Nd DATA FROM CENTRAL CEARÁ DOMAIN: ARCHEAN RELICTS, PALEOPROTEROZOIC RECORD AND NEOPROTEROZOIC CRUSTAL REWORKING

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New geological interpretations based on Nd isotopic results for rocks situated south-southeast of the Transbrasiliano Sobral-Pedro Segundo Lineament and north-northwest of the Senador Pompeu Lineament (Central Ceará Domain of Brito Neves et al., 2000 or subprovince 2 of Van Schmus et al., 1998) are here presented. The Central Ceará Domain (CCD) is situated in the northwestern portion of Almeida's et al. (1981) Borborema Province, being its counterpart in the African side the Nigerian Province Precambrian rocks (Fig. 1). In CCD, isotopic studies by Fetter (1999) indicated the existence of an Archean nucleus (Tróia-Pedra Branca-Mombaça, with zircon U-Pb ages between 2.69-2.83 Ga and Nd T_{DM} between 2.69-3.04 Ga) surrounded by rocks of ages varying between Paleo and Neoproterozoic. Caby and Arthaud (1986) and Ar-Ar studies carried out in the State of Ceará by Monié et al. (1994) stressed out the importance of the Neoproterozoic orogeny. Martins (2000), studying the Quixadá western region (Algodões-Choró Metamorphic Suite), found new informations that proved the existence of Paleoproterozoic rocks, apparently formed in an island arc environment. Fetter et al. (2003) considered the Santa Quitéria Complex as the record of a Neoproterozoic magmatic arc, and the Martinópolis Group supracrustal rocks, located north-northwestwards, as deposited under a fore-arc regime around 0.77 Ga (U-Pb in zircons from probable meta-rhyolites). In this context, the supracrustal rocks situated south-southeast of the Santa Quitéria Complex must have deposited under a back-arc regime (zircon U-Pb age of ~0.77 Ga of a probable meta-rhyolite from the Independência region). Sm-Nd data confirm such model, with the majority of T_{DM} ages yielding values intermediate to those found for the Paleoproterozoic basement and the oldest Neoproterozoic zircon U-Pb ages for granitoids identified within the Santa Quitéria Complex.

In this work a set of new Sm-Nd data is presented, expressed in the form of T_{DM} ages and ε_{Nd}. This data set encompasses Paleoproterozoic rocks (situated west of the region studied by Martins, 2000), here named Madalena-Algodões-Choró Complex (MACHC); supracrustal rocks found west of MACHC, here named Rio Curú-Itataia-Independência supracrustal rocks (RCIISC), and a small volume of rocks representing the eastern margin of the Santa Quitéria Granitic-Migmatitic Complex (SQGMC). Figure 1 presents the spatial distribution of the different lithotectonic units. Table 1 contains the results of the analyses available. These data will be in the future complemented by U-Pb (zircons and monazites) and Ar-Ar dating of micas and amphiboles.

The Archean T_{DM} ages correspond to biotite and hornblende-bearing migmatitic nuclei exposed within RCIISC and MACHC supracrustal rocks. In the first case a T_{DM} age of 2.73 Ga, with corresponding $\varepsilon_{Nd(0)}$ of -22.4, was found. For the migmatitic nucleus present in the MACHC sediment-derived association the T_{DM} interval falls in the 2.6-2.8 Ga interval, with $\varepsilon_{Nd(0)}$ from -19.1 to -15.2.

MACHC encompasses two distinct lithologic associations, one of them sediment-derived, mainly constituted by garnet-bearing biotite gneisses, hornblende-biotite gneisses and smaller volumes of muscovite-biotite gneisses, quartzites, occasional gondites, and contribution of basic volcanics (amphibolites). The second association is represented by orthogneisses of quartz-dioritic to tonalitic composition, with variable hornblende and biotite proportions, here considered as intrusive in the sediment-derived association. For the sediment-derived association, the interval of T_{DM} model ages ranged from 2.41 to 2.36 Ga, with $\varepsilon_{Nd(0)}$ values between -25.8 and -21.7. In the sediment-derived association, two determinations made in muscovite/biotite gneisses yielded T_{DM} ages in the 2.38 to 2.23 Ga interval, with $\varepsilon_{Nd(0)}$ between -19.7 and -18.3.

The predominant RCIISC lithotypes (~ 60% in volume) are locally migmatized biotite gneisses, with variable amounts of muscovite, garnet, sillimanite and kyanite. The other ~40% are (pure, or muscovite- or feldspar-bearing) quartzites, calc-silicate rocks and gray to whitish marbles and usually garnet-rich amphibolites. T_{DM} values found for the gneisses/migmatites fall in the 1.1-2.4 Ga interval, with less negative $\varepsilon_{Nd(0)}$ values being associated with younger ages (-5.48 and -6.55). Conversely, more negative $\varepsilon_{Nd(0)}$ values are associated with older T_{DM} ages (-19.5 and -23.8). It is worth pointing out that out of three analyses, which correspond to amphibolites considered representative of syn-depositional magmatism, two samples yielded positive $\varepsilon_{Nd(0)}$ values, respectively +3.18 and +5.16.

The study region includes only the eastern margin of the Santa Quitéria Batholith studied by Fetter (1999) and Fetter et al. (2003), and in this context, part of the granitoids and migmatites analyzed for the present work could have originated from protoliths with important participation of RCIISC. Remains of calc-silicate rocks and sillimanite gneisses found in the center of SQGMC, seem to reinforce this hypothesis. In the study region, SQGMC is preferentially composed of migmatites that usually contain biotite and less frequently hornblende, with mesosomes of granodioritic to monzogranitic compositions. In the more diatexitic portions that grade to nebulitic granitoids, monzo to syenogranites are found. West of Taperuaba, an approximately circular isotropic biotite granite stock is polyphase, with concentric phases of monzo- to syeno-granitic composition. These are the SQGMC post-orogenic granitoids, apparently correlated with the Serra da Barriga stock. It is also worth pointing out the occurrence of isotropic to weakly foliated leucogranitoids (Fazenda Memória and Serrote de São Paulo) within SQGMC, which certainly represent partial melting conditions and/or protoliths distinct from those present in the genesis of other SQGMC granitoids. The available Nd isotopic information indicate three distinct groups, compatible with the petrographic characteristics and mode of occurrence in the field: a) rocks of the metatexite-diatexite transition, with T_{DM} in the 1.68-1.74 Ga interval and $\varepsilon_{Nd(0)}$ varying between -16.9 and -6.1; b) characteristically diatexitic rocks - T_{DM} in the 1.18-1.38 Ga interval, with $\varepsilon_{Nd(0)}$ varying between -15 and -11.6; c) post-orogenic granitoids, corresponding to the Serrote São Paulo leucogranitoid, situated north of Santa Quitéria city, with T_{DM} model age of 2.2 Ga (double-stage calculation) and $\varepsilon_{Nd(0)}$ of -4.05.

Resulting from the analysis of Nd data, five main points can be listed: a) for the gneissic-migmatitic nuclei that occur within the supracrustal rocks, Archean T_{DM} ages were found, indicating that these rocks may be correlated with the Archean nucleus located *ca.* 50 km south of the studied region (Tróia-Pedra Branca-Mombaça Complex); b) the Paleoproterozoic (Nd, Sr and U-Pb) results obtained for MACHC rocks, including Martins' (2000) data and airbone geophysical, enable to extend it to the Madalena region and to consider a juvenile Paleoproterozoic origin for MACHC; c) the T_{DM} age interval found for SCRCII evidences a conspicuous participation of the Paleoproterozoic basement in the genesis of the supracrustal rocks in question, opposite to what happens in the region situated north-northwest of SQGMC (Martinópolis Group), considered by Fetter et al. (2003) the record of SQGMC fore-arc; d) two major groups of T_{DM} ages (1.74 to 1.68 and 1.38 to 1.18) were found for SQGMC. Both intervals, also identified by Fetter et al. (2003), are interpreted, by now, as indicative of mixing, respectively involving less and more amounts of juvenile material in the generation of the magmatic arc in question during the Neoproterozoic orogeny.

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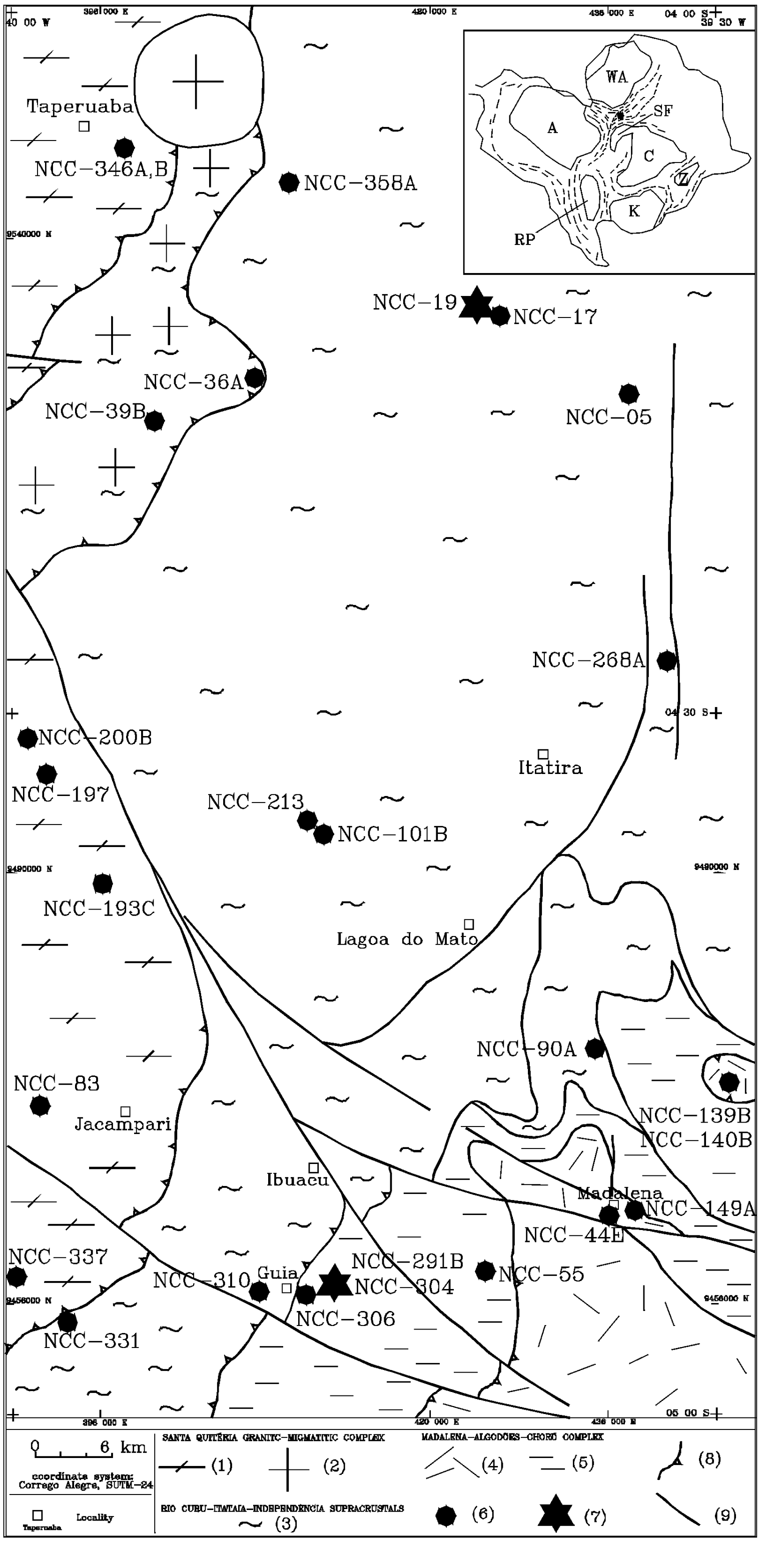

Figure 1. Geological simplified map of the Central Ceará Domain in the region cover by the Taperuaba and Itatira 1:100 000 maps. (1) Santa Quitéria Granitic-migmatitic Complex (SQGMC), (2) SQGMC pos-orogenic granitoids, (3) Rio Curú-Itataia-Independência Supracrustals (RCIISC), (4) Madalena-Algodões-Choró Complex (MACHC), intrusive quartz-dioritic to tonalite gneiss, (5) MACHC, paraderived association with anphibolites and gondites, (6) Nd analysis, (7) Nd analysis, Archean, (8) pos-nappes thrusts and (9) faults and contacts. Minnor figure on the upper right corner: study area (black filled circle) on the West-Gondwana context, with Major Neoproterozoic cratonic areas: A (Amazonas), WA (West-Africa), SF (São Francisco), C (Congo), RP (Rio de La Plata), K (Kalahari), Z (Zimbabwe).

Table 1. Sm-Nd whole rock analysis from Central Ceará Domain (northeast Brazil, Borborema Province), region cover by the Taperuaba and Itatira 1: 100 000 maps. For sample location, see map on the Figure 1. $\varepsilon_{Nd(0)}$ calculated with $^{143}Nd/^{144}Nd$ today=0.512638, with data normalized to $^{146}Nd/^{144}Nd$=0.72190. CHUR (DePaolo, 1981). T_{DM} (DePaolo, 1981). DS (double stage of Sato, 1998).

GEOLOGICAL MARK / SAMPLE	**Rock**	**T_{DM} (Ga)**	**ε_{Nd} (0)**
NEOPROTEROZOIC "REWORK"			
SANTA QUITÉRIA GRANITIC-MIGMATITIC COMPLEX			
pos-orogenic granitoid			
NCC-392	(biotite)-muscovite-granite	2.2 (DS, 0.53Ga)	-4.05
diatexites			
NCC-39B	biotite-gneiss with garnet	1.10	0.1
NCC-200B	biotite-granite foliated	1.38	-15.09
NCC-36A	biotite-gneiss/foliated granite	1.18	-11.89
NCC-197	biotite-granite foliated	1.24	-11.63
Metatexite to diatexite			
NCC-193C	hornblende-biotite-gneiss	1.74	-13.90
NCC-346A	biotite-horblende-gneiss	1.70	-6.15
NCC-346B	biotite-gneiss/foliated granite	1.73	-8.77
NCC-337	(hornblende)-biotite-gneiss	1.70	-14.27
NCC-83	biotite-gneiss	1.68	-16.19
RIO CURÚ-ITATAIA-INDEPENDÊNCIA SUPRA-CRUSTALS			
metasediments			
NCC-05A	garnet-biotite-muscovite feldspar schist/gneiss	1.97	-15.00
NCC-17	muscovite-biotite-gneiss	2.45	-23.87
NCC-213	sillimanite-biotite-gneiss	2.26	-19.25
NCC-310	sillimanite-muscovite-biotite-gneiss	2.12	-18.94
NCC-358A	garnet-sillimanite-biotite-gneiss	1.6 (DS, 0.65Ga)	-6.55
NCC-90A	biotite-gneiss	1.12	-5.48
metabasic rocks			
NCC-268A	garnet-hornblende-anphibolite	0.55 (DS, 0.65Ga)	5.16
NCC-331	garnet-hornblende-anphibolite gneiss	1.25	3.18
NCC-101B	garnet-hornblende-anphibolite	1.8 (DS, 0.65Ga)	-8.49
PALEOPROTEROZOIC RECORD			
MADALENA-ALGODÕES CHORÓ COMPLEX			
Quartz-dioriteic to tonalitic gneiss			
NCC-149A	biotite-hornblende-gneiss	2.38	-22.73
NCC-44E	hornblende-biotite-gneiss	2.36	-24.40
NCC-140B	hornblende-biotite-gneiss	2.36	-21.75
NCC-139B	hornblende-biotite-gneiss	2.41	-25.85
supra crustal rocks			
NCC-55	biotite-gneiss (meta-riolite?)	2.22	-18.37
NCC-306	biotite-muscovite-gneiss	2.38 (DS, 0.65Ga)	-19.75
ARCHEAN RECORD (basement inliers)			
NCC-304	hornblende-biotite-gneiss/migmatite	2.60	-19.10
NCC-291B	biotite-hornblende-gneiss	2.80	-15.29
NCC-19	biotite-gneiss/diatexite	2.73	-22.45