Ofioliti, 1999, 24 (1a), 158-159

THE MANTLE LITHOSPHERE IN NORTHEASTERN BRAZIL AND FERNANDO DE NORONHA. PLUME-RELATED MANTLE METASOMATISM?

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ABSTRACT

Cenozoic alkali basalts in the Rio Grande do Norte State and the Fernando de Noronha Island contain abundant spinel facies mantle xenoliths. At Pico Cabuji (NE Brazil) both protogranular and porphyroclastic xenoliths occur. The former mainly consists of lherzolites and the latter of harzburgites, with average equilibrium temperatures of 1064±6°C and 1238±7°C, respectively. Pressure is assumed essentially equal in the two groups (~1.8 GPa). Porphyroclastic xenoliths have more refractory bulk rock and mineral phase compositions than the progranular ones, in keeping with their mode. Both groups show chemical variation trends consistent with fractional melting and basalt extraction. REE profiles of clinopyroxenes vary from LREE enriched (spoon shaped) to LREE depleted in the progranular group, whereas they are dominantly slightly convex upwards in the porphyroclastic clinopyroxenes. HFSE (Ti and Zr) anomalies are in general modest in the clinopyroxenes of both groups. At Fernando de Noronha, xenoliths are variably-textured lherzolites and harzburgites. Their chemical variation trends overlap and extend those of the Pico Cabuji samples. Average temperature is 1056±87°C and pressure 1.6±0.2 GPa. Clinopyroxenes have spoon-shaped to LREE depleted profiles similar to those of the Pico Cabuji protogranular type, but have higher REE concentrations and

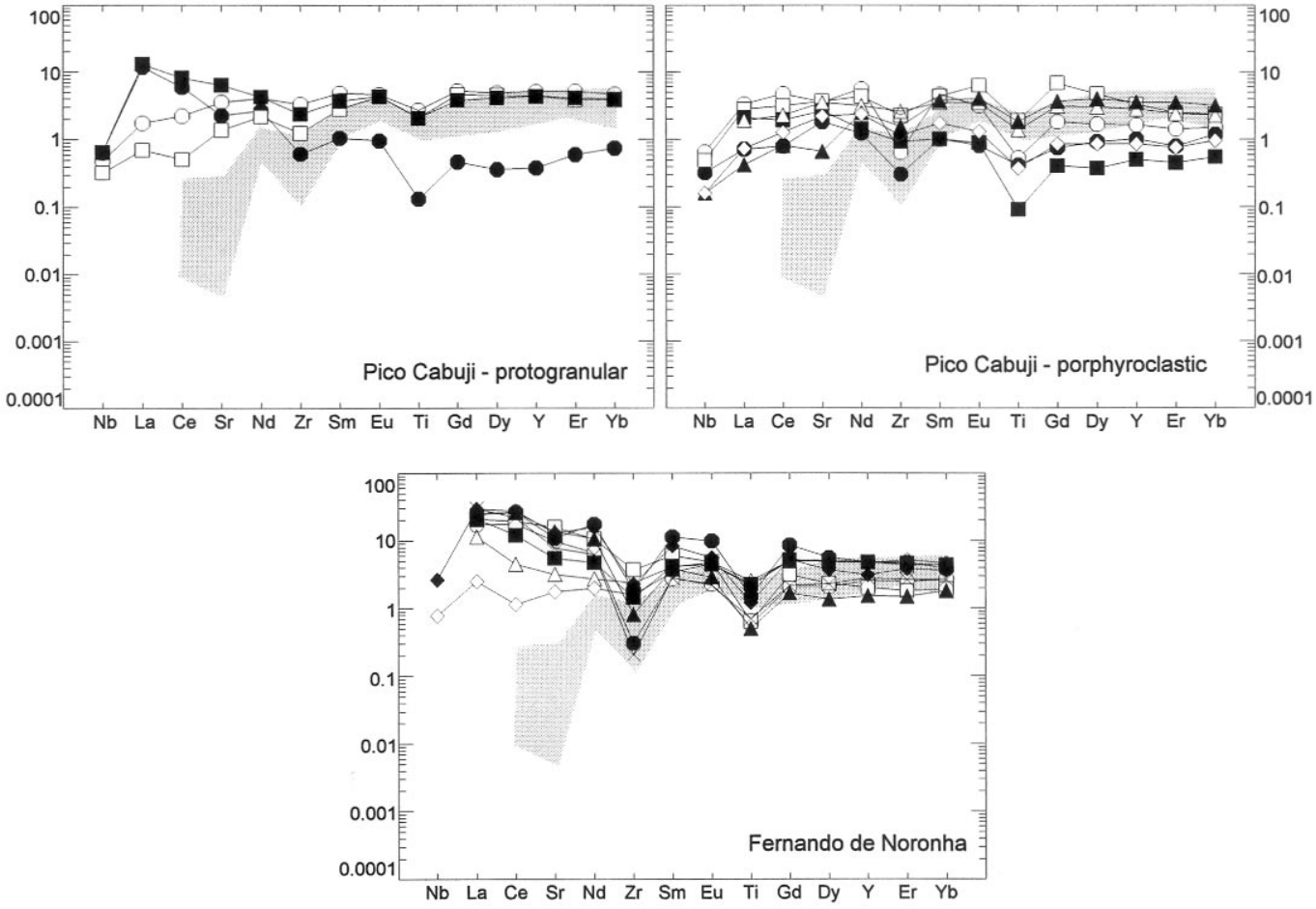

Fig. 1 - Primitive mantle-normalised (Hofmann, 1988) extended incompatible trace element patterns of the clinopyroxenes, compared with the clinopyroxenes of the spinel-facies abyssal peridotites (shaded field, Johnson and Dick, 1992).

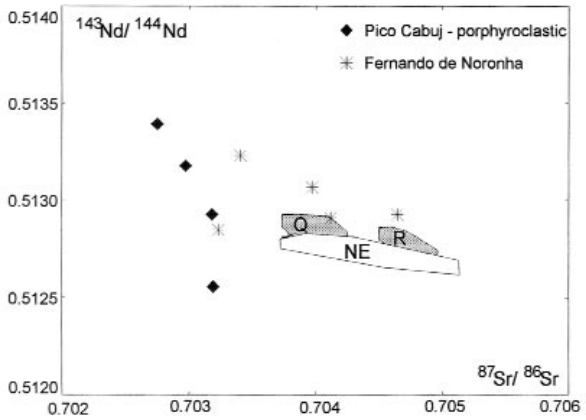

Fig. 2 - Nd-Sr isotope arrays of Fernando de Noronha and Pico Cabuji clinopyroxenes. NE = isotope filed of the basalts of northeastern Brazil (Fodor et al., 1998); Q and R = isotope range of the Quixaba and Remedios formations, respectively, at Fernando de Noronha.

more marked negative HFSE spikes (Fig. 1). Nd and Sr isotopes of the Pico Cabuji porphyroclastic clinopyroxenes ($^{143}Nd/^{144}Nd$ = 0.51339-0.51255, $^{87}Sr/^{86}Sr$ = 0.70275-0.70319) and of Fernando de Noronha ($^{143}Nd/^{144}Nd$ = 0.51323-0.51285, $^{87}Sr/^{86}Sr$ = 0.70323-0.70465) plot on distinct arrays originating from a similar, isotopically depleted composition and trending to lowNd-lowSr and lowNd-high-Sr, respectively. $^{143}Nd/^{144}Nd$ decreases, and $^{87}Sr/^{86}Sr$ increases, with increasing Mg# of clinopyroxene and with all the parameters indicative of previous melting episodes (modal clinopyroxene, bulk rock MgO). The opposite correlations are observed with LREE concentration, La_N/Sm_N, and with all the parameters reflecting metasomatic enrichment indicating different isotope and geochemical characteristics of the Pico Cabuji and Fernando de Noronha metasomatic agents. In both occurrences the premetasomatic lithosphere was isotopically similar to DMM (depleted MORB mantle) whereas the metasomatic component was EMI-like and EMII-like at Pico Cabuji and Fernando de Noronha respectively. The EMII component of Fernando de Noronha may be related with a crustal reservoir present at Fernando de Noronha and not at Pico Cabuji. The diversity of the metasomatic components between Pico Cabuji and Fernando de Noronha indicates considerable heterogeneity in their respective sources, difficult to reconcile with their supposed genetic relationship with the same plume.

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