Epizonal overprinting of mesozonal orogenic gold systems: Relating crustal exhumation
and Yukon’s gold endowment

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Recent gold discoveries in west-central Yukon add to a diverse and growing inventory of orogenic gold systems in the northern Yukon-Tanana terrane. The Coffee gold deposit (Kaminak, 4.17 Moz), the White Gold deposit (Kinross, 1.47 Moz), and other White Gold style prospects (e.g., QV, Mariposa, Dime) are the first indications of mining potential in a region that has yielded approximately 20 Moz of placer gold over 118 years, but with negligible bedrock production.

We define two main age groups of orogenic gold: (1) a Middle to Late Jurassic group, recorded in the White Gold (Golden Saddle, MacKinnon, Mariposa) and Klondike districts (Violet, Lone Star, Sheba); and (2) a mid-Cretaceous event, recorded in the Dawson Range district (Coffee, Moosehorn, Boulevard). Mineralization and metamorphic cooling ages overlap spatially and temporally, demonstrating that gold was deposited synchronously with crustal exhumation. This exhumation record is preserved within individual prospects as overprinting structural styles, vein textures, mineral associations, and ages.

For example, gold occurrences of the White Gold district records a complex paragenesis of: (1) early kink folds with axial planar quartz ± K-feldspar-magnetite-hematite veins, K-feldspar alteration envelopes, and locally developed shear fabrics (Early to Middle Jurassic); (2) massive, barren quartz veins (Middle Jurassic; ~163 Ma; Re-Os molybdenite); (3) breccias with quartz-pyrite ± gold-Ag-telluride-molybdenite-barite infill and illite-carbonate alteration (Late Jurassic; 160-155 Ma; Re-Os molybdenite); and (4) chalcedony-barite ± dickite-galena veins (age uncertain). The paragenesis records at least 8 Ma of hydrothermal activity, and documents the overprinting of progressively shallower, cooler, and more brittle features in the actively exhuming crust.

The prolific Klondike placer gold fields were sourced from auriferous quartz veins that formed synchronously with mineralization in the White Gold district (~160 Ma; U-Pb rutile), and that document a similar sequence of deeper to shallower features: (1) kink folds; (2) fibrous quartz ± gold veins; (3) massive quartz-gold veins; and (4) amethystine to chalcedonic vein interiors and hydrothermal clay-filled fractures.

A separate, mid-Cretaceous orogenic gold event accompanied exhumation of the 115-99 Ma Dawson Range arc, and includes the Boulevard prospect (96-95 Ma; Re-Os molybdenite; Ar-Ar sericite) and Moosehorn occurrence (93-92 Ma; Ar-Ar sericite). Gold is associated with quartz-sulfide veins, and precipitated from single phase H$_2$O-CO$_2$-NaCl fluids that were trapped at 280 – 310°C and >1 kbar. At the Coffee gold deposit, mineralization overprints a (Jurassic?) generation
of ductile shears, kink folds, and quartz veins similar to that observed in the Klondike and White Gold districts. In contrast to the mesozonal Boulevard and Moosehorn systems, gold at Coffee is intimately associated with arsenian pyrite, requiring a temperature of formation below 250°C. We therefore interpret Coffee to represent cool and shallow (epizonal) mineralization that overprinted significant older, mesozonal features.

Collectively, the orogenic gold systems of west-central Yukon record hydrothermal activity over several vertical kilometers, and along structures that reactivated repeatedly over several million years. The variety of host rocks and thermal-crustal conditions contribute to the diverse structural styles, alteration types, and ore minerals associated with the region’s gold endowment.