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ANALES XXXIV

CHARACTERIZATION OF THE GENERATING SOURCES OF CONTINENTAL CRUST OF THE RIBEIRA BELT THROUGH ISOTOPE OF Nd IN THE STATE OF SÃO PAULO, SE OF BRAZIL

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INTRODUCTION

The tectono-structural configuration of the Ribeira Belt (RB) in different juxtaposed crustal blocks is due to the collision and lateral escape tectonic among the São Francisco and Congo cratons during the Brasiliano/Pan-African Cycle (Campos Neto and Figueiredo, 1995; Hackspacher *et al.*, 1997). With the objective of characterizing the genetic features and the space and temporary relationships of the pre-Brasiliano history of the RB, it was conducted a work through the systematic use of Nd isotopes in the state of São Paulo.

The presented data represent the first results obtained as consequence of the establishment and placement in routine of the Sm/Nd method in the Isotopic Geology Laboratory of the DPM/ IGCE/UNESP. The isotopic analyses were accomplished in the IG/USP and in the IG/UnB, as procedures described in Sato *et al.* (1995) and Pimentel *et al.* (1996)

RESULTS

The geological framework of the area comprehend three domains (Fig. 1): the São Roque, Jundiaí and Embu domains. The first is characterized by the presence of metasedimentary and metavolcanic rocks of low metamorphic degree, and the last two by metasedimentary and metavolcanics rocks of high degree, separate by transcurrent shear zones. The Brasiliano magmatism is well represented in the 3 domains, characterized by granitoids with a complex architecture that includes a magmatic phase of younger circular small bodies cutting older phases, what serves as regional time marker. In a general way the granitoids bodies can be classified in 3 types: 1 - I-type Cordilheran calc-alkaline granites cutted by circular, dominantly, alkali-calcic bodies (São Roque, Ibiúna and Piedade granites); 2 I type Caledonian alkali-calcic granites cutted by circular rapakivi bodies (Sorocaba and São Francisco granites) and 3 - Rapakivi granites with circular formats, isolated or coalescent (Itu granite) (Wernick *et al.*, 1993). The evolutionary history of the magmatism, dated through U/Pb geochronology, in several granites, is episodic and of long duration.

The T_{DM} model age distribution (Fig. 1) define groups of values as presented below.

1- São Roque Domain (SRD): The metasedimentary and metavolcanic rocks of low degree of the São Roque Group (SRG) evidence provenience of different sources areas. Metaritmites present T_{DM} ages of 2.44 Ga and phyllites T_{DM} ages of 1.86 Ga. Metabasic rocks (metadiorites and amphibolites) intercalated in these metasediments present T_{DM} ages of 2.9, 2.66 and 2.2 Ga. These last ones suggest that Archean and Paleoproterozoic mantelic protoliths were involved in processes of crustal extension by occasion of the deposition of the sedimentation of the São Roque Group.

The São Roque, Socoraba and São Francisco granites are intrusive in the SRD. The São Roque granite is a high-K calc-alkaline pluton whose predominant facies are mega-porphyritic monzogranites with T_{DM} of 2.18 Ga, while late even-grained facies show values of T_{DM} of 1.95 Ga. The Sorocaba granite (Godoy, 1989) is represented by monzo and coarse sienogranites, with values of T_{DM} varying among 2.11 Ga for the porphyroid facies and 1.86 Ga for the even-grained facies. The São Francisco granite

(Godoy, 1989) comprehend dominantly, porphyritic monzogranite with T_{DM} ages of 1.93 Ga, while the subordinates even-grained sienogranites, coarse sienogranites and even-grained monzo-diorites show values of T_{DM} of 2.20 Ga, 1.94 Ga and 1.89 Ga, respectively. Even-grained and porphyritic rapakivi facies of circular plutons that cut the batolith show T_{DM} age varying from 1.85 to 1.96 Ga.

2- Jundiaí Domain (JD): Migmatites with garnet and sillymanite and garnet-contend granitic ortogneiss of the Itapira Complex, main unit of these domain, show T_{DM} ages between 1.93 and 2.09 Ga. The Itu granite, intrusive in this unit, presents T_{DM} values of 1.68 Ga.

3- Embu Domain (ED): The Embu Complex, main geological unit of the domain, is composed of paragneiss and migmatites with T_{DM} values between 1.64 and 1.80 Ga, lower than them of the metasediment from the SRG and Itapira Complex. This unit is cut by the Piedade and Ibiuna granites. The first is composed mainly by mega-porphyroid biotite monzogranites, resenting T_{DM} values varying between 1.97 and 1.96 Ga. Diorites enclaves and late facies of even-grained leucogranites involved or cutting this facies presents T_{DM} ages of 2.02 Ga and 1.91 Ga, respectively. The Ibiuna massif presents variation in the T_{DM} ages, with decreasing values from the center to the border of the batolithe. Porphyroid monzogranites, your main facies, and subordinate quartz diorite and granodiorites, presents values of 2.14 and 1.93, 1.82 and 1.79 Ga, respectively.

DISCUSSION.

The systematic Sm/Nd mapping in granitoids and host rocks of the RB (São Roque Group, Embu and Itapira complexes) show that this method is a strong tool for chronological determination of events related to the different periods of continental crust generation. The data presented above suggest:

1- the main event of continental crust formation in this segment was Paleoproterozoic, well evidenced by the T_{DM} ages around 1.9-2.0 Ga. The Paleoproterozoic sialic crust is the source of larger contribution for the generation of the Brasiliano magmatism in the study area, so much as for the sedimentation source (protolith ages).

2- the metasedimentary rocks of the São Roque, Embu and Jundiaí domains show different isotopic signatures indicating heterogeneity of the sedimentation source ages and they could be considered as representing different tectono-estratigraphic terranes during the Brasiliano Orogeny. However, the intrusive Brasiliano granites in the Embu and São Roque domains show the same isotopic signature, with T_{DM} values between 1.8-2.0 Ga. These data confirm the ideas of Hackspacher et al. (1997) that in the considered area do not occur exotic terranes.

3- T_{DM} ages higher than 2.4 Ga for part of the source of the metassedimentary and metavolcanic rocks of the SRG characterize the presence of Archean continental crust and lithospheric mantle in this domain. The presence of both source in metasedimentary and metavolcanic rocks suggest a formerly complex structuring of the SRD comprehending Archean and Proterozoic subblocks. The source of the sedimentation of the SRG would have, partly, older derivation than the source of the intrusive granitoids, all with Paleoproterozoic T_{DM} ages. To the east of the study area Ragatky (1998) has obtained T_{DM} ages of 1.4 Ga for intrusive granitoids in the SRG metasediments. This suggests that different evolutions can be registered in this same crustal segment or that different rocks exist being considered as belonging the same estratigraphic unit. Based on the second hypothesis, Juliani *et al.* (1998) suggested that the SRG comprehend, in reality, two meta-vulcanosedimentary sequences represented by the Serra of Itaberaba Group, with sedimentation source around 1.7 Ga and the SRG of sedimentation sources in 1.4 Ga (Mesoproterozoic provenience age).

4- the interns architecture of the São Roque, Sorocaba and São Francisco granites are suggesting that the magmatism grew by different magmatic pulses (Wernick *et al.*, 1993). Two isotopic evidences support this hypothesis: i) the great variation in the isotopic composition of different magmatic phases present in each pluton. It is considered as a common feature in all the analyzed bodies, whose T_{DM} values vary at intervals among 2.2 - 2.1; 2.0-1.95 Ga and 1.89-1.86 Ga; ii) the zonation of the T_{DM} ages, in the Ibiuna and São Francisco granites suggest your structuring reflected the accretion of successive pulses in these batoliths .

5- these results also indicate that similar calc-alkaline and alkali-calcic magmatic phases are synchronous in plutons of the three studied domains. These way, the compositional and temporal (T_{DM}) variations in these granites can reflect the derivation of: i) different

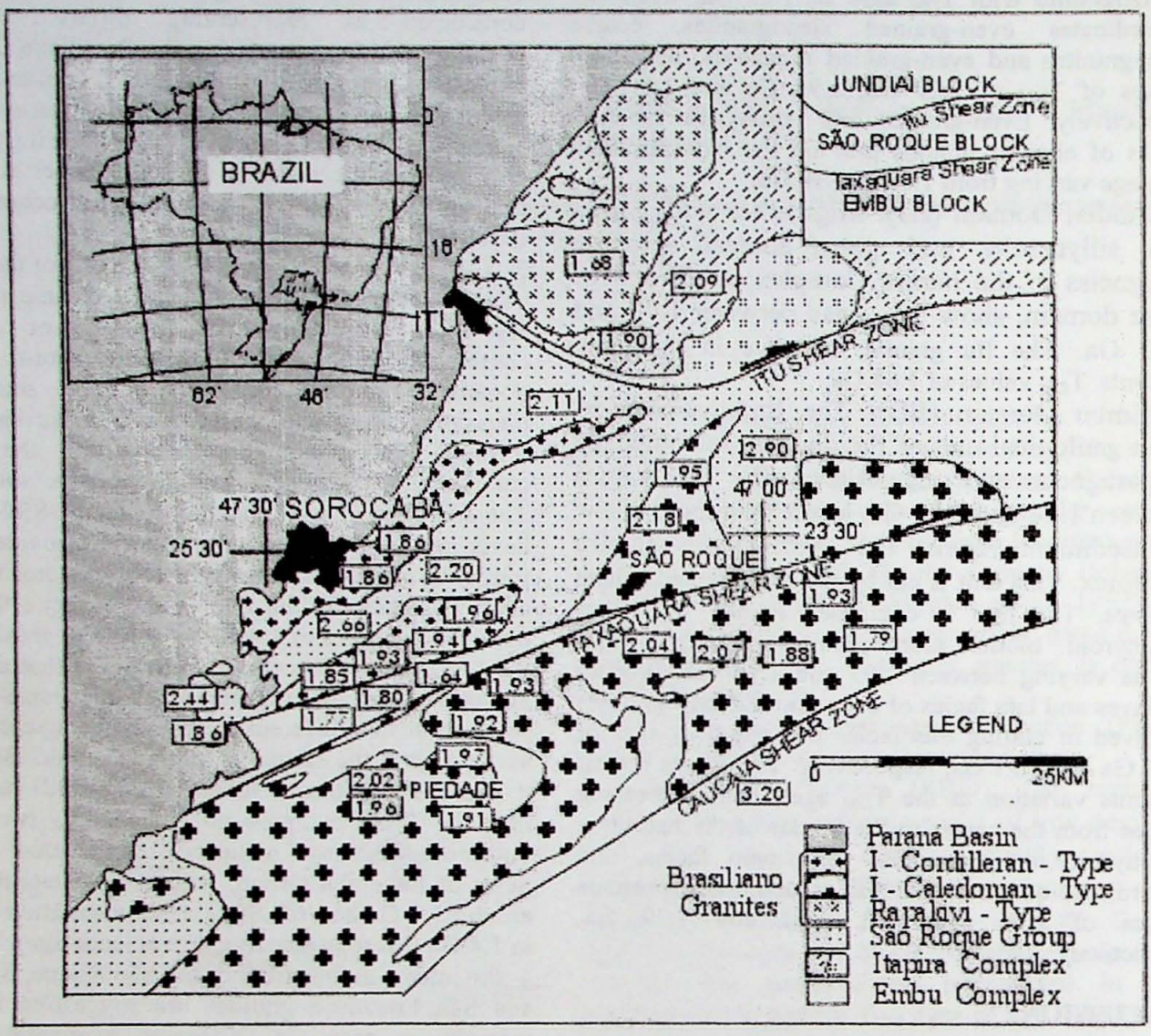

Figure 1 - Nd isotopic map distribution of the Ribeira Belt, São Paulo State, Brazil.

sources; ii) same source developed under different magmatic conditions or ; iii) still submitted to processes of crustal. contamination

6- T_{DM} values smaller than 1.8 Ga, in the Itu granite (Jundiaí domain) and in the metasediments of the Embu Complex (Embu domain) suggest the presence of a Mesoproterozoic sialic crust. Alternatively, considering the regional abundance of Neoproterozoic neossomes and Archean and Paleoproterozoic paleossome (Arthur, 1988), a mixture of old reworked crust with Brasiliano material can be assumed.

7- The variation in the T_{DM} values between 2.2 to 1.8 Ga in a same batolith of different domains can be interpreted as: i) the result of the progressive exhaustion of the Paleoproterozoic source during the magmatogenese, as suggest by the structuring of the bodies; or ii) by the magmatic mixture between fractions derived from an old crust (2.2 Ga) with fractions derived of a young crustal source (1.8 Ga or 1.4 Ga?); iii) it magmatic mixing between fractions derived of crustal material with other originated by the melting of a metassomatic mantle. iv) alternatively, the Mesoproterozoic ages related to the magmatism should be an apparent age, representing mixed ages in the generation of the rapakivi magmatism (isotopic fractionation) owed to anomalous petrogenetic processes as the high participation of volatile that exists associated to this magmatism type.

8- there is not until the moment register of Nd isotopic evidencing the presence of Neoproterozoic juvenile crust in the area. The lack of metavulcanic and plutonic rocks with Neoproterozoic T_{DM} suggest absence of delamination processes during the Brasiliano evolution of the RB in this area.

9- Magma mixing between fractions derived from older and more young crust indicate that each one of the domains considered here developed separately previous your amalgamation and juxtaposition in the end of the Brasiliano cycle, along the transcurrent shear. Therefore, each lithospheric block can have your crustal signature preserved since your generation. In other words, the lithospheric mantle and crust of each block/domain are isocronous.

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