Magmatism and Post-Emplacement Uplift at the Red Chris Cu-Au Deposit, BC Canada: Implications for Porphyry Copper Formation and Preservation

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The Late Triassic Red Chris porphyry Cu-Au deposit in British Columbia, Canada, hosts proven and probable reserves totalling 5.29 Moz of gold and 1.4 Mt of copper, with average grades of 0.62 g/t Au and 0.52% Cu (Newmont, 2025). Mineralization is concentrated in several zones within the Red Stock, a 6.5 × 1.5 km east-northeast-trending, multiphase dyke swarm (Rees et al., 2015). Chalcopyrite ± bornite ± molybdenite mineralization occurs in quartz veins and as disseminations within plagioclase-hornblende monzonite porphyry intrusions and, to a lesser extent, in mafic volcanic and volcanosedimentary rocks of the Triassic Stuhini Group. Molybdenite Re-Os ages date mineralization to ca. 206 ± 1 Ma (Zhu et al., 2018).

Previously, magmatism at Red Chris was thought to span nearly 10 million years, based on LA-ICP-MS zircon U-Pb ages ranging from 211.6 ± 1.3 Ma to 201.7 ± 1.2 Ma (Zhu et al., 2018). However, preliminary CA-ID-TIMS U-Pb zircon ages suggest rapid emplacement of the Red Stock at ca. 206.5 Ma, over a ~0.5-million-year period.

Stratigraphic constraints further define the pre- and post-emplacement history. The youngest fossils in the underlying Stuhini Group are Late Norian (212–205.6 Ma), while the overlying Hazelton Group, which forms an erosional unconformity with the Red Stock, contains Late Pliensbachian fossils (189.6–186.7 Ma; Evenchick & Thorkelson, 2005). This framework, combined with our new geochronology, reveals a dynamic ~16-million-year interval encompassing emplacement, uplift and erosion of the Red Chris Cu-Au porphyry deposit.

These results highlight the role of short-lived magmatism and tectonic exhumation in the formation and preservation of porphyry systems. When integrated with regional biostratigraphy, high-precision geochronology provides critical insights into the geological processes that shape economically significant mineral systems.