Geochemistry of the Tuli Syncline high-Ti picrites and basalts, Karoo CFB, South Africa: Origin from a high $\delta^{18}O$ pyroxenite mantle source

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The 183 Ma Karoo continental flood basalts (CFB) outcrop over extensive areas of southern Africa and Antarctica. The Tuli Syncline represents one of the larger erosional remnants in the northern region. The area of outcrop is a syncline 240 km by 50 km in dimensions.

We present XRF major and trace element analyses for 817 high-Ti picrite and basalt samples as well as Sr-Nd-Pb-Hf-Os isotope analyses and REE for a selected suite of samples. The picrites and basalts are sub-divided into three groups based on Zr/Nb and Ce/Y ratios and termed: 1) HZN-1; 2) HZN-2; and 3) LZN. The HZN-1 occurs at the base of the volcanic sequence, overlain by the HZN-2, which is in turn overlain by the LZN.

The HZN-1 have low εNd_i (-7.2 to -9.8), low εHf_i (-8.9 to -14.2), high Os (1.7-3.3 ppb), and relatively unradiogenic $(^{87}Sr/^{86}Sr)_i$ (0.7048-0.7059). They also have chemistry indicative of melts derived from a pyroxenite mantle source, such as high 10000*Zn/Fe (>12.5) and high (>60) FeO/MnO. The HZN-2 and LZN have higher εNd_i (-1.2 to -4.5) and εHf_i (0.1), and low Os (~0.06 ppb) with $(^{87}Sr/^{86}Sr)_i$ of 0.7044-0.7054. Pyroxenite-peridotite melt indices indicate a peridotite source lithology for HZN-2 and LZN basalts.

Geochemical constraints, in conjunction with reported high $\delta^{18}O$ olivine, suggests the HZN-1 are sourced from an enriched pyroxenitic SCLM. The HZN-1 has low Nb/Nb* relative to the HZN-2/LZN, indicating that this source is a metasomatic component formed by infiltration of subduction-derived melts. The primitive melts of the HZN-2/LZN are sourced from a depleted peridotite SCLM similar to the Karoo low-Ti magma series with a low contribution from the enriched component. Thus, progressive melting of the source through time results in initial melts dominated by the more fusible pyroxenite lithology followed by later stage melts dominated by peridotite.