The Klinkit Formation: stratigraphy, geochemistry, and paleogeographic reconstruction of an arc system offshore from the Paleozoic Pacific margin of the North American craton

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The Canadian Cordillera is known to be a collage of oceanic and arc terranes that were accreted to the western margin of the North American craton during the Mesozoic. Upper Paleozoic magmatic sequences are an important part of these terranes. However, the understanding of the tectonomagmatic evolution of these terranes is limited, in part due to incomplete knowledge of the stratigraphy and geochemical composition of these sequences. An understanding of the geological and geochemical evolution of these sequences is essential for paleogeographic reconstruction, as well as for comparison and correlation of the various time-correlative magmatic suites in northern British Columbia and southern Yukon.

The Mississippian to Permian Klinkit Formation in northern British Columbia and southern Yukon, straddles several inboard terranes, both exotic and pericratonic, of the northern Canadian Cordillera. This well-preserved volcanic sequence provides a rare opportunity to document a pre-accretion volcanic system on the Paleozoic Pacific margin, prior to its destruction in the formation of the Cordillera.

The Klinkit Formation conformably overlies a prominent reef and debris-flow carbonate of Bashkirian age (Late Carboniferous-Pennsylvanian) and also deep-water sedimentary rocks. The Klinkit Formation is informally subdivided into: (1) the volcaniclastic unit, a >250 m thick dominantly volcanic pile with interbedded sediments, overlain by (2) the thin Bigfoot unit, a mixed volcanic and sedimentary sequence which contains upward increasing sandstone and dark argillite. These sequences are megaturbidites typical of a subaqueous, below-wave-base depositional setting. The Klinkit rocks are unconformably overlain by the Triassic Teh succession composed of clastic sediments of continental affinity.

The Klinkit volcanic rocks are calc-alkaline with characteristics of a mature island-arc suite including (La/Yb)n ~ 2.8– 4.7, negative Nb and Ti anomalies on the mantle-normalized trace element plots and positive åNd values. The Klinkit Formation is interpreted as the distal facies of an arc system.

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The Klinkit Formation is similar in composition and age to several Paleozoic arc successions of the exotic Quesnel terrane (e.g., the Lay Range Assemblage of the Harper Ranch Subterrane, northern central British Columbia; Boswell-Semenoff Hills, central Yukon), and of the pericratonic Yukon-Tanana terrane (Little Salmon succession, central Yukon).

The volcanic suites in the present assemblage of distinct pericratonic and exotic terranes in the northern Canadian Cordillera could provide the magmatic link to indicate that a large Paleozoic arc system was structurally dismembered prior to its emplacement on the western margin of the North American craton.