Trace Element Geochemistry of Chatanika Eclogites and Accompanying Protoliths

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Introduction

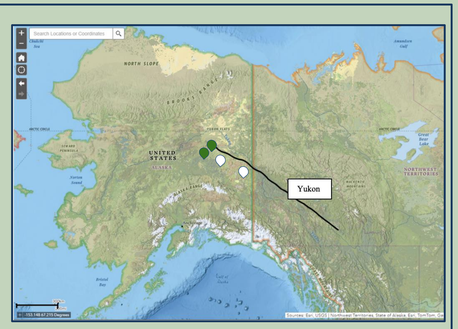
The Tintina fault is an ancient fault spanning from eastern Alaska to the southern Yukon region of Canada. This fault system has been studied in the past and has proven to have tectonically complex history. Previous geologic work along the Tintina Fault has provided information regarding thermobarometry (P = 1.3 GPa and $T \approx 495 \pm 20$ ℃), pressure-temperature-time paths (P=20 kbar and T=660 °C), and trace element geochemistry but the trace element data are incomplete and primarily used collection sites on the far east side of the fault. In the scope of this research, trace element concentrations were compared to each other and to existing trace element data of the eastern side of the fault. Analysis of eclogites and potential protoliths for high field strength fluid immobile elements was used to perform a comparison of diagenetic processes and the protoliths in the region. Concluding thoughts are that the tested eclogites come from an ocean island basalt protolith, while the tested "protoliths" are mid-ocean ridge basalts and thus cannot be the protolith of the tested eclogites. However, the tested protoliths align very closely to previously studied eclogites labeled as metamorphosed MORB rocks.

Research questions considered in the data collection process included:

- Do the protolith sample compositions fall within the specified range as given in previous research of the region?
- Are consistencies present between all the tested rocks and existing data collected in the Yukon region?

Figure 1: Collection site of tested rocks in relation to fault

A total of two eclogites and three predicted protolith gabbros+basalt were tested for this research. Dark green pins designate eclogite and white pins designate the unmetamorphosed samples. The black line marks the location of the fault and the scale bar is 300 km.



Hypothesis

Trace element signatures of mafic Chatanika Eclogites and unmetamorphosed potential protoliths fall within the range of previously analyzed Yukon Eclogites.

Methods

Trace element concentrations were determined using solution-based ICP-MS. Sample preparation consisted of powdering the samples and digesting them in a sequence of acids. Raw concentration output from the instrument was adjusted for dilution factor, then values were plotted against published values from the Yukon region.

Results

Figure 3: Reference graphs used in determining appropriate trace element ranges

Graph created as a representative pattern for different tectonic settings (left), graph displaying range values in rocks of the eastern side of the fault (right)

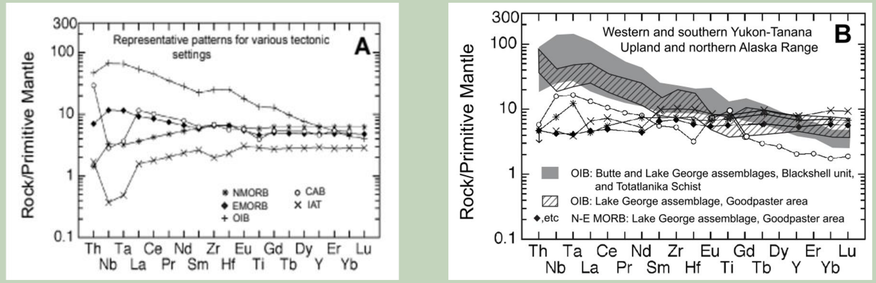


Figure 4: Concentration values of five samples

Normalized concentration values of eclogites and possible protoliths, respectively. Eclogites have been labeled as having ocean island basalt protoliths (OIB). The predicted protolith samples have values that align with those of mid-ocean ridge basalts (MORB), thus they are not protoliths of the eclogites.

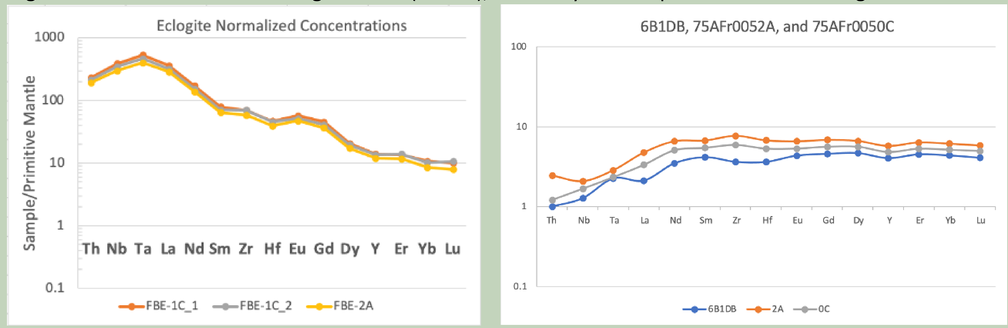


Figure 2: Flowchart of sample preparation processes

Round one of data collection included the two eclogite samples and standards BCR-2 and BHVO-2 (left). Round two included potential protolith rocks, a redo of the two eclogites, and standard BCR-2 (right).

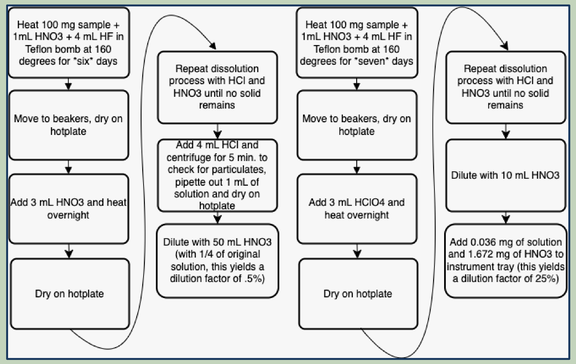
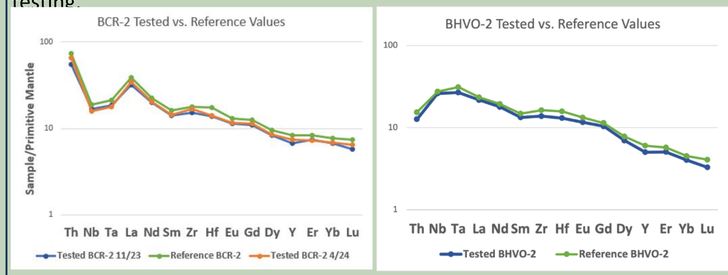


Figure 5: Standards BCR-2 and BHVO-2

GeoRem values plotted with tested values of standards BCR-2 and BHVO-2, used to test legitimacy of measured concentrations in each round of testing.



Conclusions

- Predicted protoliths do not possess comparable trace element signatures to the eclogite samples, therefore they are not protoliths of the eclogites tested in this research.
- The unmetamorphosed rocks do have comparable trace element content to previously tested eclogites, which were also labeled as having MORB protoliths. Some of those samples were collected in nearby sites to the protoliths in this sample.
- The null hypothesis is rejected. Although the trace element signatures of both types of rocks fall within the range of previously tested rocks, they do not align with each other. There are two types of protoliths present in this region.
- Between the location of the Chatanika rock collection and the rocks slightly east, there is a change in tectonic setting from OIB to MORB.

Acknowledgements and References

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