

Spatiotemporal Links Between Volcanism, Structure, and Magmatic-hydrothermal Mineralization in the Toodoggone District of Northern British Columbia

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Latest Triassic and Early Jurassic Hazelton Arc volcanism within the Stikine Island Arc Terrane of northern British Columbia is associated with numerous magmatic-hydrothermal deposits of epithermal to porphyry affinity. The Toodoggone district lies on the eastern margin of the Stikine terrane and hosts significant past producing mines including the Kemess South porphyry deposit, the Bonanza high sulfidation epithermal deposit, and the Shasta, Baker, and Lawyers low sulfidation epithermal deposits. Intrusion related porphyry style deposits and fault controlled low sulfidation epithermal deposits that form at different paleodepths and often in different stress regimes are both hosted by the same units at similar stratigraphic levels across the region. This study aims to build a geologic framework for the volcanic and structural history of the Toodoggone district in the Early Jurassic to constrain the timing, exhumation history, and tectonic setting for hydrothermal mineralization and explain the spatial relationships of different deposit types in the region. We hypothesize that porphyry deposits formed early in Hazelton Arc evolution during regional compression or transpression, while epithermal vein deposits formed later following a change to regional extension possibly within a back arc setting. This research will integrate detailed mapping of volcanic units and lithofacies within the Toodoggone Formation volcanic cycles with well-constrained U-Pb geochronology, low-temperature thermochronology, and lithogeochemistry. Mapping of growth faults constrained by geochronology and geochemistry of growth strata will establish when faults were active and constrain periods of high permeability for epithermal mineralization. These data will enhance our understanding on the relationship between volcanism and hydrothermal mineralization, while establishing an Early Jurassic structural history for the Stikine Terrane during a period of major metallogenies that is overprinted by cordilleran deformation in other parts of British Columbia.