High-K to Shoshonitic Magmatism Across the Northern Archean Kéména Man Margin (Guinea): Implications for the Late Eburnean Orogenic Gold Mineralization

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The West African craton, including two principal Precambrian domains, the Réguibat Rise to the north and the Leo-Man Rise to the south, hosts a number of world-class gold deposits formed during a narrow time window at the late stages of the Eburnean orogeny, between ca. 2.15 and 2.07 Ga. The Leo-Man Rise comprises the Kéména-Man Domain, an Archean cratonic nucleus in the southwest, surrounded by Paleoproterozoic terranes referred to as the Baoulé-Mossi Domain. The Baoulé-Mossi Domain, which hosts the bulk of the gold endowment, consists of low-grade Birimian greenstone belts intruded by tonalite-trondhjemite-granodiorite (TTG) suites and potassic granitoids.

As part of the orogenic cycle, a suite of intermediate and felsic weakly deformed to unfoliated potassic intrusive rocks was emplaced from ca. 2.10 to 2.07 Ga along the Paleoproterozoic margin of the Archean Kéména Man craton in Guinea. These high-K to shoshonitic intrusive rocks are characterized by (1) enrichment in LILE and LREE, (2) depletion in HFSE, and (3) strong Pb spikes. These features may suggest that an enriched component (metasomatized mantle source by subduction or crustal contamination during magma ascent) was involved in the genesis of these plutonic rocks.

These Paleoproterozoic potassic rocks present two different Hf signatures, suggesting two distinct sources. The first group is characterized by positive $\varepsilon Hf_{(2.1\ Ga)}$ values and Hf model ages at ca. 2.7 to 2.4 Ga, pointing to a mantle source or to a juvenile mafic lower crust source enriched or formed not a long time before these intrusions. The second group presents clearly negative $\varepsilon Hf_{(2.1\ Ga)}$ values and calculated Hf model ages at ca. 3.7 to 3.2 Ga, implying that they have formed by reworking of a preexisting Paleoarchean crust. The presence of inherited Archean zircon grains in this second group of intrusive rocks is also consistent with the reworking of an old Archean crust.

A geodynamic model explaining the geochemical and isotopic features of the Paleoproterozoic potassic suites analyzed involves the convergence of the juvenile Paleoproterozoic Baoulé-Mossi Domain toward the old Archean Kéména Man nucleus. In this convergence scenario, the collision between Archean and Paleoproterozoic blocks leads to the mantle lithosphere delamination, allowing for explanation of both Hf signatures and the geochemical affinity of these potassic intrusive rocks dated from ca. 2.10 to 2.07 Ga. A previous subduction period is invoked to explain the presence of a metasomatized mantle. Through this geodynamic process, the reworking of metasomatized lithospheric mantle through the remobilization of residual Au-rich cumulates left in the deep lithosphere by previous arc magmatism may have been a fundamental process for the formation of late orogenic gold deposits in the Baoulé-Mossi Domain.