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Nd and Hf isotopic analysis of Barberton komatiites

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In order to constrain the origin of komatiites from the Barberton Belt, particularly the nature of their mantle source and the conditions of partial melting, we analyzed the Nd and Hf isotopic compositions of 33 komatiite samples. Of these 15 were from the ca. 3.5 Ga Komati Formation, 3 were from the 3.47 Ga Hooggenoeg Fm and 15 from the 3.3 Ga Weltevreden Fm. The samples were collected from outcrop and represent the three main types of komatiite found in the Barberton Belt: i.e. Al-depleted, Al-undepleted and Al-enriched. The analyses were carried out at ENS Lyon using the procedure described by Blichert-Toft et al.

For each sample suite we obtained a relatively large range of calculated initial isotopic values. In each suite, one or more samples gave an unreasonably high or low value, particularly for the Hf isotopic system. Excluding these outliers, the values are as follows: Komati Fm, epsilon Nd = -0.8 to +2.5, epsilon Hf = +1 to +8; Hooggenoeg Fm, epsilon Nd = -0.1 to +0.2, epsilon Hf = +1 to +2; Weltevreden Fm, epsilon Nd = 0.3 to +2.0, epsilon Hf = +4 to +13. There were no systematic differences between the isotopic compositions of the three different types of komatiite. Within the relatively large variability of the data, the epsilon Hf values tend to become more positive with age while the epsilon Nd values remain essentially constant.

These results are broadly in line with those obtained in most of the previous studies of Barberton komatiites. Notably: 1) there is a wide range in initial isotopic compositions that is not compatible with normal magmatic processes. At least part of the range can be attributed to disturbance, particularly of the Lu-Hf system, after eruption of the lavas; 2) notwithstanding this uncertainty, both the Nd and Hf isotopic compositions are slightly radiogenic, indicating formation from a moderately depleted mantle source.

To obtain more reliable data, we intend a) to analyse carefully chosen and prepared samples from core recovered during the ICDP drilling project; 2) analyse magmatic pyroxene separated from selected samples.