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PRE-BRASILIANO OROGENIC EVOLUTION IN THE SERIDÓ BELT, NE BRAZIL: CONFLICTING GEOCHRONOLOGICAL AND STRUCTURAL DATA

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RESUMO A Faixa Seridó (Provincia Borborema, NE do Brasil) comprende formafoes supracrustais proterozoicas (o Grupo Seridó), seu embasamento gndissico e plutons granitdides. As intrusoes mais antigas (os *ortognaisses* G_2) sao afetadas por uma deformasao tangencial penetrativa (o evento D_2). A deformação transcorrente brasiliana (D_3) esta superimposta as estruturas relacionadas ao regime tangencial mais antigo (D_2), cuja idade absoluta ainda e motive de controve'rsia. Uma datação Pb/Pb em zircão de 1,99±0,01 Ga, pela t6cnica de evaporacao, foi obtida em um pluton de *augen* gnaisses G_2, admitido como intrusivo numa formação flyschdide do Grupo Seridó. Metapegmatitos sin-D_2 apresentam idade minima de 1,80±0,03 Ga, como definido por uma isócrona Rb-Sr. Tais dados sao consistentes com uma orogSnese colisional no Paleoproterozdico (1,95±0,05 Ga; Jardim de Sd 1994). Por outro lado, datações U-Pb em zircao e idades modelo de Nd, nas supracrustais do Grupo Seridd, indicam uma idade mais jovem, meso a neoproterozdica, para esta unidade (Van Schmus *et at* 1995a,b), conduzindo a atribuição do evento orogênico colisional ao Ciclo Brasiliano. Ambas as interpretações apresentam pontos conflitantes e questoes nao solucionadas, que deverao ser abordadas por futuras investigações na regiao. De todo modo, a Faixa Seridó e considerada como uma microplaca continental, preservando um registro termotectônico mais antigo, soldada aos terrenes adjacentes num evento orogenico meso ou neoproterozdico.

ABSTRACT The Seridd Belt (Borborema Province, NE Brazil) comprises Proterozoic supracrustal formations (the Seridó Group), its gneissic basement and granitoid plutons. The older intrusions (the *G_2 orthogneisses)* were affected by penetrative tangential deformation (D_2 event). The Brasiliano transcurrent deformation (D_3) overprints structures ascribed to the older (D_2) tangential regime, whose absolute age is still under debate. A 1.99+0.01 Ga Pb/Pb zircon evaporation date was obtained from a G_2 augen gneiss pluton, thought to be intrusive in a flysch-type formation of the Seridó Group. Syn-D_2 metapegmatites are at least 1.80±0.03 Ga old, as defined by a Rb-Sr isochron. Such data are consistent with a late Paleoproterozoic collisional orogeny (1.95±0.05 Ga) in the region (Jardim de Sa 1994). On the other hand, U-Pb zircon and Nd model dates from Seridó Group supracrustais point to a much younger, Meso- to Neoproterozic age for this unit (Van Schmus *et al.* 1995a,b), allowing to relate the collisional orogeny to the Brasiliano Cycle. Both interpretations bear conflicting points and still unsolved questions, which will have to be addressed by future investigations in the region. Notwithstanding, the Seridó Belt is regarded as a continental microplate preserving an older thermotectonic imprint, welded to adjacent terranes in a Meso or Neoproterozoic orogenic event.

INTRODUCTION Arguments about the age of orogenic structures in the Seridó Belt (NE Brazil) bear important constraints on the nature of the Brasiliano/Pan-African orogeny along the Borborema/Trans-Sahara Belt. This kind of information is essential in order to discuss the relative proportion between accretion of juvenile material and reworking of older crust, or to unravel major differences in crustal evolution between adjacent terranes. Recognition of superimposed orogenic cycles depends on the capability of the continental crust to retain its previous orogenic memory throughout a younger event; this subject remains a major issue concerning the tectonics of deep, ductile domains.

The Brasiliano age of the strike-slip shear zones and associated deformation is well established in NE Brazil. However, different opinions are met when dealing with older structures, generally of tangential style. Correlating these structures with the Brasiliano orogeny, Caby (1989) and Caby *et al.* (1991) built on models of monocyclic supracrustal belts and widespread nappe tectonics in a late Neoproterozoic Himalayan-type collisional setting. On the other hand, Jardim de Sá *et al.* (1987) and Bertrand & Jardim de Sá (1990) argued for a pre-Brasiliano, Paleoproterozoic age for these tangential structures and therefore a poly cyclic evolution, at least in some of the supracrustal belts in NE Brazil. Recent data (U-Pb zircon and Nd model dates; Van Schmus *et al.* 1995a,b) point to a younger, Meso to Neoproterozoic age for the supracrustal sequences in Seridó and elsewhere in the Borborema Province. The evolutionary models based upon these dates are at variance with the former polycyclic models plus a large body of structural and stratigraphic field relations, as discussed in this paper (see also Jardim de Sá 1994).

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GEOLOGICAL FRAMEWORK OF THE SERIDÓ BELT The Seridó Belt (**SB**) is a domain of the Borborema Province. Its southern and western limits are taken, respectively, as the Brasiliano E-W and NE-trending Patos and Portalegre shear zones; fundamental differences in stratigraphy (the nature and age of the supracrustals and intrusive pre-Brasiliano plutons) and structural style are recognized accross these major structures (Jardim de Sá *et al.* 1992, Jardim de Sá 1994). Towards the coast it is covered by Mesozoic and Cenozoic deposits associated with the Atlantic passive margin.

The following units and tectono-stratigraphic relations are found in the **SB** (Fig. 1):

(i) High-grade Paleoproterozoic to Archean gneisses and amphibolites of the *Caicó Complex* represent the oldest unit in the **SB** and the basement (with previous, D_1 structures) to younger supracrustals;

(ii) The *Seridó Group* comprises supracrustals mostly in amphibolite facies, displaying the imprint of two major deformation episodes (D_2 and D_3). It is divided in the lower *Jucurutu Formation* paragneisses and marbles, the *Equador Formation* quartzites and the upper *Seridó Formation* micaschists. The latter unit is regarded as a flyschoid turbidite sequence, while the other ones represent shallow water, shelf-type deposits.

(iii) The *G_2 orthogneisses* correspond to granitoid plutons displaying a penetrative, originally flat-lying fabric;

(iv) The *G_3 granitoids* constitute the younger unit, being only affected by the D_3 NNE-trending strike-slip shear zones and contemporaneous folding; it corresponds to the Brasiliano plutonism in the SB.

Details about the Neoproterozoic plutons and structures can be found elsewhere (Jardim de Sá *et al.* 1987, Caby *et al.* 1991, Archanjo & Bouchez 1991, Corsini *et al.* 1991, Jardim de S£ 1994, Corsini 1995). Geological and geochronological data for the Caicó Complex and other high-grade associations is summarized by Souza *et al.* (1993) and Dantas *et al.* (1995). The present contribution is especially concerned with contentious aspects such as the structural relations of the G_2 orthogneisses and the timing of the tangential deformation, discussing recent geochronological data obtained in the region.

STRUCTURES AND GRANITOID PLUTONS PREDATING THE BRASILIANO TRANSCURRENT DEFORMATION IN THE SERIDÓ BELT Deformation phases in the **SB** were initially defined and correlated with an early tangential regime (D_2), later overprinted by strike-slip (D_3) structures (Jardim de Sa *et al.* 1987). Caby (1989) and Caby *et al.* (1991; see also Archanjo & Bouchez 1991) interpreted the flat-lying (mostly S_2) and steeply-dipping (mostly 83) foliations as part of the same kinematic regime, representing thrust flats and lateral ramps, or the edges and central parts of flower structures. Although examples of the latter case are now well constrained, the association of D_2 and D_3 with different kinematic regimes is supported by the following features (Jardim de Sá 1994, Jardim de Sá & Fuck 1995):

(i) Older, originally flat-lying foliations and the overprinting relations are systematic features not only in the outcrop but also at the regional scale, as demonstrated by structural mapping using Landsat imagery,

(ii) In several localities, successive stretching lineations (L^X2 and L^Xs) have different orientations; associated kinematic markers display mutually incompatible shear sense criteria;

(iii) D_3 is associated with a prograde andaluzite-cordierite (or staurolite)-sillimanite low pressure metamorphic regime. D_2 structures are associated with relict staurolite-kyanite-sillimanite parageneses, which cannot be easily integrated with the D_3 low pressure minerals in a single PTt path.

The G_2 orthogneisses correspond to an assemblage of strongly deformed porphyritic granites of monzonitic to K-rich calc-alkaline affinities, associated with shoshonitic monzonites, alkaline granites and quartz syenites, and calc-alkaline granodiorite-tonalite types. Jardim de Sá (1994; see also Jardim de Sá *et al.* 1987, 1995a,b) considers these plutons as intrusive in the Seridó Group, as discussed later. On the other hand, these rocks were regarded as anorogenic, syn-sedimentary intrusions in the Jucurutu Formation (Caby 1989, Caby *et al.* 1991,1995), mostly based on the assumption that they were not intrusive into the flysch-type metaturbidites (the micaschists of the Seridó Formation, considered to be of Neoproterozoic age by those authors), at the top of the Seridó Group. The lower supracrustal formations (Jucurutu and Equador), cut by these plutons, were interpreted as a Paleoproterozoic platform cover.

In this paper, the status of the G_2 suites as synorogenic granitoids is reinforced on the basis of the following evidence (additional details in Jardim de Sá 1994):

(i) The plutons correspond to subhorizontal sheets, controled and/or affected by the tangential D_2 structures. Emplacement as shallow sills is not consistent with the lack of volcanic equivalents in the country rocks. Although less frequently, they also intruded the flyschoid micaschists of the Seridó Formation in a few places, as for example to the NE of Cerro Corá (figure 2; photo 1 in plate 1).

(ii) The plutons systematically display homogeneous, strongly penetrative, high temperature S-C fabrics (asymmetric augen structures generally recording top to the south shear sense), best explained by deformation following a decreasing PTt path, typical of cooling syntectonic intrusions (Gapais 1989).

(iii) Associated microgranite or pegmatite sheets are emplaced alongside axial planes of F_2 folds in the country rocks and display the corresponding fabrics, an unequivocal evidence of syntectonic intrusions (photos 2, 3 in plate 1).

Besides the D_2 structures, an older event (D_1), restricted to the basement Caicó Complex, is inferred from pre-D_2 amphibolite dykes cross-cutting the metamorphic banding (S_1) in those gneisses, together with previously deformed pebbles in the basal metaconglomerates of the Seridó Group. Field evidence as well as chemical and geochronological data constrain the age of the D_1 event around 2.2-2.15 Ga, contemporaneous with widespread calc-alkaline plutonism (Souza *et al* 1993, Jardim de Sá 1994).

RECENT GEOCHRONOLOGICAL RESULTS AND THEIR TECTONIC IMPLICATIONS The Paleoproterozoic age of the D_2 deformation in the **SB** was initially proposed on the basis of *ca.* 2.0 Ga Rb-Sr poorly defined whole rock isochrons for porphyritic and fine-grained facies of the G_2 orthogneisses, assumed to be synorogenic intrusions (Jardim de Sá *et al.* 1987,1995a,b). The best result so far obtained is the U-Pb zircon age of 1934±12 Ma, reported by Legrand *et al. (*1991) for a G_2 augen gneiss SE of Açu. Details about analytical data are found in Jardim de Sá (1994).

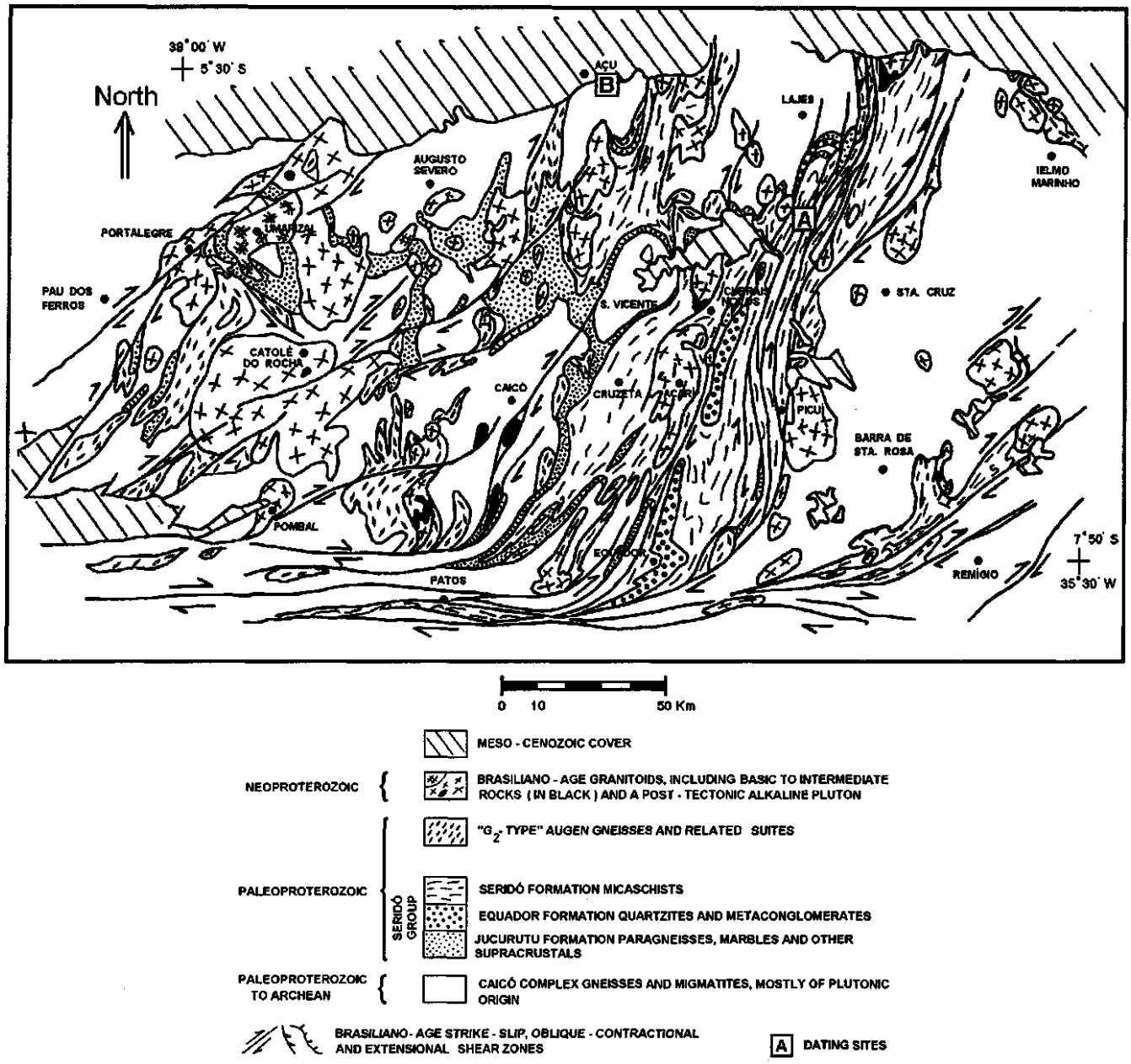

Figure 1 - Simplified geological map of the Seridó Belt, NE Brazil, according to Jardim de Sá (1994).
Figura 1 - Mapa geológico simplificado da Faixa Seridó, NE do Brasil, segundo Jardim de Sá (1994).

Pb/Pb Zircon Age of a G_2 Pluton Intrusive in the Seridó Formation Flyschoid Micaschists in order to test the supposed stratigraphic control of the G_2 orthogneisses, argued by Caby (1989) and Caby *et al.* (1991,1995), a granitic augen gneiss was sampled NE of Cerro Cora (site A in Fig. 1). This pluton (Fig. 2) is in contact with the Seridó micaschists along its western border, where it also truncates, at a low angle, the gradational, interlayered contact of the micaschists with the underlying Jucurutu paragneisses. Although this border of the pluton is reworked by a D_3 strike-slip shear zone, outcrops in a lower strain state preserve intrusive relations as shown by apophyses and xenoliths (photo 1 in plate 1). Dating of this pluton is thought to establish a minimum age for the flyschoid deposits that closely predate the D_2 deformation.

The zircon concentrate of this sample contains two types of grains: a) automorphic, clear zircons, with or without inclusions and devoid of visible cores, corresponding to magmatic crystals; b) xenomorphic, yellowish brown grains, sometimes with visible overgrowths, interpreted as xenocrysts inherited from a crustal source or contaminant.

The zircons were dated, following the evaporation technique (Köber 1986), at the Institut of Geosciences of the Rennes I University (Fig. 3). Instead of separate single grains, a few crystals of both zircon types had to be used in each of the measurements, due to their very small grain size. In a first heating step (* 1), the averages of 2099±22 Ma, 2048±20 Ma and 1990±10 Ma were computed (15 errors are quoted) according to increasing voltage, which is proportional to the energy required to liberate Pb from the crystal lattices. In a second experiment (* 2), at higher temperatures, the calculated age was 2301 ±16 Ma. The mixing of phases as expressed by the two populations allows the following interpretation: a) the older dates in the first experiment reflect a

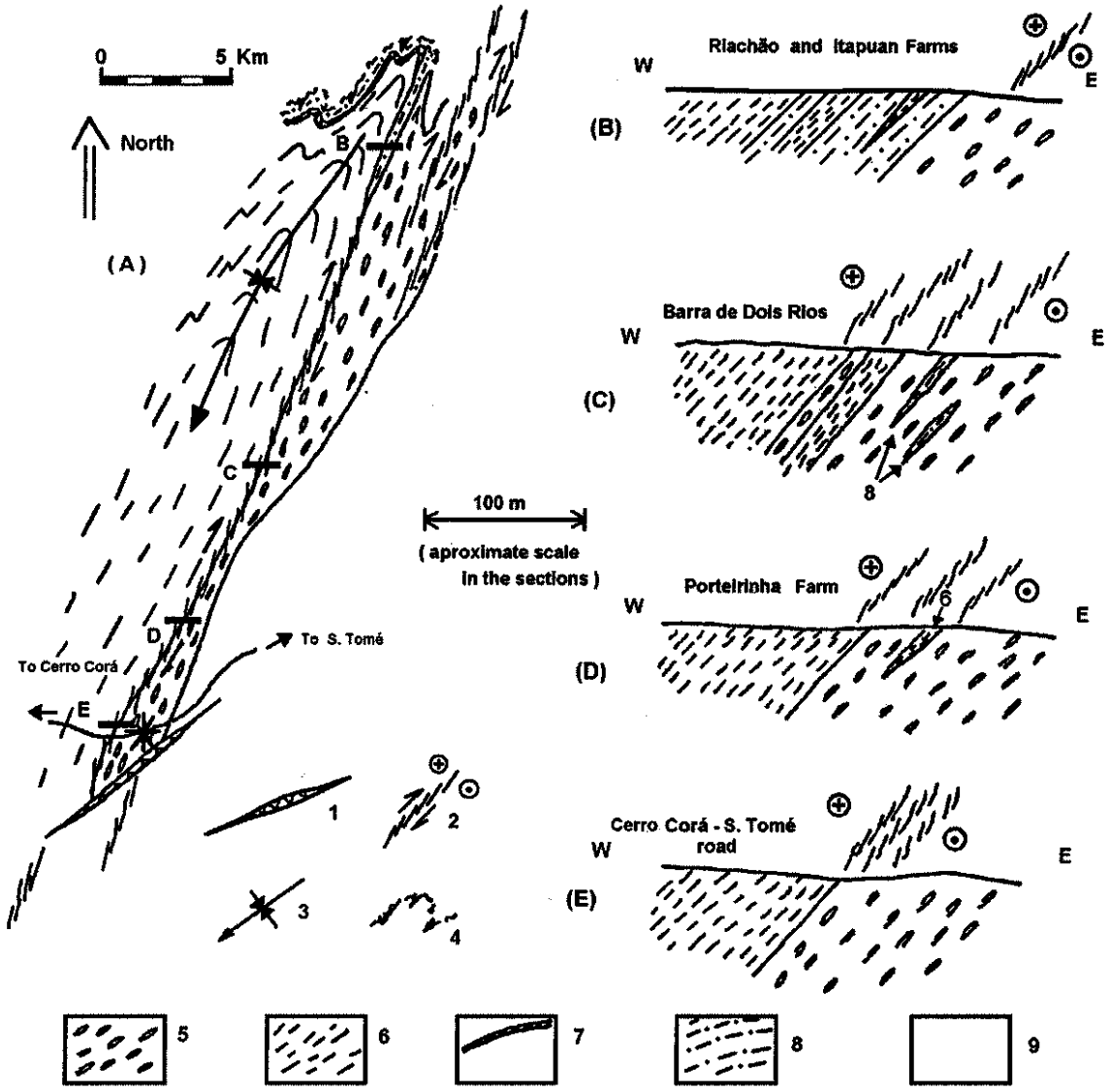

Figure 2 - Contact relations of a G_2 pluton NE of Cerro Cord town (RN). (A) Geological sketch. To the west, the pluton is in contact with the Seridó orJucurutu Formations, although reworked by a D_3 mylonitic belt which dies out and steps to the north. The contact (locally interfingering) between these formations is truncated by the pluton in this northern part of the shear zone. The schematic cross sections (B to E) are located in the map. Ds mylonites were represented in the upper part of the sections, above the corresponding protoliths; note the granitoid apophyses and xenoliths of the metasediments. Symbols: (1) late D_3 fracture and pegmatite; (2) D_3 strike-slip shear zone; (3) Santa Rosa D_3 synform; (4) D_2 thrust; (5) G_2 augen gneiss; (6) Seridó Formation; (7) Equador Formation; (8) Jucurutu Formation; (9) Caicó Complex. The asterisk in the road Cerro Cord to São Tome locates the analysed sample.

Figura 2 - Relações de contato de um pluton G_2 a NE de Cerro Corá (RN). (A) Esboço Geológico. O contato oeste do pluton é feito com a Formacao Seridó ou a Formação Jucurutu, sendo retrabalhado por uma faixa de milonitos D_3 que termina e é revezada para norte. Nessa área, notar que o contato (interdigitado) entre as formações Jucurutu e Seridó e truncado pelo pluton. Nos perfis esquematicos, os milonitos D_3 foram representados na parte superior do corte, acima dos respectivos protdlitos, permitindo visualizar as apdfises do granitoide e os xenó1itos dos metassedimentos. Simbologia: (1) fratura e pegmatite tardi-D_3; (2) zona de cisalhamento transcorrente D_3; (3) sinforme D_3 de Santa Rosa; (4) empurrao D_2; (5) *augen* gnaisse G_2; (6) Formacao Seridó; (7) Formação Equador; (8) Formacao Jucurutu; (9) Complexo Caicó.

component of radiogenic Pb extracted from inherited zircon grains, whose crystal lattices have a lower activation energy, due to progressively acummulated radiation dammage; b) an age *ca.* 2.0 Ga could be inferred for this G_2 protolith. This estimate may be slightly high, considering the possibility of a small Pbrad fraction associated with the xenocrysts. In this case, the younger date (1990±10 Ma) is preferentially retained, being more compatible with the U-Pb age reported by Legrand *et al,* (1991) in the pluton SE of Açu. A Paleoproterozoic age for the Seridó Group flyschoid turbidites may thus be inferred from this result; c) the older, 2.3 Ga date reflects the radiogenic Pb component associated with the xenocrysts nuclii, which are better preserved from the isotope loss and reequilibria phenomena which took place during their incorporation within the granitic magma. This age corroborates the ones already reported for the Caicó Complex (Souza *et al.* 1993, Van Schmus *et al.* 1995a, Dantas *et al.* 1995).

Rb-Sr Dating of G_2-Type Metapegmatites Aplitic, fine-grained or pegmatitic sheets, as well as local mobilizates,

are frequently found intrusive alongside the axial surfaces of F_2 recumbent folds, bearing the S_2+L^X_2 fabric. Based on this structural signature, these rocks can be correlated with the G_2 suites. To the E/SE of Acu (site **B** in Fig. 1; photo 2 in plate 1), metapegmatites with such relations were sampled in adjacent outcrops of the Caicó gneisses. Individual 20 to 25 kg of whole rock samples were taken, due to their very coarse grain size. In all cases, the pegmatite sheets truncate the older Si banding of the gneisses and display a penetrative, high temperature D_2 fabric characterized by the ductile behavior of the feldspars. D_3 deformation in this region was relatively weak, as indicated by the open style of F_3 folds, with accompanying metamorphic conditions at high greenschist to low amphibolite facies. Post-D_2 unmixing textures in the pegmatites, especially perthites and myrmekites, can be related to this younger deformation event. Rb-Sr and complementary K-Ar dating was performed at the Centro de Pesquisas Geocronologicas of the University of São Paulo.

Even though being very heterogeneous, five out of eight pegmatite samples are well-aligned along a 1799±30 Ma isochron, with Is_r = 0.7063±4 and MSWD = 3.5 (Fig. 4; la errors are quoted). This figure is regarded as a minimum age estimate for the intrusion of the pegmatite and its deformation in the D_2 event. When compared with a nearby 1934±12 Ma old augen gneiss, the younger age value of the metapegmatite isochron and the scatter of the remaining three analytical points may be explained as the effect of D_3 and/or D_2. A K-Ar date on a muscovite concentrate indicates an age of 494±13 Ma (Jardim de Sá 1994), confirming the late Neoproterozoic reheating. On the other hand, a two-point Rb-Sr *isochron* calculated with the whole rock + muscovite pair is 1.0 Ga old, and the same value is obtained for the muscovite, assuming any Isr ratio between 0.7 and 1.0. The latter figures are difficult

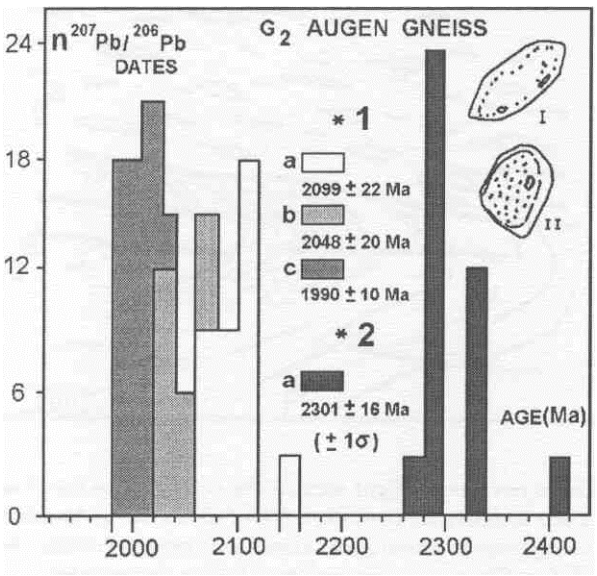

Figure 3 - Pb/Pb evaporation zircon dates of the G_2 augen gneiss NE of Cerro Cord (RN). Type I crystals are euhedral, limpid, with or without inclusions and devoided of visible nucleii, being ofmagmatic origin. Type II zircons are anhedral or subhedral, yellowish and present visible overgrowths, being interpreted as xenocrysts.

Figura 3 - Idades Pb/Pb pela tecnica de evaporação do *augen* gnaisse a NE de Cerro Corá (RN). Os cristais tipo I são euedrais, límpidos, com ou sem inclusoes e desprovidos de nucleos visíveis, sendo de origem magmatica. Os zircoes tipo II são anedrais ou subedricos, amarelados e apresentam sobrecrescimentos visíveis, sendo interpretados como xenocristais.

to explain assuming a Brasiliano age for the D_2 deformation and metamorphism, as the strong dynamic recrystallization associated with this event must have completely reset the muscovite isotope system. The 1.0 Ga mineral dates are thus consistent with an older, pre-Brasiliano age for D_2, coupled with syn to late-D_3 reheating, perthitization and other unmixing textures of the K-feldspars, leading to the isotope disequilibria observed in these systems. The mineralogy of the rock offers few sites for retention of radiogenic Sr liberated from their crystal lattices (Moorbath & Taylor 1985). This is also reflected in the rock's bulk composition; for instance, the two most discrepant whole rock samples in Fig. 5 have less than 70 ppm of Sr, while the other ones display values between 107 and 471 ppm. In any case, even if not precise, and interpreted either as a *magmatic* or a *deformational* age, the metapegmatite isochron militates against correlation of D_2 with the Brasiliano orogeny.

U-Pb Zircon and Nd Model Dates of Seridó Group Supracrustals (Van Schmus *et al.* 1995a,b)

Recent U-Pb zircon data on a high-grade Jucurutu paragneiss was interpreted (Van Schmus *et al.* 1995a,b) as reflecting detrital grains (and therefore, a maximum sedimentation age), inherited from sources *ca.* 2.15 Ga and 1.75 Ga old; Nd model (T_{DM}) dates from these metasediments vary from 2.6 to 2.4 Ga. Elsewhere, Nd model dates obtained from Jucurutu Formation paragneisses and Seridó Formation micaschists are in the range 1.6 to 1.2 Ga. Van Schmus *et al.* (1995b) also reported U-Pb zircon dates from the Seridó micaschists and felsic rocks interpreted as interlayered volcanics, suggesting contributions from a source and/or volcanic detritus not older than 0.8-0.7 Ga. Such results lead those authors to ascribe a Meso- or even Neoproterozoic age for the Seridó Group. Such an age is difficult to reconcile with the intrusive relations of the G_2 orthogneisses with regard to the Seridó supracrustals. In that case, the tangential (D_2) structures in the Seridó Group should be ascribed to the Brasiliano orogeny, or at least to an event *ca.* 1.0 Ga old, like the one proposed in the Zona Transversal Domain to the south, by Jardim de Sá *et al.* (1992,1995c), Santos & Brito Neves (1993), and Campos Neto *et al.* (1994). One is thus faced with major conflicts around these geochronological and structural data sets.

DISCUSSION OF THE CONFLICTING POINTS

The G2 Orthogneisses and the Supracrustal Country Rocks: Ages and Stratigraphic Relations

The geochemical signature of the G_2 orthogneisses points to an erogenic, syn to late-collisional context for their emplacement (Jardim de Sá 1994, Jardim de Sa *et al.* 1995a,b), to which the tangential D_2 structures are ascribed. Clear intrusive relations with regard to the Jucurutu paragneisses are displayed by xenoliths and apophyses, the same holding (although with some dispute; see also Caby *et al.* 1995) with the Seridó micaschists. Even if the precision of the G_2 dates reported in this paper or in previous contributions may be challenged, their rough agreement (including different methods) makes it difficult to relate these metaplutonics to a younger, Meso- (1.4 to 0.9 Ga ?) or Neoproterozoic event. In the light of gradational, interfingering contacts between the different formations of the Seridó Group (Jardim de Sa 1994), the 1.9±0.1 Ga dates in the G_2 granitoids reported in this paper point to a Paleoproterozoic age for all those supracrustal units.

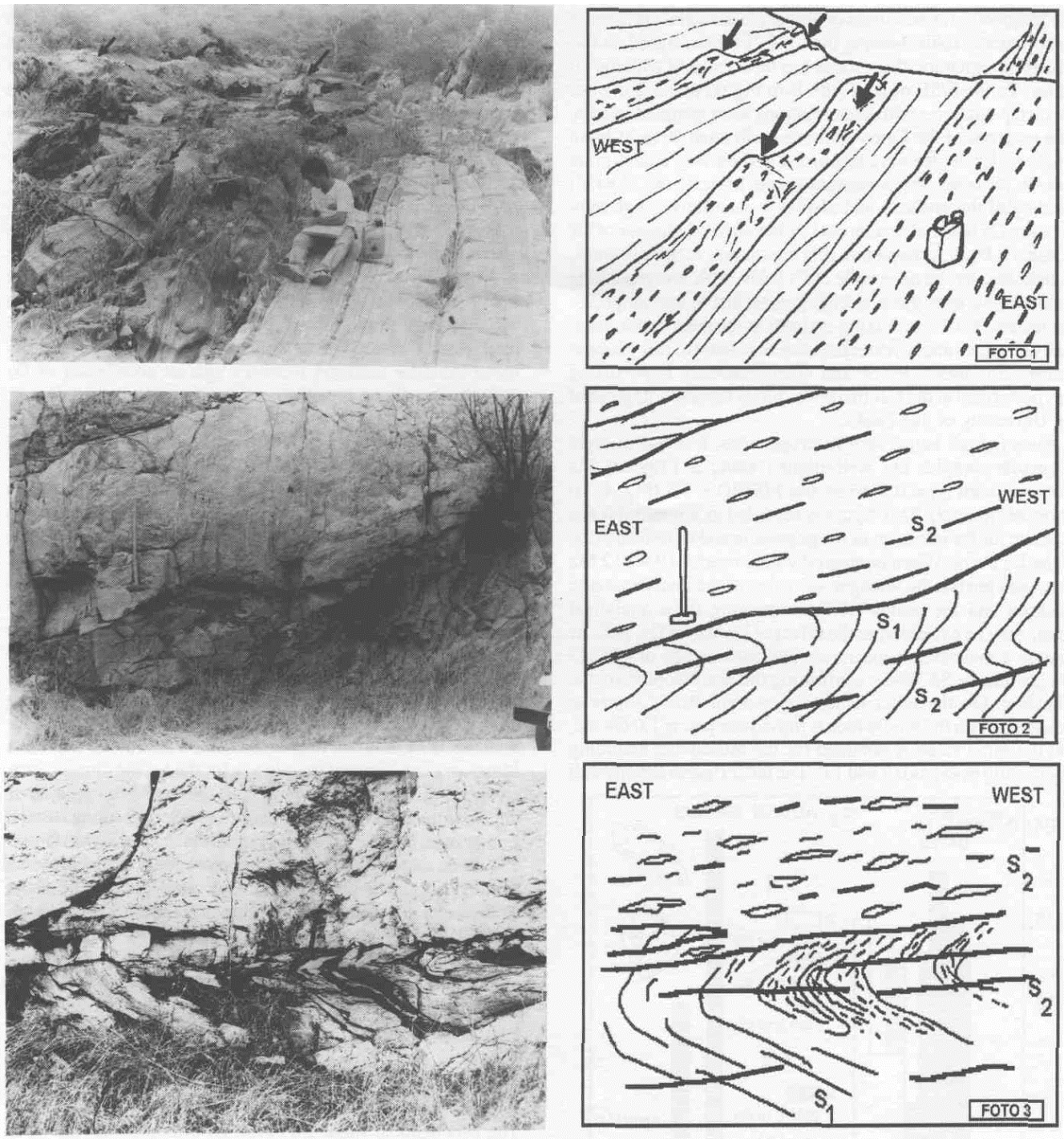

Plate 1. Photo 1 and sketch - Sheared intrusive contact between the G_2 augen gneiss (light rock in the right pan of the photo) and the Seridó micaschists (darker rocks in the left part of the picture), close to Barra de Dois Rios, NE of Cerro Cord. Apophyses of the augen gneiss (shown by arrows) cutting the micaschists are still recognizable. Photo 2 and sketch - G_2 metapegmatite sheet cutting through the S_1 gneissic layering of the Caicó Complex, east of Açu. The pegmatite and its foliation are paralell to the axial surface of F_2 folds in the gneiss, supporting its syntectonic emplacement. Photo 3 and sketch -Detail of the G_2 metapegmatite sheet in the upper part of the photo, displaying the flat-lying S_2 foliation, intruded in interleaved amphibolite and orthogneiss of the Caicó Complex (lower part of the photo), east of Açu. Once again, the pegmatite and its foliation are parallel to the F_2 axial surface. Intrafolial F_1 folds are locally observed.

Prancha 1. Foto 1 e esboço auxiliar -Contato intrusivo cisalhado entre o *augen* gnaisse G_2 (rocha clara na parte direita da foto) e os micaxistos Seridó (rocha mais escura a esquerda na foto), proximo a Barra de Dois Rios, NE de Cerro Cora. Apofises do *augen* gnaisse (marcadas por setas) cortando o micaxisto ainda são reconhecfveis. Foto 2 e esboso auxiliar - *Sheet* de metapegmatito G_2 truncando o bandamento S_1 do gnaisse Caicó a leste de Açu. O pegmatite e sua foliação são paralelos ao piano axial de dobras Fa nos gnaisses, comprovando seu alojamento sintectonico. Foto 3 e esboço auxiliar - Detalhe de um *sheet* de metapegmatito G_2 na parte superior da foto, com foliafao S_2 de baixo angulo, intrusivo em anfibolitos e ortognaisses interfoliados do Complexo Caicó (parte inferior da foto), a leste de Açu (RN). Mais uma vez, o pegmatito e sua foliacao sao paralelos a superficie axial de dobras F_2 nos gnaisses. Dobras intrafoliais F_1 são localmente observadas.

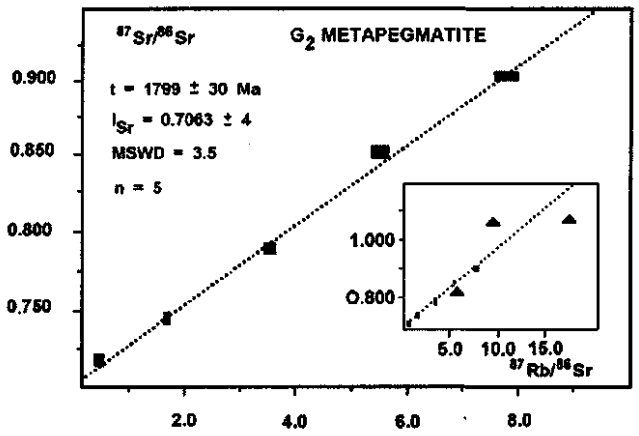

Figure 4 - Rb-Sr whole rock errorchron of the G_2 metapegmatites east of Açu (RN). The cut-off level for the five selected samples is 2.7 (1δ *error level). Three additional samples (see inset) were not considered in the calculation.* Figura 4 - Errócrona Rb-Sr em rocha total dos metapegmatitos G_2 a leste de Açu (RN). O nfvel de corte das cinco amostradas consideradas e 2,7 (nivel de erro 15), No *inset* são mostrados tres ponto adicionais, não considerados no cálculo.

On the other hand, the Nd model dates of the metasediments by Van Schmus et al. (1995a,b), together with a 1.4 Ga Sm-Nd isochron obtained from mafic metavolcanics interlayered with the lower micaschist levels of the Seridó Formation (Jardim de Sá 1994, interpreted as a meaningless mixing line), suggest a maximum 1.7 to 1.4 Ga, late Paleoproterozoic to early Mesoproterozoic age for these supracrustals. In this case, the Seridó Group metasediments would be resting, through tectonic or stratigraphic contacts, upon a basement including the Caicó gneisses and the G_2 granitoids as well. A pre-Seridó Group age for the G_2 orthogneisses would demand that their contacts were entirely of tectonic, allocthonous nature (and not deformed, originally intrusive contacts as we presently consider), what is hard to reconcile with the field relations and the shapes of these plutons (tabular sheets following or truncating at a low angle the basement-cover contacts, for instance). The existence of distinct, older and younger (pre- and post-G_2) supracrustal assemblages could remove at least some of these difficulties, but this has yet to be shown.

The Age of the Tangential Structures Except for the high strain, strike-slip mylonitic belts of Brasiliano (D_3) age, the tangential structures impart a very penetrative fabric in the metasediments, basement gneisses and G_2 granitoids. Correlation of this fabric is based on its continuity, in orientation (especially of the stretching lineations) and kinematics, across different areas and units throughout the region (Jardim de Sá 1994, Jardim de Sa & Fuck 1995). Under this view, the U-Pb 1.96 Ga age obtained by Hackspacher *et al.* (1995a) on a sphene from Caicó gneisses is consistent with the late Paleoproterozoic age postulated for this reworking event (D_2). On the other hand, a Meso- to Neoproterozoic age for the Seridó Group would demand the existence of two tangential deformation regimes, the older one (1.9 Ga old) restricted to a basement comprising the Caicó and G_2 gneisses, and a younger one present in those metasediments, predating or penecontemporaneous with the strike-slip D_3 deformation. Except for flower structures and detachment surfaces associated with strike-slip shear zones (Jardim de Sá *et al.* 1993, Jardim de Sá 1994), there are no convincing arguments for these two events of tangential deformation, which thus remain hypothetical at present (see Hackspacher *et al.* 1995b, for instance).

CONCLUDING REMARKS The recent geochronological data reported by Van Schmus *et al.* (1995a,b) for the Seridó Belt raise a number of problems concerning field relations and the presently accepted tectonostratigraphic framework, implying the occurrence of a number of features which are presently controversial. These include: a) a Neoproterozoic source area, possibly an arc-type terrain, in order to explain the low ε_{Nd} values (young T_{DM} dates) in the Seridó supracrustals; b) the occurrence of a young (Brasiliano) tangential deformation in these supracrustals, distinct with regard to the one recorded by the basement and G_2 gneisses; c) two different supracrustal assemblages, pre- and post-G_2 orthogneisses; d) a number of peculiar tectonic contacts, especially at the interface of the G_2 plutons and their present country rocks. All such features still require demonstration by apropriate, field structural-stratigraphic data.

Taking into account such problems, one is led to consider other possibilities such as complex isotope systematics and alternative geochronological interpretations. Concerning the U-Pb zircon dates *ca.* 700 Ma, obtained in the supracrustals near Barra de Santa Rosa (Van Schmus *et al.* 1995b), some of the samples indeed correspond to Brasiliano granitoid sheets. In the micaschists, affected by high temperature, low pressure syn-D_3 metamorphism (sillimanite grade), at least part of the analysed zircons (euhedral, clear and limpid short prisms) could be of metamorphic origin and not detrital grains, being very similar to the ones reported by Toteu *et al.* (1990) from micaschists in Cameroon. Concerning the Nd data, an open system isotope evolution (due to volatile fluxing during the Brasiliano event ?) could be tentatively argued in order to produce anomalously young model dates (see Black & McCulloch 1987, for instance); this is no more speculative than the other interpretations mentioned above, dealing with field geological relations. It is clear that a final answer, if possible, is once more postponed to a future step in the regional research.

Being a penetrative, high-temperature contractional deformation in the **SB,** the D_2 flat-lying structures are interpreted in terms of a collisional event which also involved terranes now exposed in the Nigerian Shield and possibly further north in Central Hoggar (Bertrand & Jardim de Sá 1990, Jardim de Sa 1994). However, instead of an integral, *in situ* paleoproterozoic orogenic belt preserving its own tectonic zonation, these polycyclic terranes represent dismembered microcontinents welded together during the Brasiliano orogeny, and possibly also in a previous, *ca.* 1.0 Ga old orogenic event (Jardim de Sá *et al.* 1992,1995c, Santos & Brito Neves 1993, Jardim de Sá 1994). The importance and good preservation of pre-Brasiliano structures in the **SB** drives attention to the potential preservation of earlier events in the crustal orogenic memory, as stated in many classical and more recent papers (Den Tex 1974, Passchier *et al.* 1990) but so frequently denied by some workers nowadays.

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