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Geological Features Common for Bonanza-Forming Epithermal Gold Deposits

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High-grade (bonanza) epithermal quartz-adularia-gold veins with illite and carbonates occur in volcanic arcs around the world, from Pliocene to at least Jurassic age. Characteristic features include fine-grained colloform laminations due to colloidal silica deposition from boiling, gas-rich but low-salinity solutions. The deposits form at <500-m depth at 180°–250°C. The relationship of mineralization to magmatism has not been well established.

The plate configurations and lithospheric structures plus temporally associated magmatism with young deposits show striking similarity in the geological development leading to the mineralization. Studied deposits include the Hishikari deposit in southern Japan (>440 t Au, ~1 Ma age, extension related to lithospheric rotation, primary host Cretaceous Shimanto accretionary sediments, contemporaneous with basaltic-andesitic volcanism of Lower Hishikari Andesite); the Sado deposit of western Japan (>77 t Au, 14 Ma, back-arc extension during Japan Sea formation, underlain by organic-rich Tertiary basin sediments, contemporaneous with mafic dike swarms); the McLaughlin deposit, California (109 t Au, 1 Ma, pull-apart extension along a San Andreas Fault splay, underlain by Franciscan accretionary prism sediments, contemporaneous with basaltic-andesite Clear Lake volcanism); the Hauraki gold fields, NZ (372 t Au, 6–8 Ma, rotational extension, underlain by Cretaceous accretionary sediments, contemporaneous with andesite volcanism); and the Ada Tepe deposit, Eastern Rhodopes, Bulgaria (~30 t Au, 35 Ma, underlain by Cretaceous accretionary sediments formed during Africa-Europe convergence, contemporaneous with a range of volcanism).

These deposits are hosted or underlain by rootless, immature sediments of accretionary prism that underwent sub-greenschist metamorphism. After the uplift of the marine sediments, subaerial magmatism derived from the asthenospheric mantle overlies the sediments. The volcanic rocks are contemporaneous with the mineralization. Plate configurations reveal lithospheric-scale extension that allowed asthenospheric mantle upwelling for the volcanism and associated hydrothermal activity (with asthenospheric N isotope signature for high-grade gold ore at Hishikari).