5.2.43

The Paleocene picritic Vaigat Formation on Disko and Nuussuaq, West Greenland: Separate evolution of sources, conduit systems, and contamination events

L.M. LARSEN[1] AND A.K. PEDERSEN[2]

[1] Geological Survey of Denmark and Greenland (GEUS), Øster Voldgade 10, DK-1350 Copenhagen K, Denmark (lml@geus.dk)
[2] Geological Museum, Øster Voldgade 10, DK-1350 Copenhagen K, Denmark (akp@savik.geomus.ku.dk)

The up to 2 km thick volcanic Vaigat Formation (60 Ma) in West Greenland is situated peripherally within the North Atlantic Igneous Province. It is dominated by picrites but also comprises c. 10% crustally contaminated lavas in several discrete horizons. Uncontaminated lavas average c. 15 wt% MgO (range 6.5–30 wt%), whereas contaminated lavas are siliceous basalts to magnesian andesites with average 9 wt% MgO (range 3–15 wt%). The uncontaminated picrites show very little reaction with the contaminated melts, and the two must have had separate conduit systems. The picrites show an evolution through time of the asthenospheric mantle sources from highly depleted to much less depleted; the majority is within the range of Icelandic Sr–Nd isotopic compositions but has lowish Pb isotope ratios compared to Iceland.

The contaminated magmas were formed in recurrent, discrete events during periods with low melt production rates, when magmas were trapped in high-level magma chambers. About 15 distinct, contaminated units exist and range from minor monogenetic occurrences to regionally extensive, composite horizons with several production centres. Most of the contaminated units are well defined chemically and form separate groups in elemental and isotopic plots, signalling individuality of the contamination events. At least three contaminants can be identified: sandstone with high La/Sm, Th/Nb and Zr/Nb; carbonaceous shale with high La/Sm and Th/Nb and low Zr/Nb; and an enriched component with high La/Sm and low Th/Nb and Zr/Nb and higher $^{143}Nd/^{144}/Nd$, far lower $^{87}Sr/^{86}Sr$, and higher $^{206}Pb/^{204}Pb$ and $^{208}Pb/^{204}Pb$ than the sediments. The enriched component is known in melt form as the Manitdlât Member, a local alkaline lava unit, and is thought to sit in the lithospheric mantle beneath Disko; however, enriched patches must be present beneath the whole province. Lower crustal contaminants have not been identified. There is no systematic evolution with time of the proportions or amounts of the three contaminants. Several contaminated units have lost Cu and Ni due to reaction with sulphur- and carbon-rich sediments, and sulphide and metal mineralisations may be present at depth. Two units contain native iron precipitated high in the conduits and after extrusion due to the strong pressure dependence of the C–CO–CO_2 buffer equilibrium.

5.2.44

Interaction of the rifting East Greenland margin with a zoned ancestral Iceland plume

A.K. BARKER[1], D.W. PEATE[1,2] AND J.A. BAKER[1,3]

[1] Danish Lithosphere Centre, Øster Voldgade 10 L, 1350 Copenhagen, Denmark (akb@dlc.ku.dk)
[2] University of Iowa, Department of Geoscience, 121 Trowbridge Hall, Iowa City, IA 52242, USA
[3] School of Earth Sciences, Victoria University of Wellington, P.O. Box 600, Wellington, New Zealand

High-precision Pb isotope data show that, in general terms, Icelandic volcanism defines three spatial isotopic domains: (1) a high $^{206}Pb/^{204}Pb$ component (18.6-19.5) sampled at Torfajökull near the plume stem. (2) a lower $^{206}Pb/^{204}Pb$ component(s) (<18.6) represented by lavas from Theistareykir and the northeastern rift zone (3) lavas from the Reykjanes Peninsula with intermediate $^{206}Pb/^{204}Pb$ (~18.8) but higher Δ7/4 than the northeastern Iceland component(s). We have investigated the role of these mantle components in a 6 km profile of basalts from East Greenland erupted during the break-up of the North Atlantic at ca. 55-54 Ma. Basalts have been analysed for Nd and Pb isotopes (using a ^{207}Pb-^{204}Pb double spike). Crustally uncontaminated basalts from the lower half of the section (Milne Land and Geikie Plateau Formations, MLF and GPF) have low $^{206}Pb/^{204}Pb$ (17.9-18.4). These formations are overlain by the Rømer Fjord Formation (RFF), which has radiogenic Pb almost identical to Icelandic Torfajökull basalts, indicating derivation of these melts from near the plume stem. This is then followed by basalts (Skraeterne Formation; SF) with intermediate $^{206}Pb/^{204}Pb$ with higher Δ7/4, similar to Reykjanes Peninsula samples.

We envision these abrupt changes in mantle sources to reflect interaction of the rifting continental margin with a zoned ancestral Iceland plume with a similar disposition of components as that currently beneath Iceland. The MLF and GPF were produced by the northeastern periphery of the Iceland plume and, as the continental margin moved over the plume, it passed over the plume stem resulting in eruption of the RFF lavas with high $^{206}Pb/^{204}Pb$. As Greenland continued to drift away from the plume, the high $^{206}Pb/^{204}Pb$ signature disappeared and the Reykjanes Peninsula signature becomes apparent as the SF was erupted. Finally, the stratigraphic changes in isotope ratios are also related to changes in incompatible trace element ratios (e.g., La/Sm) and challenges the assertion (Tegner et al., Nature, 1999) that secular changes in inter-REE ratios in the East Greenland flood basalt series primarily reflect secular cooling of the ancestral Iceland plume.