Chemical and isotopic investigations of low-Ti depleted continental flood basalts in East Greenland

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Voluminous flood basalts along the east Greenland margin were emplaced between 60 and 55 Ma during continental rifting in the northeast Atlantic and impact of the Iceland mantle plume. The Plateau Basalt sequence approaches 6 km in thickness and was emplaced over ca. 1.2 My at 55 Ma. Most basalts in the sequence are Ti- and LREE-enriched (TiO_2 = 1.6-6.2%, La/Sm_N = 1.1-2.1). However, MORB-like low Ti, LREE-depleted (TiO_2 = 0.8-2.0%, La/Sm_N = 0.42-0.94) basalts also occur interleaved in the basalt pile. We have determined Sr, Nd, and Hf isotopic compositions for the low-Ti lavas and selected interspersed high-Ti lavas to investigate their respective mantle sources and compare them to the Iceland plume and other basalts from the East Greenland margin. The majority of low-Ti basalt samples investigated have uncontaminated compositions with $^{87}Sr/^{86}Sr_{(55Ma)}$ = 0.70266 to 0.70301, $\varepsilon Hf_{(55Ma)}$ = +13.5 to +18.0 and $\varepsilon Nd_{(55Ma)}$ = +7.5 to +9.9, rare examples have Sr and Nd isotopic compositions suggestive of minor crustal contamination, but to much lesser degrees than seen elsewhere in the East Greenland flood basalt province. Sr and Nd isotopic compositions overlap with primitive Icelandic lava compositions and MORB. However, Nd and Hf isotopic compositions of the low-Ti basalts are identical to those of the present day depleted products of the Iceland plume and distinguish them from N-MORB (higher εHf at a given εNd). The more voluminous high-Ti basalts contrast by having more consistent and lower $^{176}Hf/^{177}Hf$ and $^{143}Nd/^{144}Nd$, and in general higher $^{87}Sr/^{86}Sr$. Pb isotope studies will be carried out to further characterise the different flood basalt types and identify potential contaminants (if any). Trace element ratios (e.g. Ba/Nb, Rb/La) indicate that the contrasting isotopic composition of the high and low Ti basalts, and the large isotopic variation of the depleted suite (>4 εHf units), is not due to crustal contamination. The distinct REE patterns of the two suites indicate melting at different depths in the mantle beneath a variable thickness cap, and the contrasting isotopic compositions indicate simultaneous melting of a compositionally heterogeneous mantle plume. The majority of low-Ti flows were emplaced over a restricted stratigraphic interval (30 lava flows), representing a period of likely only 100 ka, and it is only in this interval that the most primitive isotopic compositions occur. We suggest that these chemically and isotopically depleted flows may represent a pulse of magmatism associated the first appearance of a true oceanic rift interacting with the Iceland Plume.

Nitrate Release from a Melting Snowpack in Alptal

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Introduction

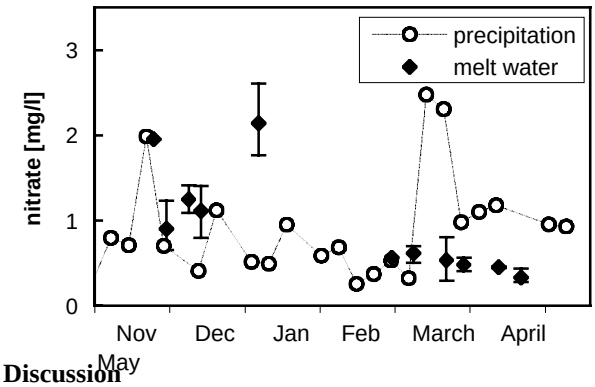
Chemical species in precipitation are a relevant source of sparse nutrient for the vegetation. Several authors found higher ionic concentration in the first portion of melt than in the snow pack (Johannessen & Henriksen, 1978).

Measurements and Results

In winter 1998/1999, we sampled the melt water released from a snow pack on a open field in Alptal (Switzerland) using a network of 32 small basins (Waldner et al., 2000). The chemical and physical properties of the melt water, the snow cover and the precipitation were analysed.

The water release from the strongly layered snow pack showed a large spatial variability. The ratio between the concentration in the melt water and the mean concentration in the snow pack was in the range between 0.7 and 1.4.

Fig. 1: Nitrate concentration in precipitation and melt water.



Discussion

The observed low concentration ratio are in line with the findings of Eichler et al. (2000), who stated that ionic concentrations in melt do not differ much from those in the snow, if latter are close to the solubility in ice.

References

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