New Constraints On The Age, Geochemistry, And Environmental Impact Of High Arctic Large Igneous Province Magmatism

Tracing The Extension Of The Alpha Ridge On To Ellesmere Island, Canada

> Tiera Naber (she/her), B.Sc.H., M.Sc. Candidate University of British Columbia tnaber@eoas.ubc.ca

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Cretaceous OAE and LIP Events

- Oceanic Anoxic events (OAE) are associated with large igneous province (LIP) volcanism.
- Major Cretaceous OAEs include: OAE Ia (~120 Ma; Aptian), and OAE II (~ 94 Ma; Cenomanian-Turonian).

Global LIP Map



From Self et al. (2014)



After Naber et al. (2021)

-5000 -3000 -2000 -1500 -1000 -500 -200 -100 -50 -25 -10 0 50 100 200 300 400 500 600 700 800 1000 (Meters)



PBZ = Petersen Bay Fault

80°W

Hansen Point – Field Site



Hansen Point – Field Site



From Naber et al. (2021)

Photo credit: Christian Tegner

Hansen Point – Dikes and Flows

Dolerite dike

Silicic flow

Dolerite dike

Silicic flow

From Naber et al. (2021) Photo credit: Christian Tegner

Hansen Point – Amygdules and Pyroclastic Deposits



Photo credit: Tiera Naber

Geochemistry of Hansen Point samples



High Arctic LIP volcanism – tholeiitic and alkali



Hansen Point vs. Alpha Ridge







HALIP – tectonic settings

Hansen Point and Strand Fiord Fm.: Intermediate E-MORB and OIB signature, crustal contamination.

Alpha Ridge and local volcanism: OIB signature, some fractional crystallization.





SFF = Strand Fiord Formation

HALIP volcanism – multiple episodes



Alpha Ridge and local volcanism: Younger, alkaline, OIB signature

Hansen Point and Strand Fiord Fm.: Older, tholeiitic, intermediate E-MORB and OIB signature









Pearya Terrain

PreCambrian



Strand Fiord Formation

Cretaceous volcanic rocks of northern Ellesmere Island

Wootton Intrusive Complex

MPFZ = Mitchell Point Fault Zone EFFZ = Emma Fiord Fault Zone PBZ = Petersen Bay Fault



Hansen Point Tholeiitic

Conclusions

- The Alpha Ridge and Hansen Point samples differ in age and composition. However, we have very little data from Alpha Ridge. Need more data to see if composition and age varies along the ridge for a more robust comparison.
- The Audhild Alkaline Suite represents a younger HALIP eruption event (~83-73 Ma), separate from the Hansen Point Tholeiitic Suite.
- Hansen Point Tholeiitic Suite and Strand Fiord Formation are subaerial, similar in age (~97-93 Ma) and composition and overlap with OAE II (~94 Ma).
- We suggest the Hansen Point Tholeiitic Suite and Strand Fiord Formation were part of the same High Arctic LIP eruptive event, and therefore, likely responsible for the onset of OAE II.

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