



Mid ocean rift alkali basalts from Arctic Lena Trough

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Lena Trough in the Arctic Ocean is an oblique amagmatic rift separating the continents of North America and Europe. It is the connection between Gakkel Ridge to the North and the rest of the global mid-ocean ridge system to the South. Basalts were recovered from Lena Trough on 4 cruises: Polarstern ARK XV-2, ARK XVII-2, USCGC Healy 0102, and Polarstern ARK XX-2. Basalts were only dredged from the extremities of Lena Trough however, as the central valley of Lena Trough is entirely composed of peridotite.

The Northern Lena Trough basalts erupt along structures that are clearly allied with neighboring Gakkel Ridge. Their geochemical characteristics thus closely resemble those of the magmatically robust Western Volcanic Zone of the Gakkel Ridge. Rocks from the southern Lena Trough, however, are quite different. These rocks are moderately to highly enriched MORB, but show different geochemical characteristics than either MORB from Gakkel Ridge or MORB from the rest of the mid-ocean ridge system.

They are slightly evolved (Mg# 65) alkali basalts with 4% Na₂O (Na_{8.0} of 3.5), 1.5% K₂O (K/Ti 0.54) and are LREE enriched with average (La/Sm)_N of 1.6, and (Sm/Yb)_N of 2.41. Their low HREE budget agrees with the presence of garnet in the melting source, which is consistent with results to date from Lena Trough peridotites(1). This is contrasted however by the high silica (~51%) and very low iron content (~6.5%), suggesting low pressure melting. These two observations can best be reconciled via late melting of a garnet-bearing source such as garnet pyroxenite veins.

One distinguishing feature is their vespicularity: Whereas mid-ocean ridge basalts are

generally not highly vesicular, reflecting the great depth of their eruption, Gakkel Ridge basalts occasionally are, despite their great depth. Basalts from the southern Lena Trough are all highly vesicular (up to 25%), despite water depths of over 3000m. This suggests very high volatile contents.

Coherent garnet melting indicators in Lena basalt and peridotite thus seem to suggest a relatively hot thermal regime in Lena Trough juxtaposed against a cold thick lithosphere. Alternatively, shallow melting may be occurring within mantle that bears eclogitic veins.

1) Hellebrand, E. and Snow, J., 2003. Deep melting underneath the highly oblique-spreading Lena Trough (Arctic Ocean). *Earth and Planetary Science Letters*, 216:283-299.