ST.005
Potential for Volcanogenic Massive Sulfide Mineralization in the Upper Hazelton Group, North-Central British Columbia

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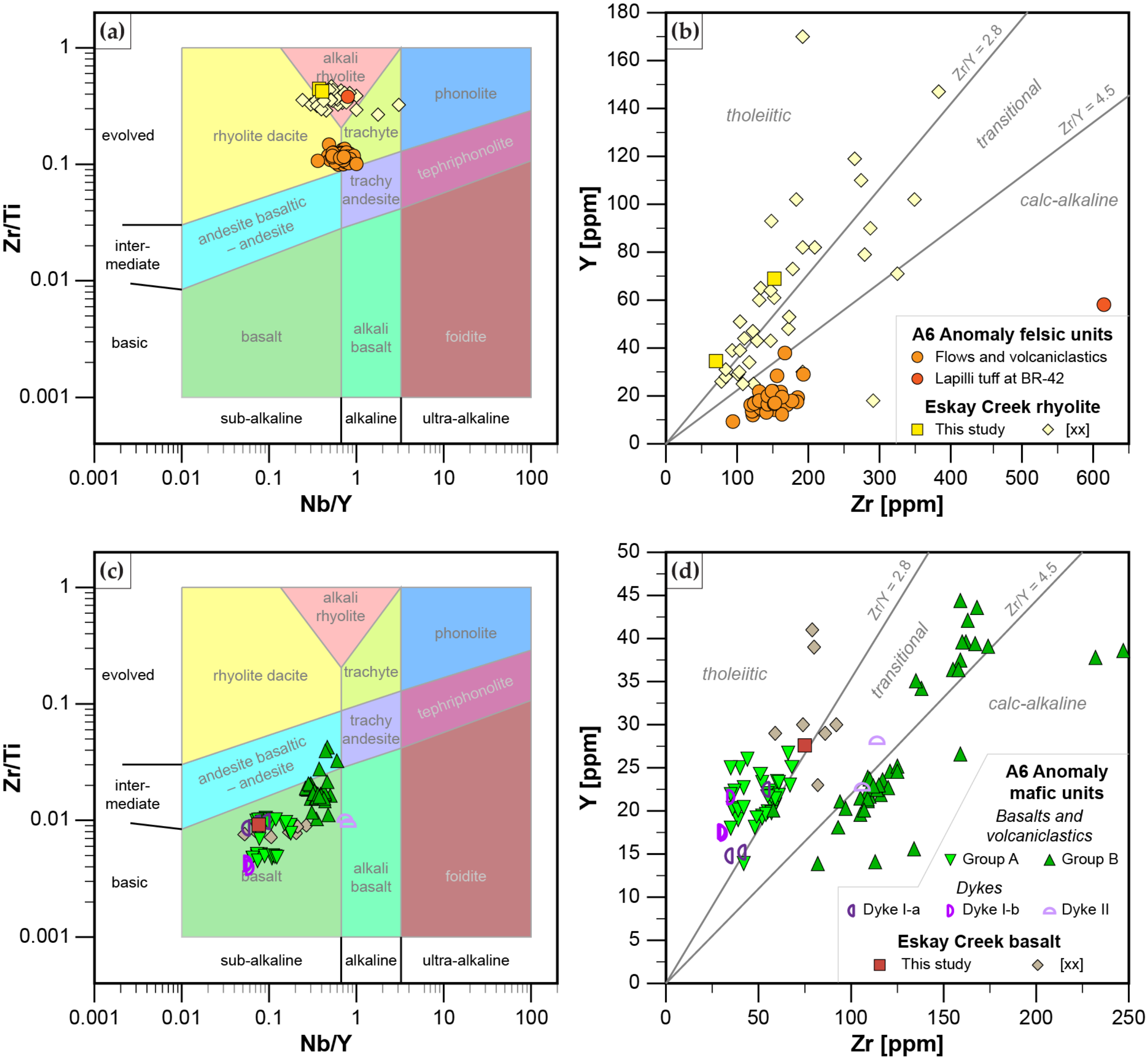
The A6 Anomaly, located circa 15 km northeast of the epithermal Brucejack Au mine and circa 30 km southeast of the Au-rich volcanogenic massive sulfide (VMS) Eskay Creek deposit, is a greenfields exploration project which was drilled in 2019-2020 to investigate its VMS potential. Observations from surficial mapping and drill core puts the A6 Anomaly into the Lower to Middle Jurassic Upper Hazelton Group. The stratigraphy shows similarities to Eskay Creek with an andesitic tuff unit overlain by quartz-sericite ± chlorite ± pyrite-altered massive and flow-banded coherent felsic rocks and minor volcaniclastic intercalations. The felsic units are overlain by a volcano-sedimentary package of mudstone to polymictic conglomerate intercalated with basaltic flows, sills, and hyaloclastite.

Lithogeochemical results on altered felsic flows indicate a rhyodacite to trachyte composition and calc-alkaline affinity similar to FII rhyolites. Immobile elements have constant ratios, indicating a common precursor of these rocks, but the ratios are different to the tholeiitic, strongly altered Eskay Creek rhyolite. Basaltic flows and sills in the hanging wall of the altered felsic flows have calc-alkaline to tholeiitic affinities.

Alteration of the felsic flows is dominated by quartz and illite with minor Fe-chlorite (chamosite) and trace pyrite that occurs as either disseminated crystals or pyrite stringers. Illite composition was determined by X-ray diffraction and electron probe microanalyses yielding an average illite composition of $(K_{0.67}, Na_{0.03}, Ca_{0.01})_{S0.70}(Al_{1.38}, Fe_{0.10}, Mg_{0.15})_{S1.63}(Al_{0.65}, Si_{2.94})_{S3.59}(OH)_{1.48}$ that is deficient in Si, Al and interlayer cations, presumably due to intergrowth with another clay component of unknown composition. However, Tschermak substitution (i.e., changing from phengite to celadonite composition) is not present. Illite alteration is moderate and a product of feldspar destruction by mildly acidic, relatively low-temperature hydrothermal fluids.

The fluid temperature was determined from oxygen isotope compositions of illite measured by secondary ion mass spectrometry. Illite has an average $d^{18}O$ = 10.7 ± 3.0 ‰ VSMOW; geothermometry was applied using an assumed $d^{18}O$ = 0.5-2.3‰ VSMOW of the hydrothermal fluid. An average fluid temperature of 150°-180°C was determined to have caused the pervasive quartz-sericite (illite) ± chlorite ± pyrite alteration in calc-alkaline rhyodacites to trachytes. This is similar to fluid temperatures responsible for alteration and Au-rich sulfosalt mineralization at the Eskay Creek deposit and lower than hydrothermal fluid temperatures reported for the majority of VMS deposits.

The A6 Anomaly was most likely formed within an immature (back-arc) rift in which felsic flows and calc-alkaline basalts assimilated some crustal components, followed by a widening of the rift resulting in relatively shallow, tholeiitic mafic volcanism. Moreover, the rift was subject to several turbiditic mass movements into which calc-alkaline and tholeiitic basaltic flows and sills intruded prior to consolidation of sedimentary sequences. Although mineralization is not prominent and limited to pyrite in the drilled holes, stratigraphy, lithogeochemistry, and alteration mineralogy and chemistry indicate potential for a bimodal-felsic VMS-style deposit formed in a (back-arc) rift similar to other calc-alkaline hosted VMS deposits of which the A6 Anomaly may represent the distally altered, low-temperature footwall.



(a)
evolved
inter-mediate
basic
alkali rhyolite
rhyolite dacite
trachyte
phonolite
tephriphonolite
trachy andesite
andesite basaltic – andesite
basalt
alkali basalt
foidite
sub-alkaline
alkaline
ultra-alkaline
Zr/Ti
Nb/Y
(b)
tholeiitic
transitional
calc-alkaline
Zr/Y = 2.8
Zr/Y = 4.5
Y [ppm]
Zr [ppm]
A6 Anomaly felsic units
Flows and volcaniclastics
Lapilli tuff at BR-42
Eskay Creek rhyolite
This study
[xx]
(c)
(d)
A6 Anomaly mafic units
Basalts and volcaniclastics
Group A
Group B
Dykes
Dyke I-a
Dyke I-b
Dyke II
Eskay Creek basalt