The Brucejack Porphyry-Related Epithermal Au Deposit, Northwestern British Columbia

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Abstract

Brucejack is a precious metal porphyry-related epithermal Au deposit located in northwestern British Columbia. The deposit is one of many world-class economic deposits that formed in association with extensive volcanic arc-related magmatism in Late Triassic-Early Jurassic time in the Canadian Cordillera. Brucejack mineralization is hosted by island arc-related Early Jurassic latitic flows, and associated volcanic fragmental and subordinate volcaniclastic rocks. Variably altered and mineralized host volcanic rocks yield U-Pb zircon dates ranging between 196.4 ± 0.7 Ma and approximately 184 Ma. Age estimates for mineralization at Brucejack range between 191 ± 0.8 Ma and 188.9 ± 0.9 Ma (Re-Os molybdenite), and are within broad agreement with estimates for local porphyry-style mineralization (195-192 Ma) and for the causative intrusions. The deposit includes features typical of intermediate-sulphidation epithermal deposits, although evidence is present for deeper levels of emplacement than is typical for epithermal deposits. Six vein stages have been recognized at Brucejack; (1) highly deformed and discontinuous pyrite stringer veins containing carbonate and quartz with common sericite-chlorite alteration; (2) electrum-bearing deformed quartz-carbonate ± sericite stockwork veins and breccias, which are spatially associated with subvertical stringer quartz veinlets, also hosting electrum; (3) Zn-Pb-(Cu) sulphide veining containing common Ag-sulfosalts and electrum; (4) highly deformed carbonate ± quartz veins containing abundant orange-coloured, Mn-bearing calcite, also containing electrum; (5) late stage quartz-carbonate shear veins with asymmetrical sericite, chlorite, and pyrite banding; and (6) subhorizontal white bull quartz-carbonate tension gash veins with appreciable chlorite alteration (these are cospatial and likely cogenetic with stage 5 shear veins). The deposit is cross-cut by late stage andesite-trachyandesite amygdaloidal dykes, which truncate all mineralized veins, and which are cross-cut by late stage (post-mineralization) veins. A U/Pb zircon age of 182.7 ± 1.0 Ma has been determined for one of these dykes, providing a minimum age for the hydrothermal system.