Mantle dynamics during a continental break-up: Insights from the North Atlantic magmatic province

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Continental extension between North America and Greenland started about 130 Ma ago. Final break-up occurred during the Paleocene and Eocene together with the emplacement of thick volcanic series on the continental margins from apart the Davis Strait. In order to further understand the geodynamics of this process, we report ages (^{39}Ar-^{40}Ar and K-Ar) and geochemical compositions (major and trace element concentrations and Pb, Hf, Sr, Nd isotopes) on ~100 basaltic samples from the Svartenhuk West Greenland volcanic margin (~71°N). Our data show that >1 km of subaerial lava flows were emplaced in less than ~2 m.y. The wide range of geochemical compositions, from picritic and tholeiitic basalts to alkaline basalts ($(La/Yb)_N$=0.9-15.4), suggests variations of melting conditions or/and the involvement of several mantle sources during that short period of time. Pb, Hf, Sr and Nd isotopic features of relatively uncontaminated lavas also display a rather large diversity (-14.8-<εNd<8.9; -23.2<εHf<16.3; ~16.1<^{206}Pb/^{204}Pb<~19.3; ~36.7<^{208}Pb/^{204}Pb<~38.8; 0.70306<^{87}Sr/^{86}Sr<0.71202), that can be accounted for by a binary mixture of Icelandic plume and “C”-like mantle source materials. Our data indicates that the tholeiitic basalts from the main magmatic phase resulted from rather high degrees of mantle melting (10-20%) at ~3 GPa and 1300-1450°C. Earlier and latter alkaline lavas derived from <10% mantle melting at deeper levels.