Characterization and Stratigraphic Framework for Late Cretaceous Kasalka Group Volcanics, northern Interior Plateau, central British Columbia

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I. Introduction

The Kasalka Group is a Late Cretaceous package of volcanic, volcaniclastic and sedimentary rocks. Au-Ag mineralization at the Blackwater project in central BC is believed to be hosted in these volcanic sequences (Christie et al, 2014). Poor bedrock exposure has hindered exploration efforts for other deposits in the region.

View from Tchesinkut Radio Tower

This research aims to characterize the Kasalka Group, as a component of Geoscience BC's TREK (Targeting Resources for Exploration and Knowledge) project. This will be achieved by identification of constituent subunits by lithogeochemical analysis and petrographic studies. Geochronology studies will aid in further constraint of age brackets for the Kasalka Group. This research will aid in improving targeting strategies for mineral exploration in central BC.

II. Geological Setting

The Interior Plateau region lies within the Intermontane Belt superterrane, underlain by the Paleozoic to Mesozoic Stikine, Cache Creek and Quesnel accreted arc terranes (Figure 1, Monger & Price, 2002). Volcano-sedimentary packages of the Stikine terrane are composed of Late Triassic to Middle Jurassic arc volcanics and their erosional products.

Post-deformation, continental margin arcs were unconformably deposited episodically through Late Cretaceous to Eocene times and produced the Kasalka, Ootsa Lake and Endako groups of volcanic strata (Evenchick, 1991). Neogene flood basalts and Quaternary glacial till cover are extensive in this region.

The northwestern portion of the TREK project area and surrounding area encompasses this study area. The geology is dominated by Mesozoic sedimentary, volcanic and plutonic rocks. The lowest identified stratigraphic successions include the Jurassic Hazelton Group volcano-sedimentary packages and the Skeena Group sediments.

Rocks attributed to the Late Cretaceous Kasalka Group and equivalents have a wide distribution from Kemano, in coastal BC, and as far north as Smithers, BC (Figure 1).

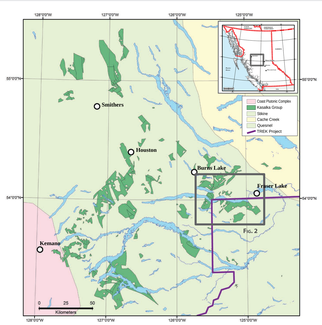


Figure 1: *Major tectonic terranes of the Cordillera , TREK Project location and study area (modified from Colpron, 2011). Distributions of Kasalka Group rocks in central BC are highlighted*

III. Study Area

The Late Cretaceous rocks in the study area (Figure 2) are found to be mapped in close proximity to both Jurassic and Eocene volcanic suites. The Kasalka Group was first described by MacIntyre (1977) in the Whitesail Lake map area (NTS 093E). The Kasalka Group is described to have an angular unconformity of basal conglomerate overlying deformed older rocks. The conglomerate is unconformably overlain by thick packages of andesite flows and volcaniclastic rocks. The youngest members consist of rhyolitic flows that unconformably overlie the andesite flows and volcanic rocks (MacIntyre, 1977, 1985). A stratigraphic succession from field observations is presented in Figure 3.

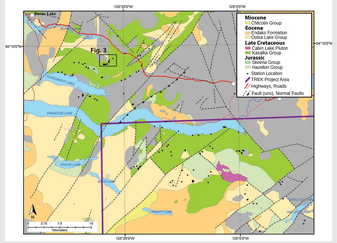


Figure 2: *Generalized bedrock geology for study area. The units highlighted in this map are volcanic and intrusive suites. Modified from BCGS Digital Bedrock Geology*

V. Lithogeochemistry

Subalkaline discriminant plots (Figure 4a) show the andesites have a calc-alkaline to high K calc-alkaline affinity. The rhyolite, crystal tuff, and dacite samples are plotting within the shoshonite series, indicating silica and alkali enrichment with increasing felsic content.

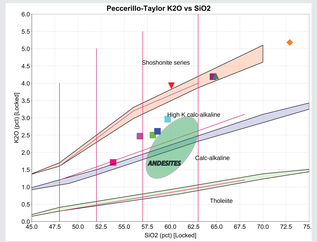


Figure 4a: *Subalkaline division using K2O vs. silica abundances. From Peccerillo and Taylor (1976) .*

Total alkali vs. silica discriminant plots (Figure 4b) are used to confirm lithologic constraints from the field. Andesites are shown to range from basaltic to trachyte trachyandesites.

Comparisons to lithogeochemical data of Kasalka Group andesites from the Skeena Arch project MacIntyre (2001) are presented as ellipsoid ranges in Figures 4a, b and d. The Kasalka Group andesites described at the Skeena Arch are also calc-alkaline. Broadly, it can be observed that there are similarities in where the samples are plotting on both graphs.

Limited sample sizes used in these studies may contribute to the discordance observed in the alkali discrimination plots.

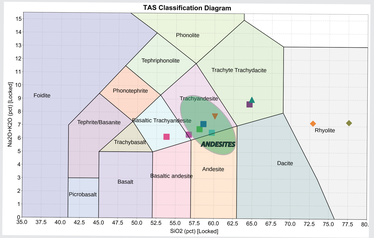


Figure 4b: *TAS Classification of total alkalis vs. silica. From Le Maitre et al. (1989).*

IV. Field Observations from the Tchesinkut Lake - Yellowhead Highway Traverse

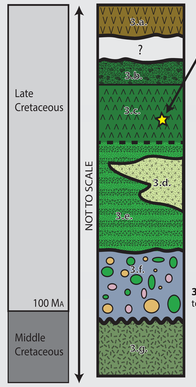
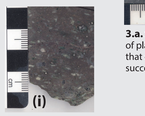
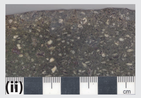


Figure 3: *Schematic showing the interpreted stratigraphic succession of the Kasalka Group observed at the Tchesinkut Lake-Yellowhead Highway traverse*

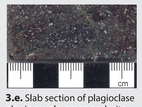


(i)

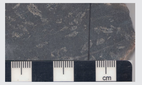


(ii)

3.c. (i) Plagioclase phyric andesite to **(ii)** dacite flows directly below 3.b.

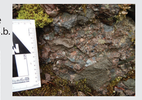


3.e. Slab section of plagioclase phyric purple-green andesite

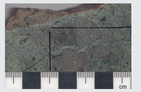


3.a. Slabbed hand sample of plagioclase phyric basalt that caps this stratigraphic succession

3.d. (i) Fragmental felsic ash with altered pumice lithics

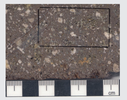


3.f. Outcrop of poorly sorted, clast-supported conglomerate with a red quartz-feldspar sand matrix. Volcanic, plutonic and sedimentary cobble to pebble-sized clasts are observed



3.b. Slabbed hand sample of andesitic volcanic autobreccia. Maroon lithic clasts are visible through pervasive alteration

3.d. (ii) Flow-banded rhyolite



3.g. Slabbed hand sample of plagioclase-biotite-hornblende phyric dacite

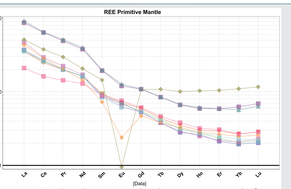


Figure 4c: *REE abundance normalized to primitive mantle, from Sun and McDonough, 1989.*

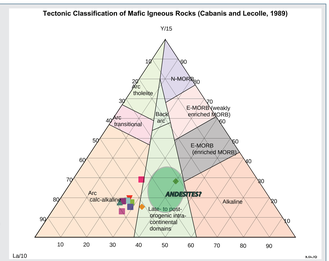


Figure 4d: *La-Y-Nb discrimination plots for tectonic classification, from Cabanis and Lecolle, 1989.*

REE abundances normalized to primtive mantle (Figure 4c) show enrichment in light REEs and depletion in HREEs, characteristic of calc-alkaline melts. Negative europium anomalies in the rhyolite samples, indicative of plagioclase fractionation in calc-alkalic volcanic arc suites. Tectonic classification using La-Y-Nb relative abundances (Figure 4d) shows a divide that corresponds to field lithology classifications. The andesitic samples are associated with arc calc-alkaline settings, and rhyolites associated with late to post-orogenic magmatism. increasing affinity for late to post-orogenic continental magmatism. The Skeena Arch Kasalka andesites (MacIntyre, 2001) show post-orogenic magmatic affiliation, similar to the rhyolite samples of this study.

VI. Conclusions and Future Work

The Kasalka Group is observed to be a volcano-sedimentary sequence, dominated by a series of fragmental and coherent volcanic rocks overlying clastic sedimentary rocks. Regional bedrock mapping in the northern TREK project and surrounding area indicates that this unit can be highly variable.

Hornblende phenocrysts are proposed (Anderson et al. ,1999) as a common feature in Late Cretaceous fragmental volcanic rocks south of the study area. Hornblende phenocrysts are documented in the andesitic volcanic rocks and intrusive suites in this study and as such, are tentatively interpreted to be Late Cretaceous. However, hornblende phenocrysts are also present in Late Jurassic volcanic rocks (Diakow et al., 1997) and are lithologically difficult to differentiate from Kasalka Group volcanic rocks in the field. Further evaluation of these rock types and hornblende phenocrysts with petrographic and geochemical studies may provide further constraints on the characteristics of the Kasalka Group volcanic rocks.

Current age distributions of the Kasalka Group are broad and variable. Reported ages ranging from 105 to 75 Ma (MacIntyre, 1988) suggest that the Kasalka Group ranges from mid to latest Cretaceous in age, while Late Cretaceous ages have been reported for rocks that were previously mapped as Jurassic and Eocene (Friedman et al., 2001). Improved lithological and age constraints on the Late Cretaceous volcanic suites will provide improved regional context and discriminate potential regions that may be more prospective for precious-metal mineralization.

Preliminary geochemical results and field observations have provided a framework for this study. Future work will include detailed characterization of samples using geochronology and petrology studies. Correlations between geochemical and petrographic observations will be made in order to determine characterizing features. The age and stratigraphy of the Kasalka Group units will also be constrained with isotopic dating of U-Pb on zircon and Ar-Ar on biotite and hornblende.

VII. References

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Northern TREK Project area

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