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D'Angelo M, Alfaro M, Hollings P, Byrne K, Piercey SJ, Creaser RA, 2017, Petrogenesis and magmatic evolution the Guichon Creek batholith: Implications for the Highland Valley porphyry Cu (Mo) district, south-central British Columbia, Economic Geology, 112, 8, 1857-1888

The Late Triassic Guichon Creek batholith is host to the world-class Highland Valley Cu-Mo porphyry system, comprising at least seven known mineralized centers (Valley, Lornex, Highmont, Bethlehem, J.A., Getty North, and Getty South). The Guichon Creek batholith consists of five concentrically zoned intrusive facies that young toward the center of the batholith, ranging from granodiorite and granite in the core to granodiorite and gabbro at the margin, including the (1) Border facies, (2) Highland Valley facies (subdivided into the Guichon and Chataway subfacies), (3) Bethlehem facies, (4) Skeena facies, and (5) Bethsaida facies. Abundant porphyry stocks and dikes are common near the mineralized portions of the batholith. The Bethlehem, Skeena, and Bethsaida facies all host porphyry Cu-(± Mo) mineralization. The petrographic and geochemical characteristics of the Guichon Creek batholith, in addition to crosscutting relationships between facies and new U-Pb ages, suggest that the batholith was emplaced as at least two but possibly three different magma pulses between 211.02 ± 0.17 and 206.95 ± 0.22 Ma. New Re-Os dates of molybdenite from the Highmont and Lornex deposits indicate a mineralizing event at ~208 Ma. The intrusive rocks are characterized by high Sr/Y and low La/Yb ratios and enriched in light rare earth elements (LREE) relative to middle rare earth elements (MREE) and heavy rare earth elements (HREE). This enrichment pattern indicates fractional crystallization of hornblende and clinopyroxene in a lower crustal magma reservoir. Sm-Nd and Rb-Sr isotope systematics ($\epsilon Nd(T)$ = 6.7–7.5; $^{87}Sr/^{86}Sr_i$ = 0.70337–0.70356) suggest minor contamination of the oldest intrusive facies by a crustal source, possibly Nicola Group limestones and/or basalts. The geochemistry of the magmas indicates that they were hydrous and oxidized, consistent with the observed mineral assemblage quartz + magnetite + titanite + magnesian-amphibole, which suggests relatively high oxygen fugacities (above the fayalite-magnetite-quartz [FMQ] buffer) and magmatic water contents (≥4 wt %). The primary magmas most likely formed by partial melting processes of metasomatized subarc mantle and underwent amphibole fractionation in a deep crustal magma chamber with no role for slab melts or evidence of ridge subduction.

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