II SIMPÓSIO SOBRE O CRÁTON DO SÃO FRANCISCO
EVOLUÇÃO TECTÔNICA E METALOGENÉTICA

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IDENTIFICATION OF CRUSTAL BLOCKS IN NORTHEAST BRAZIL USING SM–ND AND U–PB GEOCHRONOLOGY

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We report here initial results from Sm/Nd and U/Pb analyses in the Borborema Province of NE Brasil. The aim of this research is to use these isotopic tools to define the internal architecture of this province, with particular emphasis on delineating the northen margin of domains joined to this margin during the Brasiliano orogeny. In addition, we wish to use these results for better interpretation of correlations with similar terranes in western Africa.

Two principal types of analyses are being used in this phase of our study: (a) U/Pb analyses of zircons extracted from a variety of rocks in the older terranes, including felsic tuffs, pre-Brasiliano granites, migmatites, gneisses, and detrital zircons from meta-sedimentary rocks, and (b) Sm/Nd whole-rock analyses on Brasiliano granites, pre-Brasiliano granite, and host gneisses, metassedimentary rocks, and metavolcanic rocks. Zircon data will constrain original crystallization ages or provenance of the rocks, and Sm/Nd analyses of Brasiliano plutons will constrain the ages of the protoliths from which their magmas were derived. Sm/Nd data on older granites and gneisses help to define the isotopic character of host terranes of the granites. This will allow better resolution of the geologic history of this region and will also allow determination of which previous K–Ar and Rb–Sr results representent real events or which represent disturbed systems.

U/Pb analyses from metavolcanic and granitic rocks in the Sergipano (SDS), Pajeu-Paraiba (SPP), Riacho Pontal (SRP), and Piancó-Alto Brigida (SPAB) fold belts (Fig. 1) demonstrate that these supracrustal rocks formed about 1 Ga (Brito Neves and others, this conference). Basement gneiss and granulite of Early Proterozoic to Archean age are exposed in southern SDS, and basement of the Rio Piranhas massif (RPM) north of Patos Lineament yields Trans-amazonian ages of 2.15 Ga.

Because most of the region has been strongly affected by the ca. 600 Ma Brasiliano orogeny and primary crystallization ages have not yet been determined for many older rock units, we have calculated the Nd compositions at 600 Ma, $\varepsilon_{Nd}(600)$, for rocks analysed, rather then using T (DM) ages, which are susceptible to major uncertainties induced by possible Sm/Nd fractionation during magma genesis (especially true for Brasiliano plutons). Results are summarized in figures 1 to 3, and representative data are presented in Table 1.

There are four groups of $\varepsilon_{Nd}(600)$ shown in Figure 2; these groups correlate well with geology and geography. Two samples (group I) with very low are from gneiss terranes of probable Archean original age (Simão Dias window on the north edge of SFC, and Caldas Brandão massif, CBM, southwest of Natal).

Table 1.

(Fig.3)	Rock Type	Domain	147Sm/144Nd	$\varepsilon_{Nd}(0)$	Age	$\varepsilon_{Nd}(600)$	T(DM)
1	Granite	PEAL	0.0893	−11.8	0.6	−3.6	1.24
2	Granite	RPM	0.0827	−26.9	0.6	−18.2	2.08
3	Gneiss	RPM	0.1076	−28.6	2.15	−21.8	2.71
4	Migmatite	CBM	0.1077	30.5	2.7?	−28.2	3.21

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In group II, Rio Piranhas massif basement gneisses have zircon ages of 2.15 Ga and $\varepsilon_{Nd}(600)$ of −22 to −24, with T (DM) of 2.6 to 2.7 Ga; the Brasiliano granites intruded into these gneisses have similar Nd(600) (T. 1, Figs. 2, 3), but they have slightly younger T (DM) of 2.3 to 2.5 Ga, suggesting some Sm/Nd fractionation during magma genesis of the Brasiliano plutons (Fig. 3). The Brasiliano plutons of RPM were undoubtedly derived from the Transamazonian basement gneisses of RPM and the Nd in the plutons is a good indicator of the basement age.

Samples of 1 Ga metavolcanic and plutonic rocks from SDS, SRP, SPAB and SPP and samples of Brasiliano granites from these foldbelts and PEAL (group IV) all have much less negative ε_{Nd} (()) and $\varepsilon_{Nd}(600)$, with T (DM) of 1.2 to 1.5 Ga. A simple interpretation of the Nd data and Braziliano granite genesis implies that there is no Transamazonian or Archean basement underlying these folbelts or most of the PEAL massif. Fig 3 shows representative data, and although there are several possible ways to interpret the differences in $\varepsilon_{Nd}(600)$ between Brasiliano granites of group II and group IV, we believe that the best is the simplest: there is very little to no Early Proterozoic to Archean basement underlying the regions of group IV data. Group III data are similar to group II, but displaced to less negative values. We interpret these data to indicate the presence of older crust, but either with greater involvement of juvenile Brasiliano material or less involvement of Archean material; resolution of this uncertainty must await more data. In general, group IV data support the model of Brito Neves et al (this conference) in which 1.0 Ga rifting was an important tectonic and crust-forming event along the northern edge of the São Francisco Cráton. Furthermore, our data show that significant parts of the Borborema Province are not remobilized Transamazonian to Archean crust, but that Middle Proterozoic crust is a major feature of the Province. There are, however, several small remnants of older crust within the area dominated by Middle Proterozoic crust, suggesting that the rifting event created several small continental fragments that were later incorporated into the Brasiliano collisional orogen.

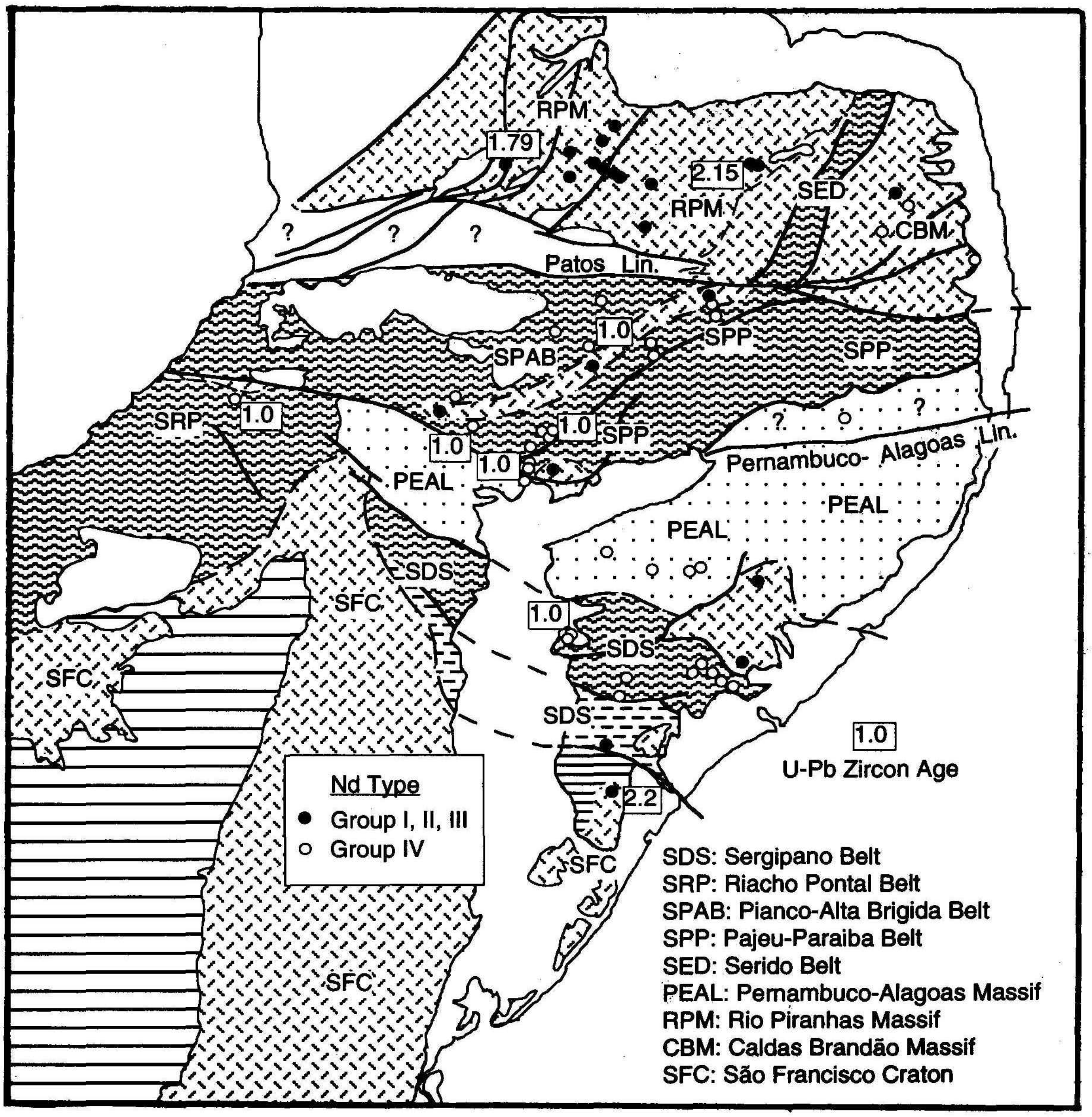
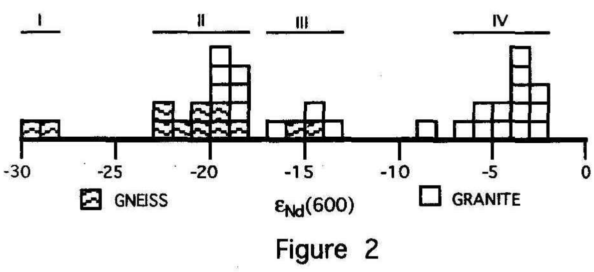


Figure 1. Simplified geologic map of northeast Brasil showing locations of samples and interpretation of results.



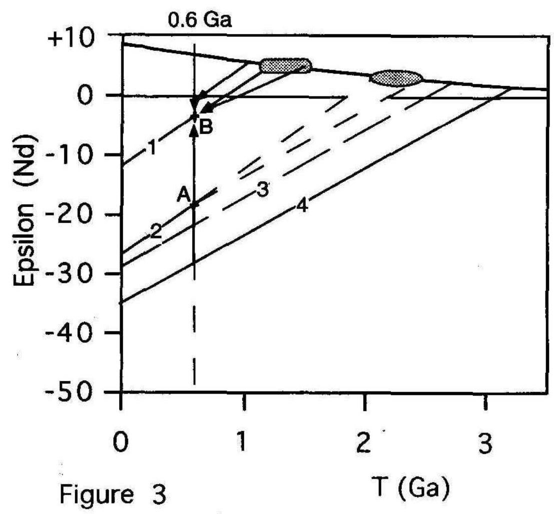


Figure 2. Histogram of Nd (600) for all samples analysed (Fig 1), showing subdivision according to different crustal domains.

Figure 3. Nd evolution diagram for 4 representative samples (Table 1).