Insights on the enriched isotopic nature of Proterozoic dyke swarms in the Northeastern Superior Province

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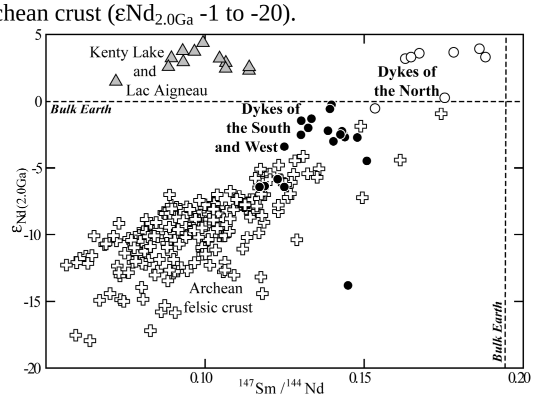
The origin of the enriched signature commonly seen in continental flood basalts has fueled a long standing debate about the relative roles of sialic crust and lithospheric mantle in the contamination of asthenosphere-derived magmas. Many Proterozoic mafic dykes have the chemical characteristics of continental flood basalts (CFB), displaying light rare earth element and large ion lithophile element enrichments relative to primitive mantle, associated with depletions in Nb and Ta relative to Th and La.

In the Northeastern Superior Province of Canada (NESP) numerous mafic dyke swarms range in age between 2.51 and 2.00 Ga, with many being *ca*. 2.21 Ga. The mafic dykes that cut the isotopically-juvenile Archean crust (T_{DM} = 2.8-3.1 Ga) of the Riviere Arnaud Terrrane in the North have lower La/Sm, La/Nb and Th/Nb ratios, and positive εNd values (+4.2 to +0.4). In contrast, the mafic dykes in the older crust (T_{DM} = 2.9-3.8 Ga) of the Hudson Bay Terrane, to the South and West, have higher La/Sm, La/Nb and Th/Nb ratios, and low to negative εNd values (+0.5 to -10.5). These differences are independent of age, but rather coincide with the nature of the crust and lithosphere in which the mafic dykes were emplaced. Although enriched alkaline basalts occur along the periphery of the NESP craton (Kenty Lake; 1.96 Ga) and alkaline lamprophyres intrude the craton (Lac Aigneau dykes; 1.94 Ga), these rocks can not represent the enriched component seen in the mafic dyke swarms, because they are characterized by low La/Nb and Th/Nb ratios coupled with positive εNd values (+3.7 to +0.5). These differences are incompatible with the involvement of a lithospheric component in the petrogenesis of the mafic dyke swarms of the NESP and suggest a significant role for old enriched Archean crust ($\varepsilon Nd_{2.0Ga}$ -1 to -20).



Geochemical, lithologic and biotic variations of the K/P boundary record, implications for seiche-like movements as causal factors in the observed mix-up

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A comparison of temporal and spatial distribution of iridium and various stable isotope records [e.g.1, 2]; in marine deposits affected by the K-P bolide impact, c. 65.0 Ma [3, 4] shows wide discrepancies indicative of unusual conditions of sedimentation. Similarly, the boundary zone displays heterogeneities in texture and microfossil contents, even within short distances of a given basin, as faunal mixing has been, indeed, the hallmark of the boundary layer worldwide. Furthermore, the boundary zone displays considerable variation in thickness within a same area, and most importantly it also includes consistent delicate primary sedimentary structures such as cross-lamination, and rip-up clasts.

These features may occur irrespective of the paleodepths of the basins. Repetitive occurrences of these primary sedimentary structures indicate vigorous multiphase subaqueous flow processes of cohesionless particles. The complexity of the structures together with reversal of directional pattern is consistent with structures related to oscillatory movements [5].

Thus, shock waves generated by the impact and subsequent major crustal readjustments not only triggered tsunamis [6,7], but they apparently generated oscillatory waves such as those observed in seiches, a phenomenon not yet studied in present deep ocean basins. This mechanism may explain the effects of exceptional subaqueous flow processes that led to the sedimentological, faunal and geochemical discrepancies observed at the K-P boundary.

References

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