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Contrasting depleted mantle signatures along the northern mid-atlantic ridge (10-50°N)

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Using trace element and Sr-Nd-Pb isotopic ratios, the geochemical structure of the northern mid-atlantic ridge between 10 and 50°N has long been described with major anomalous zones at the latitudes of 14°-15°N, 38-39°N and 42-43°N. New Hf isotopic data from basaltic samples along this 10-50°N section of the ridge plotted against Sr or Nd isotopic data reveal clear contrasting geochemical signatures: samples from 35-46°N on one hand and from 10-24°N on the other, define two separate isotopic Sr-Hf and Nd-Hf co-variations between two different depleted end-members and the common mantle component "C". This emphasizes the heterogeneous character of the depleted mantle source of the northern mid-atlantic MORB, as previously reported and discussed in [1] using only Sr isotopes.
If the 35-46°N section of the ridge involves a Highly Depleted Mantle source, HDM, containing melts from refractory mantle components such as subcontinental lithospheric fragments, this can explain its isotopic signature contrasting with the more commonly found Depleted Mantle source, DM, involved in the 10-24°N ridge section: higher Hf isotopic compositions, higher Sr-Pb and lower Nd isotopic compositions can be the result of (1) the formation of ancient sub-lithospheric mantle by partial melting of peridotite in the garnet stability field (2) its isolation from the convecting mantle for billions of years, allowing the development of radiogenic Hf (3) remelting of refractory mantle pieces which get incorporated in the upwelling asthenosphere during the opening of the Atlantic. In this interpretation, each separate isotopic Sr-Hf and Nd-Hf covariation for each ridge section is the result of mixing between the separate depleted sources, HDM and DM, and the triple junction plume source of "C" composition.
[1] Dosso et al. (1999), Earth Planet. Sci. Lett. 170, 269-286.