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Osmium Isotope Signatures of Picrites and Basalts from Theistareykir (North Iceland)

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The Theistareykir rift segment is located in the Neovolcanic Zone of Northern Iceland. In terms of Sr and Nd isotope ratios, the volcanic rocks from Theistareykir cover almost the complete Iceland array (e.g., Elliott et al. 1991). In contrast, Pb isotope ratios are more restricted and similar to Kolbeinsey ridge basalts. In addition, He isotope ratios measured on Theistareykir picrites show $^{3}He/^{4}He$ (R/Ra) values around 8 (Breddam et al. 2000), which is typical for Mid-Ocean Ridge Basalt (MORB) average.

$^{187}Os/^{188}Os$ ratios of picrites and basalts from Theistareykir vary from 0.1305-0.1349 (γ_{Os}=2.7-6.1) and are negatively correlated with Os concentrations. This range overlaps with that of Ocean Island Basalts (OIB) and also includes ^{187}Os-enriched MORB analyzed by Schiano et al. (1997). However, it is higher than the average $^{187}Os/^{188}Os$ ratio of 0.125 for Depleted MORB Mantle (DMM) as suggested by Snow & Reisberg (1995).

There appears to be a systematic change in $^{187}Os/^{188}Os$ with latitude. Whereas the $^{187}Os/^{188}Os$ ratios at north and south Theistareykir are more radiogenic (γ_{Os}=5.4-6.1), the central Theistareykir flows have less radiogenic Os (γ_{Os}=2.7-4.6). These gradients coincide with two stronger s-wave anomalies in a seismic tomography map of Wolfe et al. (1997) at 125 km depth in the north and south of Theistareykir, possibly implying a stronger plume influence at these locations.

Theistareykir picrites and the West Greenland picrites (Schaefer et al. 2000) - the latter formed by partial melting of the Iceland-Plume during the Lower Tertiary - have similar initial Os isotopic compositions. However, in contrast to the MORB-type He signature of Theistareykir, the West Greenland picrites display plume-type He of ~ 30 (R/Ra). In addition, there is a large difference in the Os concentrations. The Theistareykir samples range from to 52 to 400 ppt, and are correlated with MgO, Ni and Cr concentrations. In contrast, the picrites from West Greenland have 4-5 times higher Os concentrations at similar Ni content or Mg# as the Theistareykir picrites. This could be caused by a higher degree of partial melting in the initial plume head, more likely it reflects a source feature.

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