La/Nb VARIATION IN PROTEROZOIC AND MESOZOIC MAFIC DYKE SWARMS IN BRAZIL

E.M.Piccirillo[1]
G.Bellieni[2]
C.Moraes-Brito[3]
P.Comin-Chiaramonti[4]
G.Martins[3]
M.H.F.Macêdo[5]
A.J.Melfi[3]
J.P.P.Pinese[6]
M.A.F.Tanner de Oliveira[7]

An extensive research programme on mafic dyke swarms (IGCP-257) is currently in progress in Brazil. During the last four years, research activity was concentrated on Proterozoic (c. 1.0 to 2.5 Ga) dykes from the São Francisco craton (Uauá, Salvador, Ilhéus-Olivença, Minas Gerais) and on those of Mesozoic age (c. 120-140 Ma) from Rio Grande do Norte State (northern Brazil) and the Ponta Grossa Arch (southern Brazil). These last dykes are associated with the flood basalts of the northern Paraná basin.

In general, mafic dykes older than 1.5 Ga (except for those ~2.1 Ga old of the Uauá region) are represented by dominant amphibolites, while those younger than 1.5 Ga did not suffer metamorphism. Most dykes have compositions corresponding to tholeiitic basalt types. The unmetamorphosed ones quite often contain augite and pigeonite (or orthopyroxene). Usually, high- ($>2\%$ wt) and low- ($<2\%$ wt) TiO_2 and incompatible element dykes are found associated in the field in the different dyke swarms.

The frequency distributions of the La/Nb ratio for the investigated dykes are shown in Figure 1. All the dykes are characterized by a La/Nb ratio usually higher than 1.0 (i.e. negative Nb anomaly in terms of primordial mantle normalization; WOOD, 1979). On the average, La/Nb ratios for the São Francisco dykes are 1.99 ± 1.29 (1.5-2.5 Ga, N = 101) and 1.43 ± 0.50 (1.0-1.5 Ga, N = 175), whereas for the Mesozoic dykes, La/Nb is 1.85 ± 0.64 (N = 115). Dykes with La/Nb lower than 1.0 (positive Nb anomaly; Wood's La/Nb ratios for primordial

[1]Istituto di Mineralogia e Petrografia, Università di Trieste, Piazzale Europa 1, 34100 Trieste, Italia.
[2]Dipartimento di Mineralogia e Petrologia, Università di Padova, Corso Garibaldi 37, 35100 Padova, Italia.
[3]Instituto Astronômico e Geofísico, Universidade de São Paulo, Caixa Postal 30627, 01051 São Paulo, SP, Brasil.
[4]Istituto di Mineralogia, Petrografia e Geochimica, Università di Palermo, Via Archiraffi, 90100 Palermo, Italia.
[5]Departamento de Geologia, Universidade Federal do Rio Grande do Norte, 59020 Natal, RN, Brasil.
[6]Departamento de Geociências, Universidade Estadual de Londrina, Caixa Postal 6001, 86051 Londrina, PR, Brasil.
[7]Instituto de Geociências, Universidade Federal da Bahia, Rua Caetano Moura 123, 40210 Salvador, BA, Brasil.

mantle is 1.13) may be found closely associated in the field with those characterized by a negative Nb anomaly.

Preliminary Sr/Nd isotope data and bulk-rock chemistry suggest that low-pressure crustal contamination played a minor role in the genesis of the basaltic dyke varieties. Thus, La/Nb variation probably reflects a primary or near-primary mantle composition, given that high-pressure fractional crystallization would require a phase that selectively removes Nb with respect to other incompatible elements, such as P and Zr. Positive and negative Nb anomalies are found for dykes with high- and low- TiO_2 and incompatible element contents.

Comparison of La/Nb frequency distributions for the investigated Brazilian dykes and those for basalts from different tectonic settings (Fig. 1) suggests that the Brazilian dykes are distinct from both the basalts erupted at convergent plate margins (i.e. island arcs and active continental margins: not shown in Fig. 1), and those from oceanic islands. On the other hand, a favourable comparison in La/Nb frequency distributions was found between the Brazilian dykes and continental flood basalts. These data suggest that Nb-anomalies are not necessarily related to fluids associated with a subducting plate, which would favour the enrichment of "lithophile" elements, relative to Nb(Ta). These anomalies could be explained in terms of a variable, Nb-bearing residual phase (e.g. BRIQUEU et al., 1984). More probably, these anomalies may be associated with LIL element enrichment related to mantle metasomatic processes (e.g. ANDERSON, 1982), without the participation of crustal components. This type of metasomatic process would have variably affected the mantle source(s).

REFERENCES

ANDERSON, D.L. (1982) Isotopic evolution of the mantle: the role of magma mixing. **Earth Planetary Science Letters**, **57**:1-12.

BRIQUEU, L.; BOUGAULT, H.; JORON, J.L. (1984) Quantification of Nb, Ta, Ti and V anomalies in magmas associated with subduction zones: petrogenetic implications. **Earth Planetary Science Letters**, **68**:297-308.

THOMPSON, R.N.; MORRISON, M.A.; DICKIN, A.P.; HENDRY,G.L. (1983) Continental flood basalts. Arachnids rule OK? In: HAWKESWORTH, C.J. & NORRY, M.J. (eds.) Continental basalts and mantle xenoliths. Nantwich, Shiva. p.158-195.

WOOD, D.A. (1979) A variable veined sub-oceanic upper mantle. Genetic significance for mid-ocean ridge basalts from geochemical evidence. **Geology**, **7**:499-503.

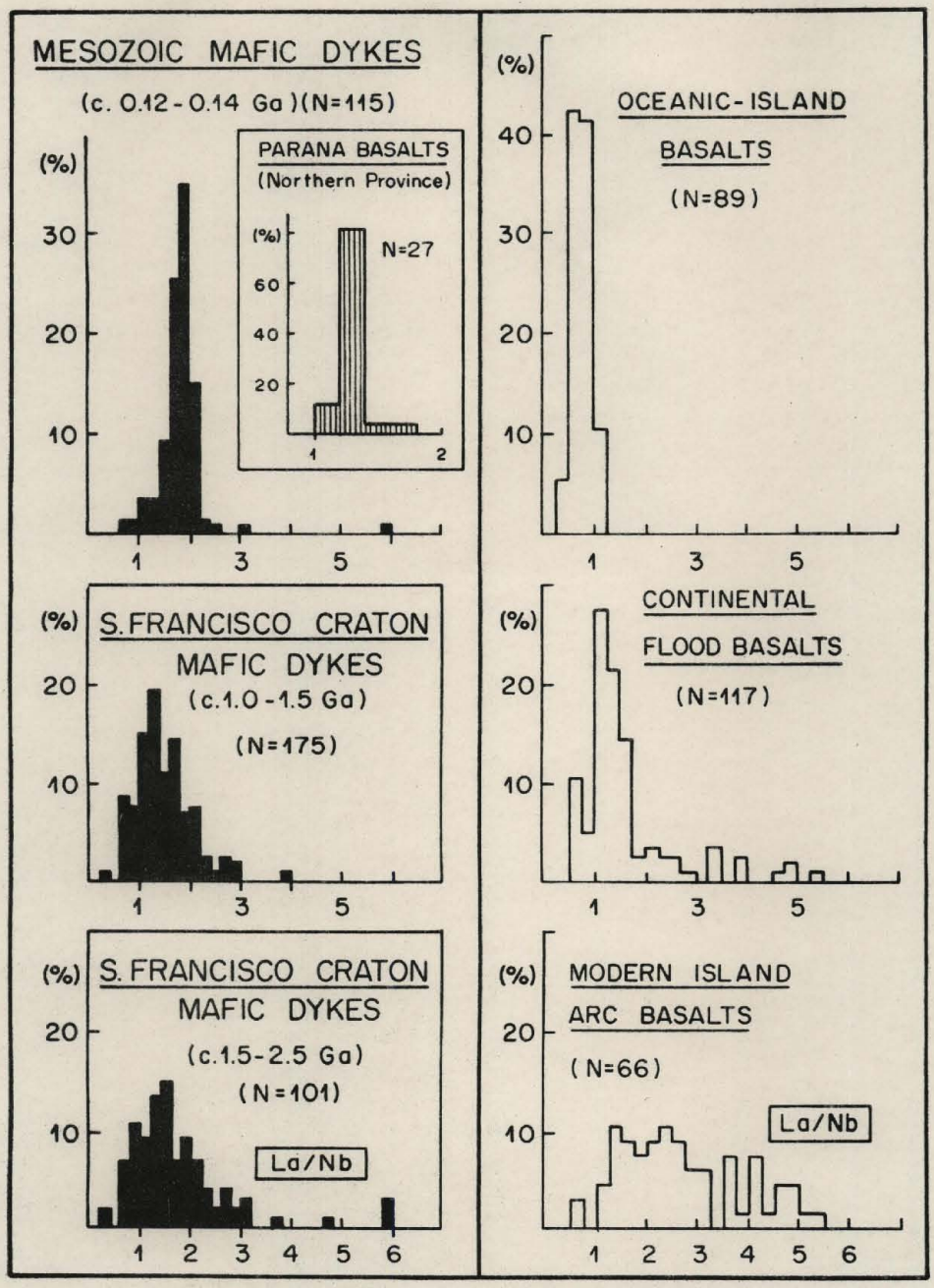

Figure 1 - Frequency distributions of La/Nb ratios of Brazilian dyke swarms compared with basalts from different tectonic settings (THOMPSON et al., 1983). A La/Nb value of 1.13 is the primordial mantle ratio (WOOD, 1979). N = number of samples.