ICP-MS analysis of incompatible trace elements in peridotites from the Oman ophiolite

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The Oman ophiolite represents the relics of an oceanic spreading center. The mantle section is constituted mainly of harzburgites cross cut by dunitic bands, the largest (up to several meters large) being found at the base and at the top of the mantle section. In this paper are presented the results of a detailed geochemical study of harzburgites and dunites from three south eastern massifs of the Oman ophiolite: the Nakhl and Sumail massifs where diapirs are observed and the Wadi Tayin massif were outcrops the deepest part of the mantle section in Oman. The trace element whole rock content of more than 40 peridotite samples were analysed by ICP-MS for Rare Earth Elements (*REE*), Zr, Hf, Rb, Ba, U, Th, Nb, Ta, and Y.

The Oman ophiolite peridotites are extremely depleted in all incompatible trace elements. Harzburgites are ultra-*REE* depleted, the most *REE* depleted harzburgites being found within diapir areas (Maqsad, Nakhl). The dunites whole rock content is similar to the one observed in harzburgites. Most harzburgites show a 'spoon-shaped' pattern, except the ones found at the base of the mantle section (Wadi Tayin) which have 'upward convex' patterns. their light *REE* content is as low as those of diapir harzburgites whereas they are heavy *REE* enriched compared to all the Oman harzburgites.

The most incompatible elements (Cs, Rb, Ba, Nb, Ta, U, Th) plot at the most depleted end of the mantle trends defined by basalt-borne mantle xenoliths (Arizona, French Massif Central and East African Rift) and orogenic peridotites (Ronda). Yet, although

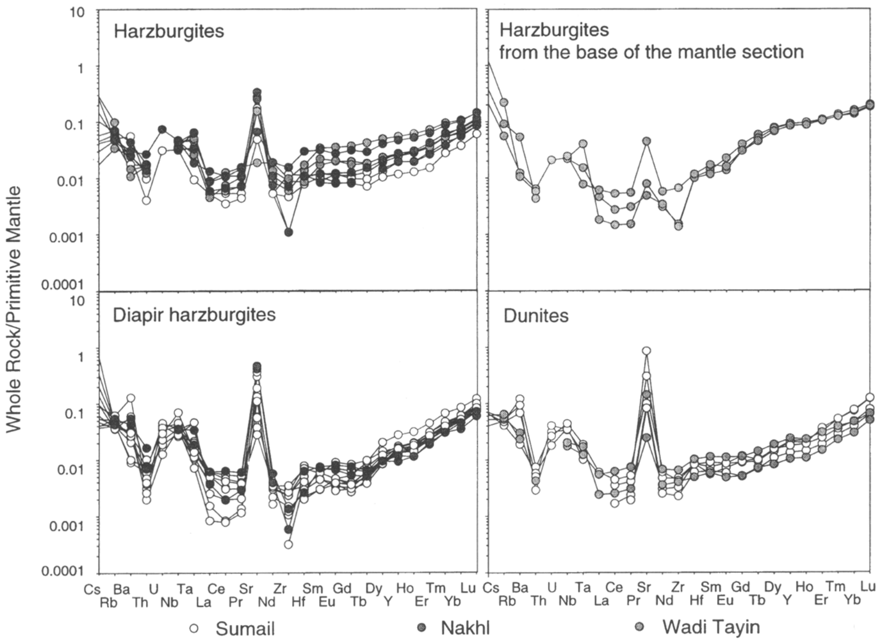

FIG. 1. Trace element content normalized to primitive mantle values after Sun and McDonough (1989) of harzburgites and dunites from the South Eastern Massifs of the Oman ophiolite (Nakhl, Sumail and Wadi Tayin).

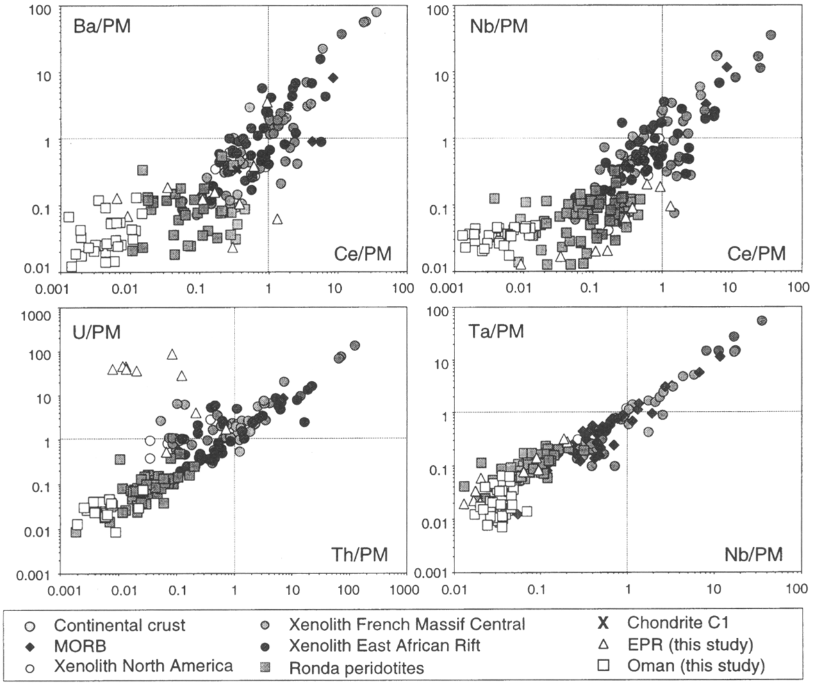

FIG. 2. Ba *vs* Ce, Nb *vs* Ce, U *vs* Th and Ta *vs* Nb (concentrations normalized to Primitive Mantle values after Sun and McDonough, 1989) in Oman peridotites and the EPR peridotites compared to Continental Crust (Rudnick and Fountain, 1995), N-MORB, E-MORB and C1 chondrite (Sun and McDonough, 1989), xenoliths from North America (Jochum *et al*, 1989), the French Massif Central (unpublished data) and the East African Rift (Bedini *et al*, 1997 and references therein).

they are at very low concentration levels, the Oman peridotites are enriched in incompatible elements relative to *REE* (e.g. (Ba/Ce) and (Nb/Ce) up to 50 times and 30 times Primitive Mantle -PM- respectively).

Most of these enrichments in incompatible elements are not observed in the East Pacific Rise peridotites (this study). In addition, inter-element fractionation differs between the East Pacific Rise and the Oman peridotites. For instance, the Oman peridotites U/Th ratio can be as high as 10 times PM and, nevertheless, plot in the mantle trend, while the U-rich EPR peridotites do not. U-rich peridotites are reported world-wide in lithospheric peridotites and have been associated with metasomatic mantle processes or later alteration processes (e.g. Alard *et al*, this volume). The oceanic alteration processes signature is showed by the EPR peridotites (U/Th ratios up to 5000 times PM). Such U enrichments are not observed in the Oman peridotites, therefore precluding an alteration origin for its relatively high U/Th ratios. Finally, the Oman peridotites show a Nb-Ta fractionation (Nb/Ta ratios of 0.6 to 4 times PM) whereas the EPR peridotites are in the mantle trend for the same low concentration levels (Nb and Ta <0.1 times PM). So, if the incompatible element distribution in EPR peridotites may be explained by mantle melting and alteration processes, the highly incompatible element enrichments relative to *REE* observed in the Oman peridotites do not result from alteration and indicate the occurrence of other mantle processes superimposed to melting.

References

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