Understanding Hazelton Group Metallogeny Using Detrital Zircon Geochronology Across Multiple Mineral Districts, Golden Triangle, NW British Columbia

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The Hazelton and Stuhini Groups are a volcano-sedimentary succession developed as part of the Stikine Terrane of the Canadian Cordillera, recording the evolution of volcanic arcs during the late Triassic to the middle Jurassic. The co-occurrence of multiple mineral systems including Treaty Creek Cu-Au porphyry, Brucejack mine Au-Ag epithermal and the Ag rich volcanogenic massive sulphide (VMS) deposit at Dolly Varden - proximal to the unconformity between the Stuhini and the Hazelton Groups records an unusual metallogenic diversity around 195 – 185 Ma that existing tectonic models do not adequately explain. Subsequent normal faulting and thrusting related to the Skeena fold and thrust belt have further fragmented the region into distinct structural blocks, adding complexity. Current models emphasizing linear arc parallel structural domains or microplate accretion and rotation fail to fully account for the observed lithological heterogeneity, paleodepth variations, and metal endowment.

A multidisciplinary approach combining new detrital zircon geochronology and trace element data, whole-rock lithogeochemistry, and detailed stratigraphic mapping from multiple mineral districts over a 170 km x 50 km area reveals a complex tectono-stratigraphic framework. More than 50 detrital zircon samples from marine sedimentary and volcaniclastic rock units of the Stuhini and Hazelton Groups were analyzed using LA-ICP-MS (>6000 zircon analyses). The widespread detrital zircon ages, spanning 240 to 165 Ma, record several erosional events and the formation of sub-basins across the Golden Triangle, prior to the development of the Bowser Basin. This complex tectonic and stratigraphic architecture may explain the diversity in the metallogenic environments present in the Golden Triangle. Comparative analysis with modern active arc systems, such as those in Papua New Guinea, suggests that this complexity may reflect dynamic crustal growth processes and structurally partitioned domains, which in turn affect the magmatic and hydrothermal activity observed around these microplates.