Res.* 262, 20–44.