



Sm-Nd isotopic patterns and new paleoproterozoic nuclei basement on boundary between Alto Pajeú and Alto Moxotó domains, Borborema Province, NE-Brazil

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INTRODUCTION

The Nd isotopic systematic has been used in the Eastern portion of the Transversal Zone (Borborema Province) to recognize and distinguish patterns in limit of the Alto Moxotó and Alto Pajeú domains.

This work presents new Sm-Nd and U-Pb (LA-ICPMS) data focusing lithotypes from São Caetano Complex in the boundary of Alto Pajeú and Alto Moxotó domains placed among Logradouro-Boa Vista/PB and Gurjão/PB cities.

GEOLOGICAL SETTING

According to Santos *et al.* (2010) the Alto Pajeú terrane comprises three main litho-tectonic assemblages. The oldest assemblage is present as 2.1-2.2 Ga cratonic basement which may be present as more or less continuous lower crust underlying the terrane. The second assemblage formed between about 1000 and 920 Ma and consists of metasedimentary, metavolcanic, and metaplutonic rocks formed during the Cariris Velhos event. The third assemblage formed between 650 and 520 Ma during various stages of Brasiliano Orogeny includes several calc-alkaline and K-calc-alkaline granitic suites and a distinctive belt of syenitic plutons. In the central and northeastern parts of this region are dominated by a metasedimentary and metavolcanoclastic sequences collectively referred to as the São Caetano Complex. This sequence has a felsic to intermediate compounds (Santos *et al.*, 2002). The protholiths for the paragneisses, quartzites, (garnet)-muscovite-biotite-gneisses and micaschists that compose this complex are respectively pelites/psammites, greywackes, and volcanoclastic rocks (Santos, 1995).

In the studied area, São Caetano Complex was subdivided in three main lithodemic associations (Figure 1): Typical São Caetano sequence - **NP1scax** includes biotite-muscovite paragneiss (metagreywackes) within little porphyroclasts of plagioclase and tourmaline and two generations of muscovite, micaceous quartzite, paragneiss, micaschists and calcitic marbles; Gneissic unit - **NP1sca** predominates homogeneous (garnet)-biotite gneisses and Migmatite unit - **NP1scam** shows stromatic migmatite with granitic or amphibolitic composition. Sillimanite was found in both units and staurolite is present in **NP1scax**. Rare acid volcanics/microgranites, ortoderived amphibolites, magnetite phillites (metavolcanoclastic rock?) occurs mainly on **NP1scax**.

São Joãozinho orthogneiss proposed here, previously described as Recanto/Riacho do Forno Suit (= Tonian Cariris Velhos metagranitoids) (Santos *et al.*, 2002; Angelim *et al.*,



2004) exhibits a biotite-amphibole *augen* orthogneiss with sienogranitic to granite composition and a high-K calc-alkaline character, metaluminous.

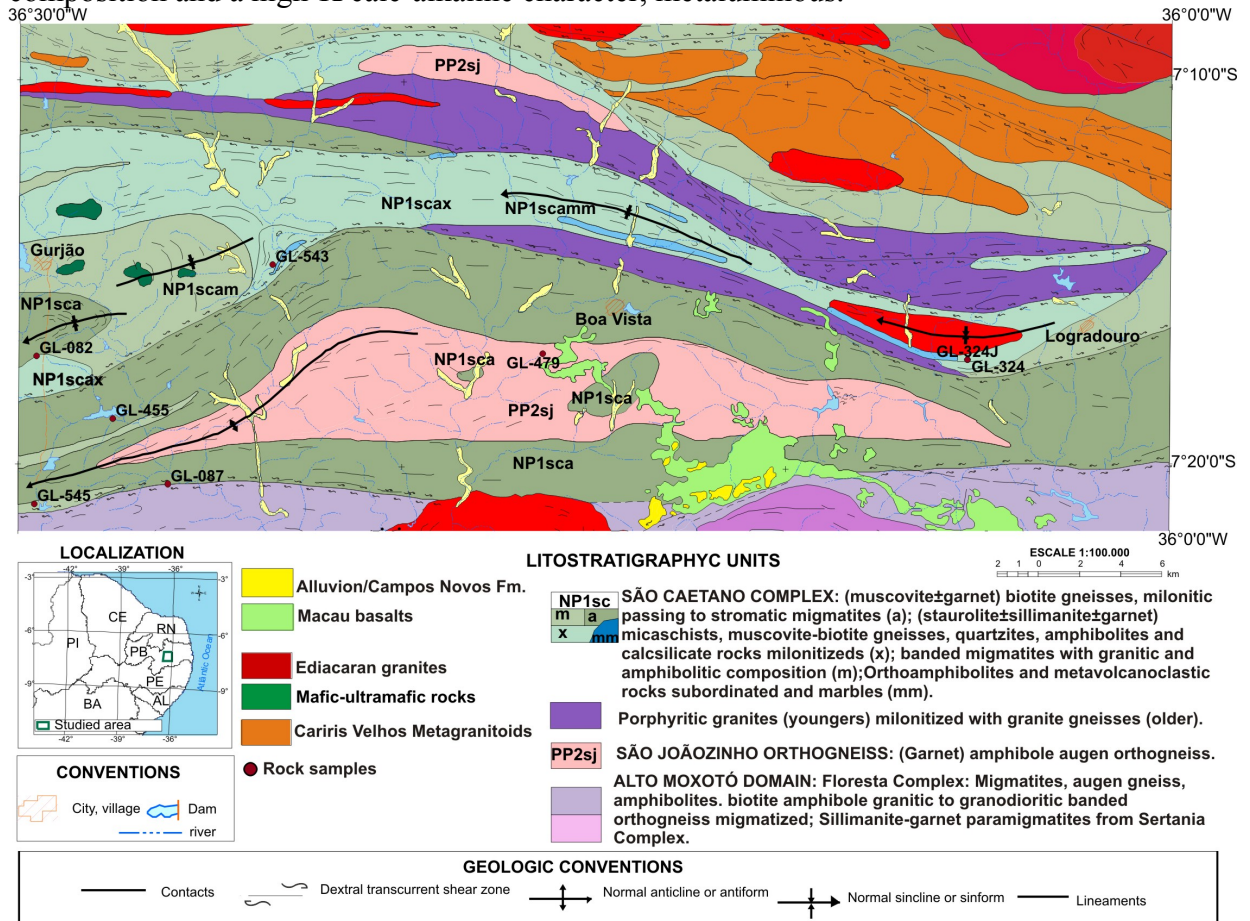


Figure 1 - Geological sketch map of a portion of the east part of Alto Pajeú Domain.

RESULTS AND DISCUSSION

U-Pb and Sm-Nd analyses of the São Caetano Complex rocks are summarized on Table 1.

Table 1 – New U-Pb and Sm-Nd isotopic data for the São Caetano Complex and related São Joãozinho metaplutonic unit. The t age used is equals to 950Ma except for sample GL-479.

Sample	Lithotype	Crystallization Age	$T_{DM}(Ga)$	$\epsilon_{Nd}(t)$	Sm(ppm)	Nd(ppm)	$^{147}Sm/^{144}Nd$	$^{143}Nd/^{144}Nd$	$\epsilon_{Nd}(t)$
Supracrustal unit									
GL-082	biotite muscovite paragneiss (metagreywackes)		2,11	-18,62	4,467	23,218	0,1163	0,511683	-8,88
GL-087	garnet gneiss with spinel		2,15	-19,36	21,918	115,044	0,1152	0,511645	-9,48
GL-324	garnet paragneiss		1,9	-11,72	8,6885	39,283	0,1337	0,512037	-4,07
GL-324J	biotite schist (pelite)		1,84	-12,65	3,8676	18,371	0,1273	0,511989	-4,23
GL-543	garnet biotite paragneiss		1,79	-12,94	7,3595	36,05	0,1234	0,511975	-4,03
GL 545	garnet banded gneiss		2,72	-29,82	10,514	60,276	0,1054	0,511109	-18,77
Igneous unit									
GL-455	acid volcanic/microgranite		2,23	-14,14	3,2356	14,262	0,1371	0,511913	-6,84
GL-479	São Joãozinho amphibole <i>augen</i> orthogneiss	2109 ± 15 Ma	3,03	-30,81	10,5137	55,921	0,1136	0,511059	-8,43

A sample (GL-479) from São Joãozinho orthogneiss placed on central part of a antiform structure, was investigated by LA-ICPMS to determine the crystallization age. Zircon grains are yellowish to colourless, and present well preserved prismatic habit and faces. Twenty spots yielded a homogeneous apparent paleoproterozoic age with the upper intercept age of

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2109±15 Ma, which is interpreted as the crystallization age. The Sm-Nd data of this sample reveals Model age of 3.03 Ga and ϵ_{Nd} calculated for 2.1 Ga of -8.43, which suggest derivation from reworked Archean crust.

Three sedimentary rocks from **NP1scax** had their Sm-Nd composition studied. The sample GL-324J is a biotite schist (pelite) interbedded with calcitic marble defining a S_0 surface and their wall rock represented by paragneiss (sample GL-324). A possible metagreywacke was collected as sample GL-543. All analysed samples presented similar results, with values of $^{147}\text{Sm}/^{144}\text{Nd}$ varying from 0.12 to 0.13, and T_{DM} model ages are between 1.79 and 1.9 Ga. The ϵ_{Nd} values calculated range from -4.07 to -4.03. These data suggest certain homogeneity of sedimentary pile.

The samples collected from **NP1sca** unit (samples GL-082; GL-087; GL-479 and GL-545) have $^{147}\text{Sm}/^{144}\text{Nd}$ values for the metasedimentary rocks and metaplutonic rocks ranging from 0.10 to 0.11, and T_{DM} model ages are between 2.11 and 3.03 Ga. The very high negative ϵ_{Nd} values range from -8.43 to -18.77 calculated to $t=1.0$ Ga e $t=2.1$ for GL-479.

Rodrigues & Brito Neves (2008) grouping new Sm-Nd data and from another authors (figure 2) in limit of the Alto Moxotó/Alto Pajeú domains recognize: a) Group I: Formed by granitic orthogneisses and supracrustals rocks is the Alto Pajeú domain that exhibits an isotopic signature with T_{DM} values between 2.28 and 1.37 Ga, high negative values for $\epsilon_{Nd(0)}$ (<-20) and $^{147}\text{Sm}/^{144}\text{Nd} > 0.12$, that indicates a possible isotopic fractioning; b) Group II: Composed mostly by orthogneisses similar to Floresta Complex and supracrustals rocks from Sertânia Complex, represented by the Alto Moxotó domain that exhibits an isotopic signature with T_{DM} values between 3.0 and 2.0 Ga, values for $\epsilon_{Nd(0)}$, between -20 and -35, and Sm/Nd ratios between 0.12 and 0.08.

According to Santos *et al.* (2010) T_{DM} ages for the majority of Cariris Velhos rocks (equals to Group I), both supracrustal rocks and metagranitoids, the T_{DM} ages are concentrated in the range 1.8-1.4 Ga, with a total range between 1.98 and 1.04 Ga. Most of for $\epsilon_{Nd(t)}$ values calculated for $t=1.0$ Ga range between +1.1 and -1.9 (Kozuch, 2003). There are some samples with positive values, +2.2 up to +5.1, as well as some samples with negative values, between -4.0 and -9.0 (Santos *et al.*, 2010).

The results obtained was plotted in Figure 2 and compared with previous groups defined by Rodrigues & Brito Neves (2008). The **NP1scax** are similar with the intervals found in rocks included in the Group I, while **NP1sca** plot within Group II. An acid metavolcanic/microgranite (sample GL-455) interlayered in **NP1sca** rocks plot in the interface on Group I.

CONCLUSIONS

The new U-Pb and Sm-Nd isotopic data exposed in this study associated to geological background allow present some relevant conclusions regarding the nature and evolution of the Paleo/Neoproterozoic continental crust in NE Brazil:

- The lithological association of detritic, chemical and volcanoclastic rocks suggests a marine depositional environment, next to an emergent active margin;
- These rocks were submitted to a minimum amphibolites facies metamorphism;
- The U-Pb crystallization study performed on a sample from the antiform structure identifies a Archean reworked source for the basement (São Joãozinho orthogneiss). Chemical data for this basement plot in geotectonic diagrams such as granites of active continental margin;



d) The Sm-Nd isotopic data for both supracrustal and metaplutonic rocks of the **NP1sca** unit and **NP1scax** (typical São Caetano sequence) suggest a provenance from a different sediment source area. The **NP1scax** unit has Sm-Nd pattern similar to that observed in rocks from Alto Pajeú domain (Cariris Velhos Metagranitoids and São Caetano Complex). The **NP1sca** unit next to São Joãozinho orthogneiss including it, have Sm-Nd pattern similar to that observed in Alto Moxotó domain (Floresta and Sertania Complex) reflecting a contribution from this domain or from São Joãozinho orthogneiss as source for the sediments.

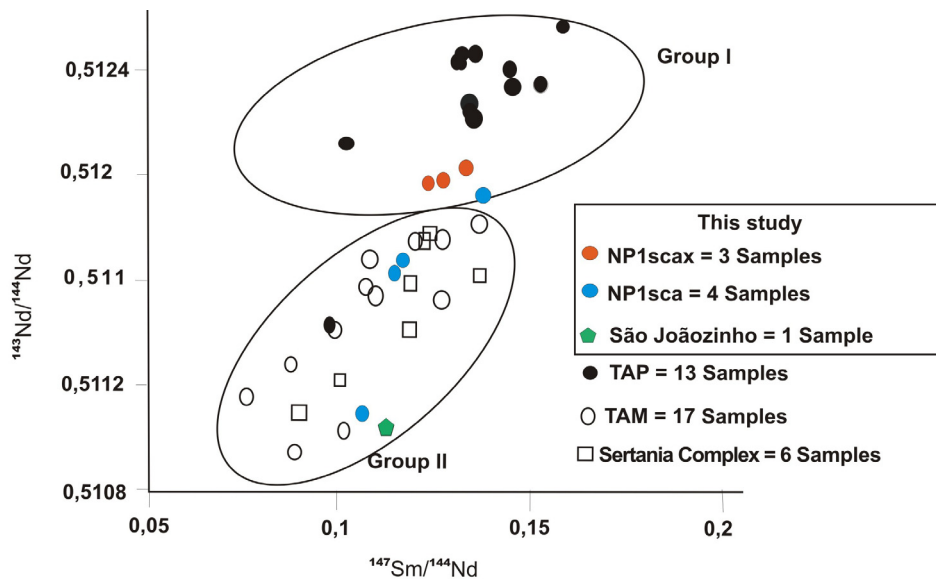


Figure 2 – Graph $^{147}\text{Sm}/^{144}\text{Nd} \times ^{143}\text{Nd}/^{144}\text{Nd}$ showing new and available Sm-Nd data from east part of Alto Pajeú/Alto Moxotó domains, Sertania Complex and this study. TAP=Alto Pajeú terrane; TAM=Alto Moxotó terrane. Modified after Rodrigues & Brito Neves (2008).

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