The tectono-magmatic framework to gold mineralization in the Sadiola-Yatela gold camp and implications for the paleotectonic setting of the Kédougou-Kénieba inlier, West Africa

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The Kédougou-Kénieba inlier is the westernmost exposure of Birimian crust in the West African Craton and a world-class gold province as its host several multi-million ounce gold deposits (e.g., Sadiola, Yatela, Yalea, Gara, Gounkoto, Massawa, Fékola). In addition to this gold endowment, the inlier also hosts a large iron resource associated with the Falémé Fe-skarns. The Sadiola-Yatela gold camp is located in Mali and hosted by detrital sedimentary rocks (e.g., wackes, arenites, siltstones, and argillites) and impure carbonates of the Kofi Series. Limited detrital zircon geochronological data indicates that rocks of the Kofi Series deposited between ca. 2120 and 2100 Ma. Within the camp, these supracrustal rock sequences strike NNW-SSE to NS, with steep dips and reversals in stratigraphic younging implying tight to isoclinal folding and locally reverse faulting. This period of basin inversion is correlated with D_{1S} (~EW-directed shortening) and occurred coevally with upper-greenschist-facies metamorphism between ca. 2100-2090 Ma. Widespread high-K calc-alkaline to peraluminous biotite-muscovite S-type granites intruded country rocks between ca. 2090 and 2060 Ma (U-Pb, Zr). The vast majority of the Eburnean plutons are characterised by negative Nb-Ta anomalies, marked Pb positive anomalies, and high LILE/HFSE ratios. This onset of such voluminous magmatic input into the crust is correlated with a switch to transpressional deformation D_{2S} (bulk incremental deformation under NW-SE- to NNW-SSE-directed shortening). The later deformation event was associated with the formation of a spaced axial-planar cleavage, interference patterns, and ultimately sinistral strike-slip along discontinuous, low-displacement, brittle-ductile NNE-striking faults synchronous with economic gold mineralization.

When integrated with published data for the Kédougou-Kénieba inlier, the results of this study indicate (1) an evolution from primitive arc magmas to increasingly evolved high-K calc-alkaline granitic melts as a result of crustal thickening during the Eburnean orogeny combined with fractionated crystallisation and melting-assimilation-storage-homogenisation processes;

(2) intermediate to felsic volcanism and batolith emplacement in the Falémé area at ca. 2080 Ma likely mark the transition between compressional and transpressional deformation;

(3) the late Eburnean tectono-thermal event between ca. 2080 and 2060 Ma is proposed as the geodynamic engine that empowered gold mineralization in the Kédougou-Kénieba inlier.