Genesis of the Hybridized Awakmas Gold System, Indonesia

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Awakmas is the largest metamorphic rock-hosted gold deposit in Indonesia, but its genetic framework remains poorly understood. This study examined a comprehensive dataset comprising 12,500 meters of diamond drill core logging, 216 thin and polished sections, and 9,456 assay results.

The mineralized zones within the deposit define composite orebodies that record three distinct hydrothermal events: (1) a pre-collisional phase, (2) a syn-collisional phase, and (3) a post-collisional phase. Genetic considerations suggest that the orebodies are hybrid in nature, with each phase contributing to the overall gold endowment.

During the collision between the Sula Spur and the West Arm of Sulawesi, pre-collisional quartz veins underwent metamorphism–evidenced by interlocking quartz grain textures, pervasive undulatory extinction, and parallel-oriented muscovite–and the pre-collisional vein zones simultaneously acted as planar structural anisotropies; gold grades of up to ~5 g/t (avg. ~0.5 g/t) occur exclusively in the metamorphosed pre-collisional quartz veins (Vein1). These structural anisotropies controlled the development of shear zones and localized the flow of hydrothermal fluids, leading to the formation of syn-collisional veins (Vein2). These veins are typically folded and/or discontinuous, mainly consist of quartz-albite-ankerite, lack alteration selvages, and contain low gold grades (avg. 0.25 g/t). Both Vein1 and Vein2 are crosscut by post-collisional quartz-albite veins (Vein3), which are typically accompanied by albite-ankerite selvages. Hydrothermal breccias containing clasts of metamorphic wall rocks, Vein1, and Vein2, cemented by quartz-albite, are common and likely related to the same post-collisional hydrothermal activity, which is interpreted to be associated with post-collisional extension. This phase is considered a major contributor to the district's gold endowment, with Vein3 or hydrothermal breccias containing up to ~10 g/t gold (avg. ~2 g/t).

This hybrid deposit, which contains pre-, syn-, and post-collisional mineralization, helps explain why multiple styles and ages of gold mineralization spatially overlap in several gold deposits worldwide.