THE DOM FELICIANO BELT (BRAZIL-URUGUAY) AND ITS FORELAND (RIO DE LA PLATA CRATON): FRAMEWORK, TECTONIC EVOLUTION AND CORRELATIONS WITH SIMILAR TERRANES OF SOUTHWESTERN ÁFRICA

ABSTRACT

The Dom Feliciano Belt (DFB) stretches for ca. 1,200 km along southeastern Brazil and eastern Uruguay, with an average width of 150 km. From its northern limit in Santa Catarina to its termination m Uruguay, DFB is internally organized according three crustal segments characterized, from southeast to northwest, by a Granitoid belt (calci-alkaline to alkaline granitoid rocks deformed to different degrees); a Schist belt (volcano-sedimentary rocks metamorphosed from green schist to amphibolite facies), and a Foreland belt (sedimentary and anchimetamorphic volcanic rocks), the latter situated between the Schist belt and the old western terranes. Despite discontinuously covered by younger sediments, the continuity of these three segments is suggested by the similar lithotypes and structural characteristics, as well as by the gravimetric geophysical signature.

In this work, DBF is interpreted as the product of successive subductions and collisions related to the agglutination of different terrenes generated or intensely reworked from the Neoproterozoic to the Cambrian, during the Brasiliano and Rio Doce orogenies, with maximum time starting at 900 Ma (opening of the Adamastor Ocean) and ending at 530 Ma (deformation of the foreland basins) related to the tectono-magmatic events associated with the formation of the Western Gondwana.

Besides the Neoproterozoic DFB and its foreland, the Rio de la Plata Craton and the Luis Alves Microplate, constituted by Paleoproterozoic gneissic-migmatitic rocks, two other tectonic units can be recognized in southeastern Brazil and eastern Uruguay: the Sao Gabriel Block (RS) where Neoproterozoic juvenile material can be characterized in regional scale (in great part associated with an island are), and the Punta del Este Terrane, which presents, in southern Uruguay, an orthogneiss basement with ages around 1,000 Ma and a metasedimentary cover (Rocha Group), which can correspond in the South-American portion, to the Namaqua and Gariep units observed in the southwest border of the African continent.

INTRODUCTION

In southeast South America magmatic, metamorphic, structural and geotectonic features record the superposition of Neoproterozoic-Eopaleozoic orogenies. The present geometry of these geotectonic units reflects collages of distinct terranes, culminating with the amalgamation of the Gondwana supercontinent. The Brasiliano (900-620 Ma) and Rio Doce (620-530 Ma) orogenies that took place in the region are

documented by remnants of magmatic arcs and metavolcano-sedimentary covers well represented by the Ribeira and Dom Feliciano Belts.

Metamorphic episodes and collisional events of the Brasiliano Cycle had their climax around 700 ± 50 Ma and 640 ± 20 Ma respectively. These orogenic episodes finished with an ample allochthony with preferential NNW transport. Late magmatism (600 ±10 Ma) is conspicuous in Southern Brazil, marking the end, in extensional regime, of events related to the Brasiliano Cycle (volcano-sedimentary basins and alkaline-peralkaline granitoids of the Serra do Mar suite).

With the stabilization of the Brasiliano orogeny, a series of magmatíc areas began to fol-m around 620 ± 20 M along the Brazilian coast, east of the landmass formed by the Sao Francisco and Rio de la Plata cratons, constituting the main domains of the terranes generated during the Rio Doce orogeny. This scenario was followed by important magmatism (600-580 Ma). The foreland-type basins, with sedimentation around 560 ± 20 Ma and deformation around 530 Ma, represent the main volcanic-sedimentary record of the Rio Doce orogeny in southern Brazil.

Figure 1 represents the distribution of the two main tectonic domains of the southern Brazil and Uruguay where the Luis Alves Microplate and Rio de la Plata Craton stand out in the western portion whereas DFB predominates in the eastern portion. Great emphasis is given to the internal! DFB segmentation, pointing out the tectonic contacts between the several DFB segments. Thus, the Granite belt is separated from the supracrustal rocks by the Major Gercino (SC), Cordilheira (RS) and partly Sierra Baleen (UY) shear zones; similarly, the contact between the Schist belt and the Foreland basins is also tectonic, prevailíng low-angíe mylonitic belts very welí characterized in Santa Catarina, where the Brusque Group metamorphites overlie the Itajaí Group sediments.

DOM FELICIANO BELT

Hasui and coworkers (1975) arranged the supracrustal rocks of southem Brazil and Uruguay in two major groups represented by the Tijucas (SC, RS and UY) and Rocha (ÜY) fold belts; these segments are separated by median massifs, fomied by oider granite-gneissic teiTanes reworked in the Neoproterozoic. m 1980,, Fragoso Cesar proposed for the southem Brazil and Uruguay the Dom Feliciano Belt separating it from the Ribeira Belt. As important geological synthesis for the síudy área was presented by Atmeida and coworkers (1981), who placed in the Mantiqueira province the eastem Brazil crystalline ten'anes situated south ofthe Sao Francisco Craton.

In Fragoso Cesar's (1980) original proposal,, the Dom Feliciano Belt resulted from a subduction process involving a W-dipping oceanic píate (in agreement with Porada's (1979) proposal), producing a magmatic are during the Upper Proterozoic (granitoids of the eastem domain), a series of supracrustal rocks (back are basin) and a molassic

basin in it.s external portion (sediments and anchimetamorphic volcanic rocks) to a great extent installed on the eastem border ofthe Rio de La Plata Craton.

Fragoso Cesar's (1980) model has been improved by changes resultant from detailed studies carried out in diíferent DFB segments, such as Basei (1985), Silva and Dias (1981), Silva et al (1985), in Santa Catarina; Soliani (1986), Fernandos et al. (1992, 1995a and b) and Hartmann et al, (1998) in Rio Grande do Sul, and Bossi & Campal (1993), Preciozzi et al. (1985), Sanchos Bettuci (1998) in Uruguay. The main synthesis ofthe gravimetric data can be found in Schukowsky et al. (1991), Halinann et al. (1993) and Quintas (1994).

Figures 2, 3 and 4 present three NW-SE geological sections can-ied out at different latitudes along DFB; the spatial relatíons between DFB segments are pointed out, stressing the types of contacts observed between these segiTients and the intemal framework of each domain.

Figure 1. Geological map of southeastern Brazil and Uruguay.

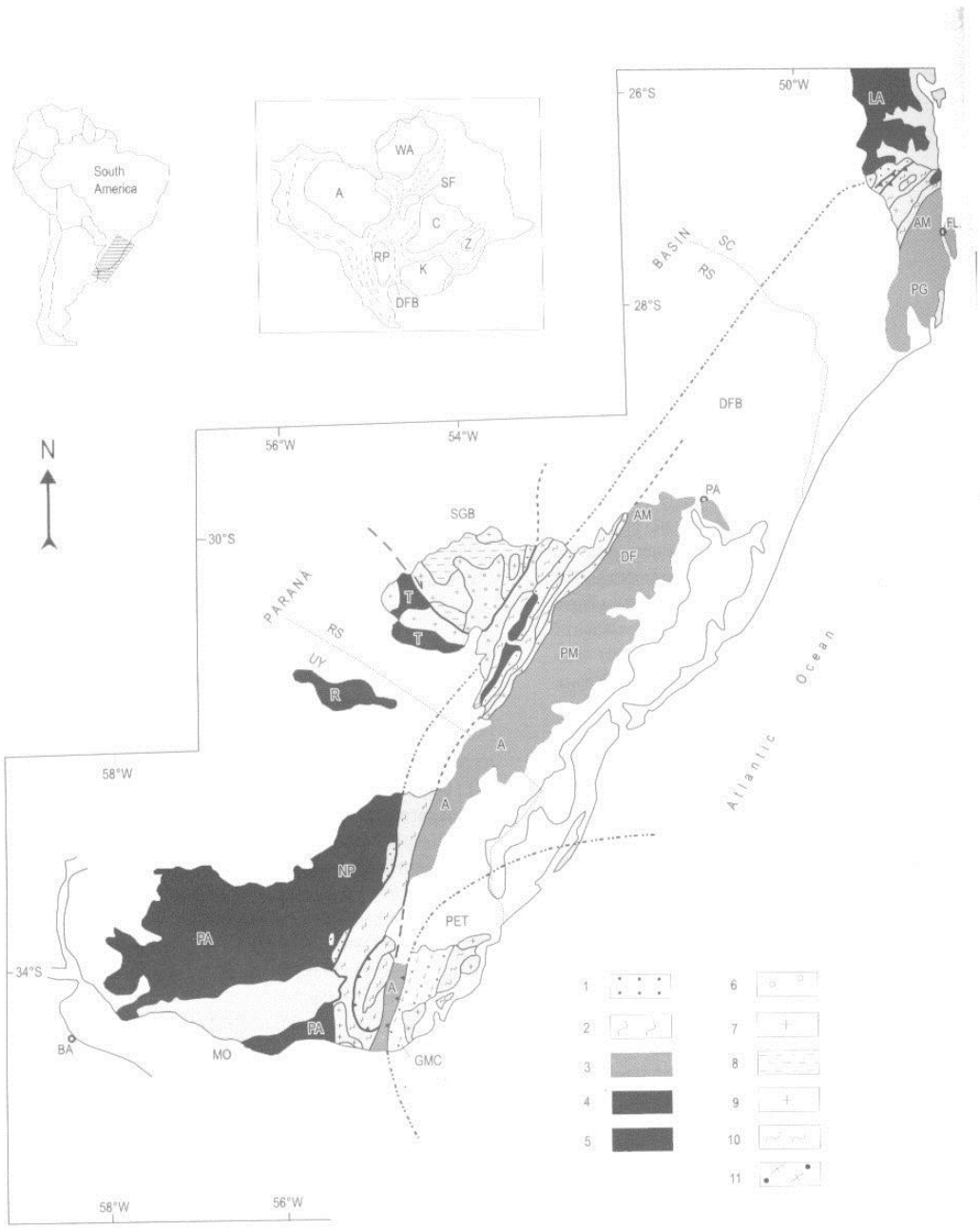


FIGURE 1 - Geological map of southeastern Brazil and Uruguay.

Dom Feliciano Belt (DFB), 1 - Foreland basins: Itajaí, Camaquã, El-Soldado-Piriapolis; 2 - Schist belts and intrusive granitoid: Brusque Metamorphic Complex, Porongos Metamorphic Complex, Lavalleja Metamorphic Complex; 3 - Granite belt: Florianópolis Batholith (AM, PG), Pelotas Batholith (AM, PG, PM), Aiguá Batholith (A); 4 - Basement inliers: Morro do Boi, Encantadas, Punta Rasa; 5 - Foreland, internally preserved of Neoproterozoic overprint: Luis Alves Microplate (LA) and Piedra Alta Terrane (PA); affected by Neoproterozoic heating and granitogenesis: Taquarembó (T), Rivera (R) and Nico Perez (NP); São Gabriel Block (SGB), 6 - Foreland basins (Maricá and Santa Bárbara); 7 - Intrusive granitoid (São Sepé, Caçapava and São Gabriel); 8 - Metamorphic rocks (Cambaí and Vacacaí gneiss); Punta del Este Terrane (PET), 9 - Intrusive granitoid (Santa Tereza and San Ignacio); 10 - Metasedimentary cover (Rocha Group); 11 - Basement (orthogneiss with metasedimentary enclaves). Geographic references: SC – Santa Catarina State; RS – Rio Grande do Sul State; UY – Uruguay; FL-Florianópolis; PA – Porto Alegre; MO – Montevideo; BA – Buenos Aires

Common relations are the tectonic contacts between the diíferent DFB segments, as well as their constancy along ca. 1,200 km. Despite regional differences, it is noted that the DFB framework ís characterized by the marked tectonic vergence from E to W with transport of all its units against the foreland. These deformations, despite the

constancy of the transport direction, reflect diíferent tectonic pulses that took place between 760 and 530 Ma, with the last phases reflectíng compressions associated with fhe approach ofthe Gi-anite Belt.

GRANITE BELT

It represents the intermost DFB petrotectonic domain, formed by an essentially igneous complex, with paraderived rocks occiirring as roof pendants among the granitoids. It is represented by fhree great segmenta occupying the eastem portions of the Brazilian States of Santa Catalina (SC) and Rio Grande do Sul (RS) and Uruguay (UY), namefy from north to south, Florianópolis (SC),, Pelotas (RS) and Aiguá (UY) batholiths, separated from each other by the Paraná Basín sediments.

The granitoids of these batholiths were considered by several authors (Porada 1989, Fragoso Cesar 1980, Femandes et al. 1992) as the roots ofmagmatic ares produced by westward subduction of a Neoproterozoic oceanic crust, being the supracrustal rocks that form the Schist Belt the remaining materials of the corresponding back-arc basins. Basei & Hawkesworth (1993 and 1994) did not agree with these tectonic modeis and based on geochemical and isotopic data, suggested that these granitoids have formed in a tectonic context not related to the Schist Belt evotution, proposing that the generation and following juxtaposition of these segments wouid have happened, in a collisional context, oniy after the metamorphic peak of the supracrustal rocks that constitute the Schist Belt.

It is possible to suggest, based on the available ages for the diíferent batholiths recognized along the Granite Belt, a trend of decreasing radiometric ages for the calc-alkaline terms from north to south. For example, the tonalitic-granodioritic terms of the Floranópolis batholitfi are a littíe oider (-620 Ma) man fheir equivalent rocks in the Pelotas batholith (--€10 Ma) and both, oider than the Aiguá batholith (-580 Ma). On the other hand,, oider Rb-Sr ages (between 700-800 Ma) that may represent a magmatic history prior to the development of the Granite Belt, being more consistently found in íts southem domain (Soliani Jr. 1986, Silva et al. 1999, Preciozzi et al. 1993).

Florianópolis Batholith

The north-northwestem limit ofthe Floranópolis Batholith is characterized by the Major Gercino Shear Zone (MGSZ),, which separates this batholith from the Schist Belt supracrustal rocks (Brusque Group). Tbis transpressional shear zone evolved polycyclically was developed in low temperature conditions, having general NE framework, ductile-brittie characteristics and an important oblique component associated with the predominant dextral movement.

Based on field relations and on petrographic and geochemical characteristics, three major suites can be characterized in the Florianópolis Batholith: Aguas Momas, Sao Pedro de Alcántara and Pedras Grandes.

Aguas Mornas Suite: Characterized as a series of defonned granitoids, predominating migmatites with granodioritic to monzogranitic leucosomes and more mafic mesosomes/paleosomes. Basic terms (amphibolites, gabbros, diorites) of varied dimensions aiso occur. It presents as characteristic lithotypes the granitoids of the Santo Amaro da Imperatriz región (Aguas Mornas Complex - Zanini et al. 1997). Mafic enclaves are normally composed of tonalitic terms with variable proportions of amphibole and biotite. The i-nineralogical composition is plagioclase (andesine), quartz, biotite, homblende and potassic feídspar. In the leucosomatic, quartz-monzonitic portions plagioclase, potassic feídspar, quartz, biotite and amphibole are the main constituents. U-Pb valúes for zu-cons and titanites indicated an age of 606 ± 12 Ma (Basei 1985, reviewed), showing that these granitoids originated in the Neoproterozoic and underwent mylonitic deformation soon after their formation.

Belonging to an ampie series of defonned granitoids, the Paulo Lopes Suite lithotypes are represented by very deformed, coarse- to very coarse-grained, protomylonitic biotite granitoids, with augen-type microcline megacrysts in a foliated, coarse-grained, biotite-rich matrix. Foliated and non-foliated aplitic veins and NS-trending, metric quartz-porphyry dikes affect these rocks. The predominant foliation has attitude N10-30E/45-50SE. Composítionally they are protomylonitic biotite monzogranites with augen-type, centimetric, white-rosy feídspar megacrysts in a foliated matrix with marked rectystallization due to mylonitization that took place under low temperatures. Mineralogically oligoclase/andesine (30%), quartz (35%), biotite (20%), homblende (10%) and microcline (5%) predominate; oftitanite, apatite, zircon, epidote and chiorite are traces. Similar granitoids that underwent different degrees of alteration occur throughout the granitic domain.

Pb-Pb ages for zircons from the Paulo Lopes granitoids indicated an age of 642 ± 46 Ma (Silva et al. 1997), whereas more precise U-Pb analyses by SHRBS/IP yielded a valué of 629 ± 8 Ma (Silva, Ph.D. in preparation), a better indication ofthe age ofthe suite.

Sao Pedro de Alcántara Suite: Composed predominantly by equi- to inequigranular, medium-grained, medium-gray biotite granitoids, which are slightíy deformed and frequently present schiieren structures. Mafic (amphibolitic or biotitic) enclaves are common, showing locally white leucogranitic bands with melanosomatic rims. They show lateral variations to granodioritic to quartz-dioritic granitoid compositions. Different degrees of deformation are imprinted, predominating slightíy foliated types with the following average mineralogical composition: oligoclase/andesine (40-50%), microcline (20-30%), quartz (25-30%) and biotite (5-10%), generally with titanite, zircon, epidote and chiorite. Feídspars occur as euhedral ciystals with partially saussuritized, zoned plagioclase. The association of biotite with epidote indícales a

disequilibrium process at low temperature, aiso suggested by granoblastic quartz with wavy extinction.

Occasionally dark-gray, médium- to coarse-grained gabbros with massive structure occur, with pyroxene megacrysts reaching 1 cm. Mineralogically they are constituted by pyroxene (50%), labradorite (45%), biotite + chiorite (5%) and traces of quartz, epidote and apatite. The plagioclases are inequigranular, sometimes saussuritized. The pyroxenes are poikilitic with plagioclase inclusions. The chiorite-epidote association can indícate the role playeé by a late thermal event. The presence of biotite and quartz can suggest a basic-alkaline origin.

Two Rb-Sr isochrons were obíained for the Sao Pedro de Alcántara Suite, yielding 593 + 24 Ma and 595 ±11 Ma, respectively for the quartz-dioritic and monzonitic facies. Zircons extrac ted from the íatter yielded, in the concordia diagram the age 617 ± 38 Ma (Basei et al., in preparation). Such valúes agree with the ages previously obtained by both methodologies. This magmatism is, from the geochemical and mineralogical point ofview, the least evolved among the batholith granitoids.

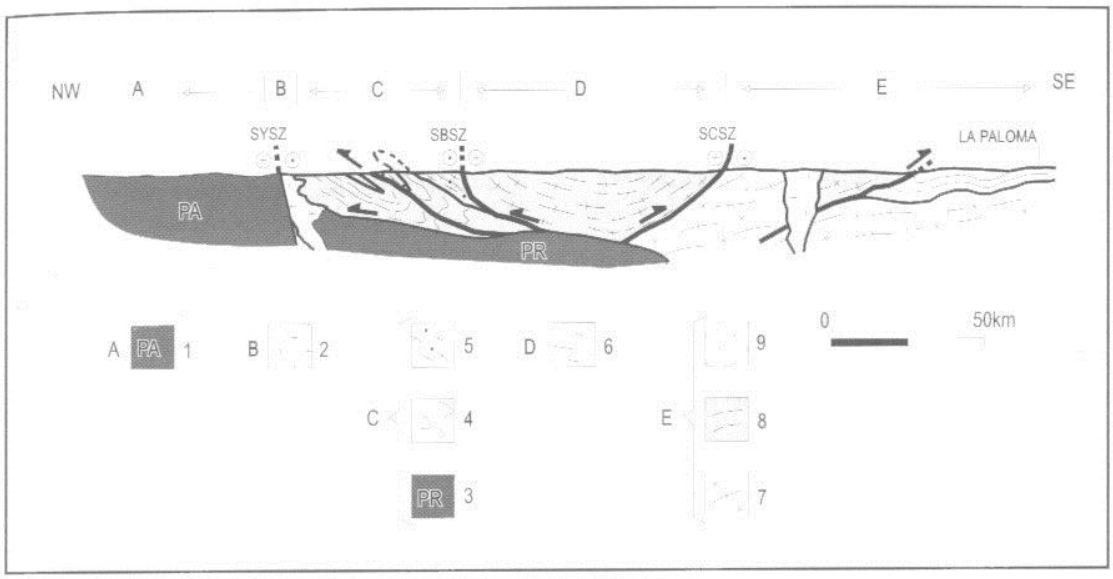
In the Santa Luzia región, a littíe fürther norfh of Santo Amaro da Imperatriz, an isotropic, monzonitic, equi- to inequigranular (white feídspar megacrysts up to 1.5 cm), medium-gray, biotite granitoid body occurs and it is mainly composed of plagioclase, microcline, biotite and scarce quartz. Zircon, titanite, and epidote are abundant. This body shouid represent a Sao Pedro de Alcántara Surte facies. The valué of 592 ±15 Ma obtained from zircons and titanites (Basei 1985, reviewed) is a litlle younger, but concordan! within the analytical eiTor with the age obtained for the Sao Pedro de Alcántara Suite, maybe representing fínal stages ofthe emplacement ofthe granitoids of this Suite.

Pedras Grandes Suite: Constituted by leucocratic, alaskitic, isotropic, red-rosy granitoids occurring as small stocks to large batholiths. They are the fínal expressions of granitic manifestations within the Florianópolis Batholith, being associated temporal- and spatiaUy with acid volcanic rocks. Not rarely do they present xenoliths of deformed granitoids. The best examples of this unit occur in the southem portion of this granitic domain, the best typical representatives being the granitos of the Santa Catarina Island and Tabuleiro.

Biotite monzogranites predominate with variations to syenogranites with alkaline ajifinities, composed of plagioclase (sodic oligoclase), potassic feídspar,, quartz and biotite; zircon, alíanite, apatite, opaque minerals and subordinately fluorite are accessories.

The best age presently available for this Suite is 593 Ma, obtained from zircons by SHRIMP (Silva et al. 1997). However, several Rb-Sr ages suggest the temporal

continuity of this magmatism up to around 550 Ma (Basei 1985, Soliani 1986, May 1990).



Magnwtism of the northern limit of the Florianópolis Batholith: The calc-alkaline magmatism which occurs associated with the Major Gercino Shear Zone is rqiresented by the granitoids of the Rolador (composed mainly of porphyritic to porphyroid monzogranites) and Femandes (coarse-grained, porphyroid amphibole-bearing rosy syenogranites) associations, defíned by Passarelli (1996). This lineament is very important to the framework ofthe southem Brazil Proterozoic terranes, being a status of lithospheric-scale discontinuity attributed to it (Basei et al. 1992); it represents a suture beíween the Granite and Schist Belts in the Santa Catarina State.

Both associatíons make tectonic contact with the Schist Belt rocks (Brusque Group), being, however, petrographically and geochemically distinct from the granitic magmatism which occurs within the Group's metasediments. Isotopic data for both associations present the same pattem observed in the Florianópolis Batholith, prevaüing Mesoproterozoic (1.5 ± 0.2 Ga) Nd model ages and moderately negative SNd valúes for 600 Ma (Mantovani et al. 1987, Basei & Hawkesworth 1993, Babinski et al. 1997).

In general, they are metaluminous granitoids that present elongated shapes with their more external portions involved in shearing process. They are isotropic in the center, with development ofmagmatic or sub-magmatic flow.

Geochronological studies using zircons extracted from granitoids of these two associations indícate 644 + 41 Ma fbr the Rolador granitoids and 612 ± 19 Ma for the Fernandes syenogranites (Passarelli et al. 1997, recalculated with the inclusión ofnew fractions). Despite both associations being spatially related to the Major Gercino Shear Zone (MGSZ), it is probable that oniy the younger Fernandes Association wouid represent the magmatism genetically and structurally associated with MGSZ dextral

development, being the emplacement structural control aiso evidenced by the elongated shape ofthe body, parallel to the shear zone.

In the Angelina región, western end of the batholith, an isotropic, rosy, equi- to inequigranular hololeucocratic granitoid occurs, with potassic feídspars standing out from a medium-grained felsic matrix. Compositionally it corresponds to syenogranites with microcline (50%), quartz (35%), plagioclase (10%), muscovite (5%) and traces of biotite. It is possible that this granite correspond to a southern extensión of the Fernandes Association granitoids whose emplacement was conditioned to the development ofthe MGSZ. The Rb-Sr isochron age of 590 ± 12 Ma for the granitoids (Basei et al. 1985, reviewed) coincides with the valué obtained by the same method for the Fernandes granitoids in the Major Gercino región (Passarelli et al. 1997).

The zircon data available for the rocks that constitute the Florianópolis Batholith indícate that this unit was essentially formed in the Neoproterozoic III and that several granitoid generations, from rocks intensely deformed (considered as formed in the Archean or Paleoproterozoic) to late isotropic bodies, were generated during a máximum interval of 50 Ma. The oidest ages are ofthe order of640 Ma (máximum U-Pb age in zircons from calc-alkaline granitoids) and the youngest around 590 Ma (U-Pb in zircons from the late isotropic granitoids). It is possible that this interval be even smaller because the majority of and the most precise radiometric determinations tend to concéntrate in the range of625 and 590 Ma.

Pelotas Batholith

As observed in Santa Catarina, the eastern portion of Rio Grande do Sul is mainly composed of Neoproterozoic igneous rocks. Several granitoid types predomínate, grouped in the Pelotas Batholith (Fragoso Cesar et al. 1986). This 400km-long and 80-120km-wide batholith is composed of several suites of deformed to isotropic granitoid rocks that frequently present remnants of metamorphic rocks representative of their hosts. In a recent paper, Phillip (1998) summarized the geological data for the Pelotas Batholith presenting, besides petrographic and geochemical studies, a geological map where the main suites ofthe Rio Grande do Sul Coastal Granitoid Belt are represented. From the different suites proposed by Phillip (1998) oniy the Pinheiro Machado, Viamáo and Dom Feliciano suites are considered in this paper as integrating the Pelotas Batholith.

Pinheiro Machado Suite: represents the oidest and the main suite of the Pelotas Batholith, constituted by the most mafic lithologies found in this domain. Granodiorites associated with monzogranites, diorites and tonalites predominate, generally showing igneous flow defined by a banding evidenced by schiieren-type structures and by the alignment of biotite and euhedral feídspar crystals. A metamorphic foliation is imprinted

generated by sub-horizontal shearing (Fernandes et al. 1995 a and b, Phillip 1998). The NE-trending low-angle foliation contains stretched minerals (preferably feídspars) with a conspicuous NW orientation. This deformation pattern is not observed in the other suites that constitute the batholith, exhibitíng oniy the deformations developed in association with the high-angle shear zones. The granitoids from the Sao Pedro de Alcántara and Santo Antonio suites musí correspond, in the context of the Florianópolis Batholith, to the Pinheiro Machado Suite.

U-Pb ages in zircons (Babinsky eí al. 1997) are 610 ± 5 Ma (migmatitic gneiss of granodioritic composition) and 616 ± 2 Ma (biotite-rich migmatitic gneiss), valúes interpreted as indicative ofthe granitoid emplacement. Silva et al. (1997) presented the same interpretation for the 629 ± 8 Ma obtained by SHRIMP for the Pinheiro Machado Suite lithotypes. The authors aiso presented a 781 ± 5 Ma age for zircons extracted from an orthogneiss xenolith that occurs within the Pinheiro Machado Suite granitoids.

Viamao Suite: It is represented byseveral elongated bodies, concordant with the main NE-SW-trending shear zones. The monzogranites predomínate over the granodiorites, occasionally occurring syenogranites. These granitoids are coarse-grained, porphyritic to equigranular, with texture defined by the alignment of potassic feídspar megacrysts and biotite, in general presenting a great quantity of mafic enclaves and significant occurrence of dioritic rocks. They must correspond, in the context of the Pelotas batholith, to the Paulo Lopes-type granitoids discontinuously observed along the Florianópolis Batholith. The geochronological study for the Viamao Suite is precarious when compared with the Pinheiro Machado suite. Valúes of 572 ± 22 Ma (Rb/Sr, Koester 1995) and 595 ± 1 Ma (U-Pb, Babinski et al. 1997) confirm field information that places this Suite after the Pinheiro Machado.

Dom Feliciano Suite (Tessari & Picada 1966): represents the youngest magmatism in the Pelotas Batholith. Rosy leucogranites predomínate, very homogeneous compositionally, structurally and petrographically with marked lack of mafic enclaves and xenoliths ofthe host rocks. These granitoids are isotropic or locally deformed under ductile-brittie conditions by late faulting. The relation of this magmatism with acid volcanic rocks and rhyolitic dikes is another point that stresses its relationship with the Pedras Grandes granitoids of the Florianópolis Batholith. The bodies of this Suite predomínate in the NE portion of the batholith (Phillip 1998) and their emplacement was not controlled by the main shear zones that affect the batholith. The lack of U-Pb ages for zircons makes a more precise definition for the main period of this magmatism impossible, being likely that, similarly to what occurs with the Pedras Grandes Suite in Santa Catarina, it is a littie oider than the valúes indicated by the Rb-Sr isochrons. These are distributed between 570 and 550 Ma (Cordani et al. 1974, Soliani Jr. 1986).

Considering that the Pelotas Batholith represents, in Rio Grande do Sul, the natural continuity of the Florianópolis Batholith characterized in Santa Catarina, it is here suggested, based on the similarities between them, that the latter western limit is defined by the Cordilheira Shear Zone, associated with the alignment of homonymous granitoids. It is thus proposed that the Cordilheira and Encruzilhada do Sul granitoids do not belong to the Pelotas Batholith but to the tectonic context ofthe Porongos Group, making contact with the metamorphites ofthe latter.

The Encruzilhada do Sul granitoids wouid in part correspond, in Santa Catarina, to the petrographically-similar Valsungana Suite bodies, having the same relations with the supracrustal host rocks. The southem limit ofthe Pelotas batholith is represented by the tectonic alignment that separated the Pinheiro Machado and Erval suites (Phillip 1998). It is aiso suggested here that the latter suite does not intégrate the Pelotas Batholith, but is related to the Aiguá Batholith that, in Uruguay, may represent another batholith correlated with other components ofthe Granite Belt.

In this paper the Pelotas Batholith is considered to be composed oniy ofPhillip's (1998) Pinheiro Machado, Viamáo and Dom Feliciano suites, whose magmatic development resulted fi-om the natural evolution of a single batholith.

Nd isotopes confírm Sr isotope data that suggest the participation of the crust in the generation ofthese rocks, with predominant Mesoproterozoic model ages (Mantovani et al. 1987, May 1990, Babinski et al. 1997). May (pp. cit.) presents two age intervals, 1,600 Ma for the Pinheiro Machado Suite granitoids and 1,200 Ma for the Dom Feliciano Suite granites.

8Nd valúes for the Pinheiro Machado Suite are distributed between -4.4 and -7.1 and for the Viamáo Suite they concéntrate in the -7.6 and 1.0 interval. More negative valúes, between -8 and -9 were obtained for gneissic xenoliths of the Pinheiro Machado Suite. The Dom Feliciano Suite granitoids present similar behavior to those of the Viamáo Suite with variation ofthe SNd valúes between -6.3 and 0.1.

According to Mantovani et al. (1987)'s suggestions, Sr and Nd isotopes for the Pelotas Batholith suggest derivation and magmatic evolution similar to those found in the Florianópolis Batholith in Santa Catarina (Basei 1985, Basei & Hawkesworth 1993), corroborating even more to the hypotheses that place these two units in a single granitoid belt.

Aiguá Batholith

Similarly to southern Brazil, in the Uruguayan shield all the región east of the Schist Belt (Lavallela Group) is constituted by a domain of granitoid rocks ofNeoproterozoic age that can be correlated to the Pelotas Batholith (Bossi and Campal, 1991; Bossi and Campal, 1992). Recently, Preciozzi et al. (1999) have identified the Punta del Este Terrane in eastern Uruguay, in the región that previously belonged to the Aiguá

Batholith. It is formed by a series of gneisses and migmatites (not recognized either in the Brazilian or Argentinean territory) that presented U-Pb ages around 1.0 Ga and that wouid be akin to the Namaqua terranes of southwestern África. The terranes that can be correlated with the granitoids of the Florianópolis and Pelotas batholiths observed in Brazil wouid then here be constrained by the Lavalleja Belt and the Punta del Este terrane.

As observed in the Florianópolis and Pelotas batholiths, in the Aiguá Batholith igneous rocks of different compositions predomínate where the main lithotypes are poly-intrusive, calc-alkaline granitoids, occurring subordinately isotropic granitoid bodies of syenogranitic composition. This granitic belt is interpreted as representing the roots of a magmatic are (Fragoso Cesar et al. 1986).

Recently Preciozzi et al. (1999, in preparation) have presented U-Pb data for zircons obtained from two granitoids of the Cañas región, both in the southern portion of the Batholith. These are rocks of monzogranitic composition with biotite and amphibole as the main mafic constituents in a quartz-rich matrix. White, sub- to centimetric potassic feídspar megacrysts stand out in a médium- to coarse-grained matrix. These are littie or non-deformed rocks, intruded during the tardi-kinematic regime.

The ages 572.2 ± 2.5 Ma and 587 ± 16 Ma are attributed to the time of emplacement of these granitoids, confírming the previous Neoproterozoic valúes inferred from the Rb-Sr method (Hart 1966, Umpierre & Halpern 1971, Fernandez & Preciozzi 1974). These ages are younger than those representative ofthe Brasiliano Cycle (ages oider than 600 Ma) available for the southern Brazil in similar terranes.

Additionally, Preciozzi et al. (1999, in preparation) present K-Ar results for the same samples from which zircons were extracted. The ages are ca. 20 to 30 Ma younger than the U-Pb valúes, suggesting a long cooling period. These authors suggest that the mineralogical and geochemical characteristics of the majority of these granitoids characterize an important crustal participation in their generation. This conclusión is confírmed by Sm-Nd data that yield very negative SNd between -9.8 and -12.6 and model ages (T_{DM}) between 2.1 and 1.4 Ga. Mesoproterozoic ages associated with SNd negative valúes are a constant in the Granite Belt granitoids of southem Brazil, confírming the correlations suggested in previous works.

SCHIST BELT

It represents the series of supracrustal rocks distributed between the Granite Belt and the Foreland Basins. In this segment metasedimentary and metavolcano-sedimentary sequences predomínate, occurring discontinuously along a narrow belt with average widths around 40 km. Three distinct metamorphic complexos can be individualized, named, from north to south, Brusque (SC), Porongos (RS) and Lavalleja (UY). These are polydeformed sequences where at least three fold phases are recognized

associated with a northwestwardiy mass transport that evolves to a predominantly lateral movement. The preferential surface in the majority of the metamorphic rocks is transpositional 82, accompanying the metamorphic peak. The regional metamorphism generated rocks ofthe greenschist facies and locally low-amphibolite facies.

The continuity ofthe áreas ofoccurrence ofthe supracrustal sequences is suggested by the tectonic positioning of these segments, by their characteristics and metamorphism ages and aiso by the granitic magmatism intrusive in these supracrustal rocks. Despite these common points, some fundamental elements for a more effective correlation are still unknown, such as sedimentation age and detailed comparative studies between the respective lithostratigraphic columns ofeach belt. Any statement attesting the continuity of these fold belts placing them in the context of the same sedimentary basin shouid be accepted with reserves.

The main critical point in any correlation refers to the sedimentation age ofthe units; up to now there have not been consistent data that precisely position of any of them in time. All possess a Paleoproterozoic basement (2.3-2.0 Ga) and Neoproterozoic metamorphism and granite génesis (~0.76-0.60 Ga) that leaves an ampie time interval for sedimentation.

Recent SHRIMP U-Pb data for zircons presented by Porcher et al. (1999) indicated for Rio Grande do Sul valúes between 783-766 Ma for the acid volcanism intercalated with the Porongos Complex. These authors interpret such ages as indicative ofthe time ofthe volcanic rock generation in the context of the Porongos paleobasin opening and consequently indicative ofthe time ofthe basin fílling. This interpretation is questioned here, being the alternative hypothesis the volcanism generated during the metamorphic climax that affected the Porongos Complex, representing a volcanism produced by melting of deep levéis of the sedimentary pile and therefore not representative of the time of deposition of the metasedimentary units. The peraluminous characteristic of the volcanism corrobórales with the participation ofupper crustal levéis in the generation of this magmatism.

Therefore it is likely that a signifícant parí of Brusque, Porongos and Lavalleja metavolcano-sedimentary sequences have been deposited in Mesoproterozoic pre-Brasiliano basins without any link with the generation and defbrmatíon of the granitic batholiths located east (Florianópolis, Pelotas and Aiguá).

Brusque Metamorphic Complex

In Santa Catarina the Brusque Group is composed of two metavolcano-sedimentary series separated by the Valsungana Batholith. In the northern series the sedimentary sequences begin with a pelitic-psamitic unit (garnet-rich mica quartz schists and quartzites) that grades to psamitic-pelitic units (homogeneous metarhythmites and sericite schists) overlain by a metavolcano-sedimentary unit (metamaris, calc-schists,

metabasics and subordinately gray sericite schists) (Basei 1985, Caldasso et al. 1994). The mafic rocks represent a syn-sedimentary basic magmatism with tholeiitic to alkaline affinity characterized as variolitic basalts where structures indicating liquid immiscibility are frequently observed (Silva 19XX, Basei 1985, Sander 1992). In the southern segment, the basal sequence is composed of a metavolcano-sedimentary unit possibly representing the rift phase ofthe Brusque paleobasin (Basei et al. 1994). In this unit volcano-exhalative deposits are characteristically formed by a thick tourmalinite pile associated with meta-basalts, BIFs, orthoquartzites (cherts?) and calc-silicate rocks (Silva et al, 1985, Basei et al. 1994). This sequence is overlain in tectonic unconformity by a metasedimentary unit formed by a thick psamitic-pelitic pile where micaceous quartzites, quartz-sericite schists, pelitic sericite schists predominate and occasional acid metavolcanics.

The Brusque Group magmatism is characterized by a series of slightiy deformed, isotropic granitoids, with metaluminous affínity, indicating strong crustal contribution. They can be grouped in three main series, all of them showing tardi-tectonic characteristics in relation to the main phases of metamorphism and deformation of the host supracrustal rocks. The oidest Sao Joao Batista Suite is characterized by two-mica leucogranites occasionally with garnet, tourmaline and fluorite, oecurring as small stocks and lode bodies. Known W and Sn occurrences are related to these granitoids. In an intermediate position, there is the Valsungana Suite composed of whitish gray granitoids typically with centimetric microcline megacrysts in a coarse-grained biotite-rich matrix. In the Nova Trento Suite light gray to slightiy rosy biotite granitoids occur late in relation to the previous series. All the granitoids develop a clear contact metamorphic rim reaching the pyroxene-hornfeis facies (Basei 1985, Caldasso et al. 1988 and 1995, Castro et al. 1999).

Porongos Metamorphic Complex

In Rio Grande do Sul the Schist Belt is represented by the Porongos Complex with best expositions in the surrounds of Santana da Boa Vista, associated with the Santana-Canapé Dome and the Cerro da Arvore Nappe. In the nucleus of an antiformal structure that characterizes the Complex there occurs the Encantadas Gneisses (basement of the Porongos Group) tectonically covered by the metamophites of the Cerro dos Madeiras Group (Jost 1982). At the base a psamitic metasedimentary unit is formed by predominant meta-arkoses and impure quartzites intercalated within metapelites and rare amphibolitic gneisses (Arroio dos Neves Formation); in an intermediate position quartzitic metarhythmites (Olaria Formation) predomínate; a pile ca. 2000m-thick of mica schists with marbie and orthoquartzíte intercalations occurs on top ofthe sequence (Irapuazinho Formation). The Cerro da Árvore nappe is constituted

by predominantly metavolcanic sequence with meta-andesites, metadacites and varied pyroclastic rocks.

Subordinately metacherts, marbies, metapelites, graphite schists and rare quartzites occur (Jost op. cit.). The vergence is northwestwards and the stmcture overrides the eastem flank ofthe Santana Dome.

The metamorphic conditions that aífect these units range from the chiorite zone in the greenschist facies to the staurolite zone in the amphibolite facies. The parageneses point to low-pressure metamorphism (between 2.0 and 2.2 kb) for Cerro da Árvore and médium pressure (3.5 to 4.8 kb) for the Cerro dos Madeiras Group (Jost 1982).

For the región ofthe Canapé antiform. Marques et al. (1999) emphasize the magmatism generated previously to íhe metamorphic and deformational climax of the Porongos Complex. This magmatism, according to these authors, has geochemical characteristics indicative of severa! tectonic environments varying from the rift stage (alkaline gneisses) to the subduction phase (calc-alkaline acid volcanics) that wouid be associated with the pre-esisting oceanic crust consumption.

It is here suggested that the granitoid and gneissic rocks of the región known as Encruzilhada do Sul Block shouid belong to the context of the Porongos Complex, and disagreeing with Fragoso Cesar's (1991), Phillip's (1998) and Silva's et al. (1999) proposals, be excluded from the Pelotas Batholith, from which they are separated by the Cordilheira Shear Zone. This región is charaeterized by igneous and sedimentar»[7] rocks with part of the gneissic rocks i-qM-esenting the basement (Encantadas type) of the Porongos Complex (Porcher et al. 1999), or deep levéis (amphibolite facies) of the supracrustal rocks of the Cerro dos Madeiras Group (Silva et al. 1999). This región, differently from what occurs in other áreas of occurrence of the Porongos Complex, presents a large number and diversity of granitoid rocks represented by the Encruzilhada do Sul Batholith and by several igneous rocks including the Piquen Syenite, Capivarita Anorthosite and Pitangueiras Granitoid.

The S-type granitíc magmatism that affecís the supracrustal rocks of the Porongos Complex is best represented by me Campiñas Granitíc Suite. These rocks are charaeterized by small circumscribed stocks distributed in the eastem portion of the Schist Belt. These are preferentially equigranular,, isotropic two-mica leucogranites with peraluminous affinity, suggesting interaction with the upper crust (Frantz & Jost 1983). The Rio Grande do Sul tin occurrences are associated with this magmatism.

Lavalleja Metamorphic Complex

In Uruguay the Lavalleja Group represents the southem segment of the Schist Belt, formed by three supracrustal units, namely, from east to west, Zanja del Tigre, Fuente del Puma and Minas Formations (Sanchos Bettuci 1998), accompanied by a decrease

in the metamorphic grade from east to west from Íow amphibolite, greenschist to very low (anchimetamorphic) grade in the northwestem región.

The Zanja del Tigre Formation corresponds to a metavolcano-sedünentary sequence made of gabbros and (para- and orthoderived) amphibolites, hosted by mica schists, gamet-rich schists and varied marbies. It is overiain by psamitic-pelitic (metaconglomerates, calcarenites, calc-dolomites and mica schists) metavolcano-sedimentary sequence (Fuente del Puma Formation) where, in relation to the basal unit, these is a clear increase of the volcanic contribution (gabbros, basalts, volcanic breccias and rhyolites). The upper Minas Formation is exctusively constituted by sedimentary tenns with metapelites, quartzites and arkoses, besides limestones that include stromatolitic units.

Spatially associated with the Zanja del Tigre Formation, and with its westem end overriding the Fuente del Puma Formation, fhere is a series of orthogneisses and migmatites from the Carapé Complex where deformed granitoids ofvaried composition predomínate and subordinately feídspatic mica schists and undifferentiated metabasic rocks. To the top, tiüs complex grades from syn-tectonic muscovite- and tourmaline-bearing pegmatites to anorogenic isotropic granitoids. Despite their tectonic contacts, Sanches Bettucci (1998) suggests that the Carapé Complex be stratigraphically over the Lavalleja Group.

As observed in the Brusque Group in Santa Catarina, the granite génesis that affects the Lavalleja Group metamorphites is widespread and very diversified, from the compositional point of view, being the largest bodies the Maldonado granitoids intrusivo m the Fuente del Puma Formation and the Penitente intrusive in the Zanja del Tigre Formation.

Basement Nuclei Within the Schist Belt

The Dom Feliciano Belt presents sporadic occun-ences of gneissic-migmatitic rocks that compose the basement of the metamorphic units of the Schist Belt supracmstal sequences.

m Santa Catarina,, a littie south of the overthrusts that constitute the Bresque Complex northem limit, a series of mylonitic granulitic gneisses occur partially covered by the sediments of the Paraná Basin and are tectonically overlain by Brusque metamorphites, yielding Pb-Pb ages ofcci. 2.4 Ga (Basei 1985). Similar valúes were obtained by the Rb-Sr method for migmatites that occur ín the Camburiú región (Mon'o do Boi). In this case, the basement occurrences are localized at the borders of the Valsungana granitoid, which suggests that this occurrence represent mega-xenoliths from the basement upiifted by the granitoid.

In Rio Grande do Sul the Schist Belt basement is well characterized as several occurrences of gneissic rocks, whose main lithotypes are the Encantadas

orthogneisses that occupy the Santana Dome nucleus. Rb-Sr ages cióse to 2.1-2.2 Ga (Soliani, 1986) were confírmed regionally by SHRIN/IP analyses in zircons (Porcher et al. 1999; Leite et al. 1999).

m Uruguay, as in the other parts of the Schist Belt, the Lavalleja Complex basement is characterized by gneissic rocks, best exposed in the locality called Punta Rasa (SE of Montevideo). These are fínely foliated mylonitic gamet gneisses that indícate, by means of SHRIMP dating, valúes around 2.1 Ga (U.G. Cordatü, pers. comm.)

From the available data, despite the fragmented information, it is possible to recognize the predominance of a Paleoproterozoic gneissic basement along the entire length of the Schist Belt.

FORELAND BASINS

The foreland basins form a naiTow belt parallel to the general DFB trend, segmented, a.s the other DFB units, in three main basins named, from north to south, Itajaí, Camaqua and El Soldado-Piriápolis. Their sedimentar characteristics suggest that they shouid have been interlínked during the Vendian-Cambrian limit by a sea opening southwestwards.

Itajaí Basin (SC)

The Itajaí Basin (Basei et al. 1999) occupies an área of more than 700 km^2 in the northeastem part of Santa Catarina, near the Itajaí River valley. It is elongated along N60E añil is characterized by a thick epiclastic sedmientary succession with subordinated trachytic to rhyolitic volcanics and pyroclastics.

Pioneer studies (Maack, 1947 and Salamuni et ctl. 1961) divided the Itajaí seríes m two dtíferent fonnations redefíned by Silva & Días (1981) as the basal Gaspar formation, composed ofpsammitic sequences with minor conglomérate and volcanic rocks, and the Campo Alegre Formation, formed by pelitic and pelitic-psammitic rhythmites.

Basei (1985) and Basei et al. (1987) attributed a thickness of 7500 meters to the Itajaí Group. They showed that it has been affected by two deformational phases aiso present in the fold belt formed by the Brusque Group, and inteipreted the structure as monoclinal with NE vergence towards the granulite terrane. They proposed that it be composed oftwo main units, divided into four informal lithostratigraphic sub-units: (i) the lower psammitíc unit, equivalent to the Gaspar Formation, with an arenaceous-conglomeratic subunit containing thick arkosic sandstones intercalated with lenses of polymictic conglomérales and volcanic tuffs, overlain by a rhythmic sandstone-silt subunit with microconglomeratic layers; and (ii) the upper silty unit, with a silty-arenaceous subunit with predominant silts at the base a silty-pelitic of homogeneous clay- and siltstones, containing small lenses of coarser material, at the top.

Several authors including Krebs et al. (1988, 1990), Appi & Cruz (1990), Appi et aJ.(1990) and Rostirolla (1991), elaborated a stratigraphic arrangement m systems of sedimentary tracts, identifying a lower sequence formed by a low-level tract and a transgressive unit represented by a condensed distal system of rhythmic slates which formed from an eroded upper tract. Citroni (1993) identified four main sedimentary facies associations, defined according to their depositional environment: 1) - Turbiditic Associations (1.1 sandstone-conglomerate dense turbidites; 1.2 thick graded dense turbidites; 1.3 Classic médium density turbidites; 1.4 Attenuated turbidites); 2) - basin associations (2.1 hemipelitic; 2.2 subaqueous slides); 3) - transitional associations (3.1 coastal plain sandstones); 4) - continental associations (4.1 ruditic alluvial fans; 4.2 intercalated alluvial sandstones).

Restricted thin (<50 cm) levéis or lenses of strongly recrystallized tuffs are intercalated within the Itajaí basal fonnations. The tuffs are fine-grained light green colored rocks composed ofquartz and sericite. Predominantly acid volcanic and subvolcanic rocks are more abundant than the pyroclastics, and are intercalated within the sediments. Clasts of acid volcanic rocks with diameters from 3 mm to 40 cm are observed in all conglomerates. Subordinate basic and intermedíate rocks aiso occur as late dikes.

Pain et al. (1998) indicated the occurrence of ichnofossiis and fossiis in low-density turbiditic levéis of the lower portion of the upper unit of the Itajaí Group. The fossil found is of the Chancelloria type representing a Cambrian taxon with worid occurrence restricted to the Lower to Médium Cambrian, which led these authors to attribute a máximum age of 540 Ma for the Itajaí Group deposition. Cambrian fossil traces corrobórate to this suggestion.

However, considering that the Itajaí Basin rocks are affected by the Subida Granito and by several domes of rhyolitic rocks, Basei et al. (1999) concluded, based on the ages around 560 Ma for this magmatism that the deposition of the Itajaí Group must liave begun before 560 Ma. As a consequence, considering the Chancelloria fossil restricted to the Cambrian, these authors suggested that fhe age of the Proterozoic-Fanerozoie limit in southem Brazil be oider than the valué 540 Ma presently accepted by the intemational community.

Camaqua Basin (RS)

In this paper the compartimentation presented by Fragoso Cesar (1991) is adopted, which associates onty the Camaqua Basin with the DFB development. The other Eo-Paleozoic basins of Rio Grande do Sul, the largest being Santa Bárbara,, wouid have their evolution related to the Sao Gabriel Block that wouid represent another Neoproterozoic Belt developed in the western portion of the basement domain in Rio Grande do Sul.

The Camaqua Basin starts with the Arroio dos Nobres Fomiation that presenta, in its basal portion, a sequence of deltaic fans constituted by sandy-pelitic rhythmites which grade, towards the top, to conglomérales and conglomeratic sandstones. On this group or intercalated with it, there is a thick mditic pile where varied conglomerates predomínate with intercalations of coarse-grained sandstone levéis. The upper unit of the Arroio dos Nobres Formation is characterized by the predominance of varied sandstones with subordinated occurrences ofruditic wedges.

After an angular unconformity, follows the Camaqua Basin upper unit,, represented by the Guantas Group sub-horizontal continental deposits that present at the base alluvial fan conglomerates and arkosean sandstones that grade to eolic arkosean sandstones that interfinger next to the borders, with breccias, conglomerates and fluvial sandstones. This group is overiain, in erosive contad, by a pile of conglomerates, sandstones and fluvial-deltaic pelites (Fragoso Cesar et al. 1999).

A major voléame manifestation is intercalated withín the Guaritas sedimentary sequence and is characterized by lenticular flows similar to pahoehoe-type lavas (Lopes et al 1999). These rocks, with basic alkaline arfínity, were dated by U-Pb with SFIRIMP (Remus et al. 1998, Hartmann et al, 1998) as 470 Ma, placing the Guaritas Group in the Ordovician.

In agreement with the suggestions to exclude the Guaritas Group from the context of the foreland basins in the Proterozoic-Fanerozoic transition period and associating it with previous rift phases ofthe Paraná Basin (Fragoso Cesar et al. 1999, Lopes et al. 1999) it is here pointed out the fact that this unit covers unconformably those belonging to the Santa Bárbara and Camaqua basins, each of them associated with one or two Neoproterozoic belts known in the Precambrian ofRio Grande do Sul.

Arroyo del Soldado-Piriápolis Bassin (UY)

Dífferently from what is obseived in Santa Catarina and Río Grande do Suí, in Uruguay there is not a single basin that can be refeired to as typical of the transition phase behveen the metamorphic-defom-iational climax of the adjacent metasedimentary belts and the installation of large Paleozoic intracratonic basins. On the other hand, there are severa! occurrences that íülfill the above mentioned characteristics.

The Arroyo del Soldado Group is the most signifícant of all basinal sequences deposited m the Proterozoic-Fanerozoic transition period in Uruguay, constituting a pile with approximate thickness of 5000 m (Gaucher & Sprechmann 1998) deposited in marine environment characterized by shallow waters, resting in angular unconfomlity on a metasedimentary basement of probable Mesoproterozoic age (Gaucher et al. 1996). The diversity of its fossil contení allowed positioning it between the end of the Vendían and the Lower Cambrian. Among the fossíls found Cloudina riemkeae stands

out in the Group lower levéis, allowing to correlate it with the Jacadigo and Corumbá Groups in Westem Brazil and the Ñama Group in Southwestem África.

In the Arroyo del Soldado Group four formations are recognized that, from base to top, correspond to an initial sandy-pelitic sequence that grades to a carbonatic level of probable biomicritic origin, covered by a peíitíc pile rich in organic matter, BIFs and cherts. The is ca. 250 m thick, the BIFs con-oborating with the suggestion of a possible glaciation that globally occurs around 550 Ma cióse to the Precambrian/Cambrian boundary. On these rocks lies a thick pile of mature quartzose to arkosean sandstones. In the upper unit a carbonatic pile once again predominates composed of oolitic calcarenites with intercalations of limestone levéis that grade towards the top to stromatolitic levéis.

A EW compression caused the development of open folds in the Arroyo del Soldado Group, with subhorizontal axes trending from N15W to N20E. The folds generated are isopachous and do not present plañe axial schistosity (Gaucher et al. 1996).

Another important occurrence, that can be temporally correlated with the Arroyo del Soldado Group, was described in detail by Masquelin & Sanches Bettuci (1993) in the Piriápolis región (east of Montevideo), being the Playa Hermosa sub-basin the most conspicuous. Several deposits observed in this región may reach a total thickness of 3700 m predominating a siliciclastic sedimentation with graded sandstones, rhythmic sandstones (altemation of sandstones and pelites) and important contribution of matrix-supported polymictic conglomeratic levéis. Towards the top, cross-bedded sandstones tend to predomínate with intercalations of conglomérate levéis frequently with ceníimetric clasts ofvolcanics and microsyenites. However, the presence ofignimbrites and trachytes (probably associated with the SielTa de Animas Formation magmatism) intrusive m the sedimentar sequence, locally with centimetric meta-arenite xenoliths, suggests a contemporaneity between the volcanism and the upper part of the sedimentary sequence.

The Playa Hermosa sedimentary sequence was deposited after the metamorphic-depositional climax of the Lavalleja Complex, oniy presenting brittie deformation characterized by tilted layers dipping NW, N20-60E thi-ust faults and cataclastic zones. Locally, as in the Canadá Azucarera región, a Si cleavage is developed in axial zones of folds with N30E-trending axes (Masquelin & Sanches Bettucci 1993).

FORELAND DOMAIN

The crystaUine terranes observed m the northwestem and westeni regions of the Dom Feliciano Belt are predominantly constituted by gneissic-migmatitic rocks that served as foreland for the Belt development during the Neoproterozoic-Cambrian. These continental masses, even those for which the term craton is applied, represent preexistent continental fragments totally involved by the ¡xocesses associated with

ocean closing between África and South América during the formation of the Gondwana supercontinent. The destructíon of the oceanic crust has as expressive counterpart the Granite belt generation and the development of the Kaoko-Gariep fold belts.

As observed in Figure 1, the Foreland terranes can be divided in two main groups: the Luís Alves Microplate in the northem región and the Rio de la Plata Craton in the central-southem portion, separated by the Paleozoíc sediments of the Paraná Basin. Geological, geochronological and geophysical characteristics do not favor a possible continuity between these two units, being likely that they represent two independent cmstal fragments.

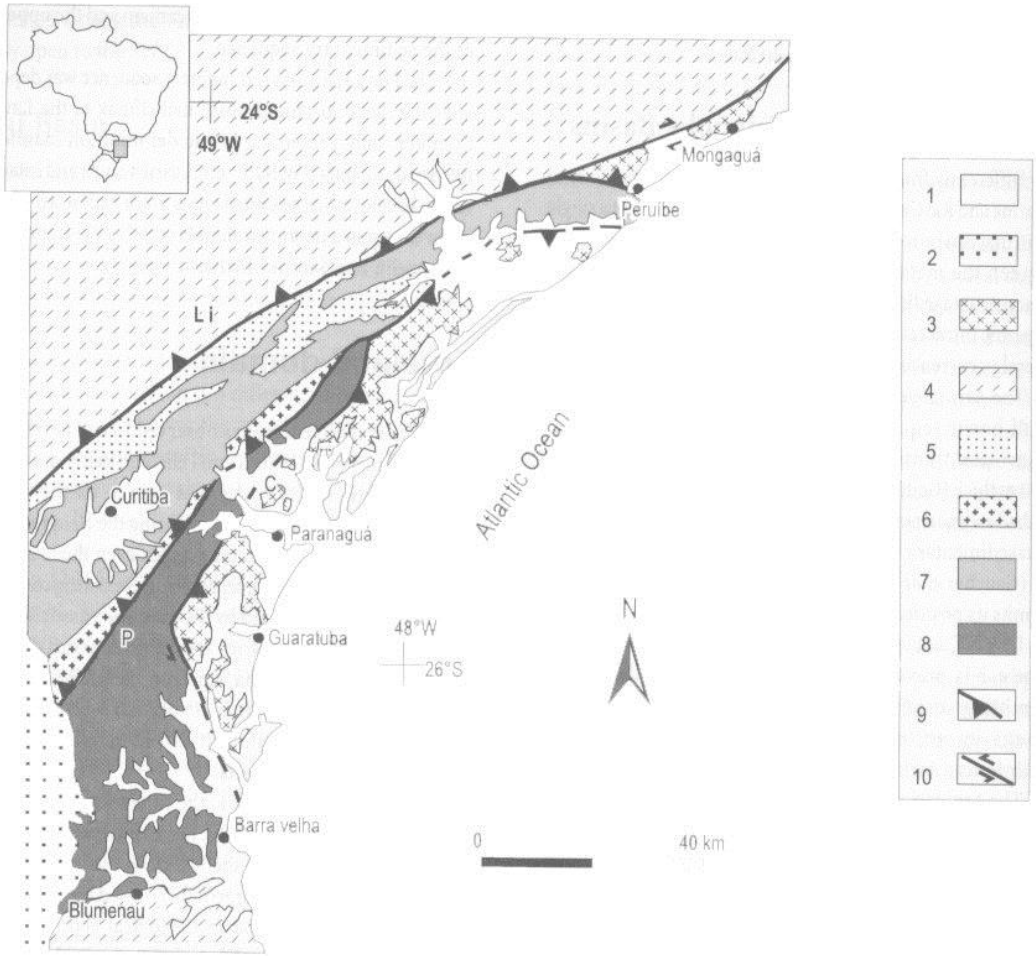


FIGURE 5 - Simplified geological map of the northern part of southern Brazil. 1 - Quaternary sedimentary cover; 2 - Paraná Basin; 3 - Costeiro Granite Belt (c. 620 Ma Paranaguá Batholith); 4 - Neoproterozoic fold belts (Ribeira Apiaí-N and Dom Feliciano-S); Curitiba Microplate, 5 - Capiru/Setuva metasedimentary sequences; 6 - Rio Pien Batholith (arc-related granitoid); 7 - Atuba Complex; Luis Alves Microplate, 8 - Santa Catarina Granulite Complex; 9 - Major Neoproterozoic Suture Zones, LI - Lancinha/Itariri, P - Pien, C - Costeiro, 10 - Trancurrent Shear Zones. Post-orogenic granitoid and basins were not represented.

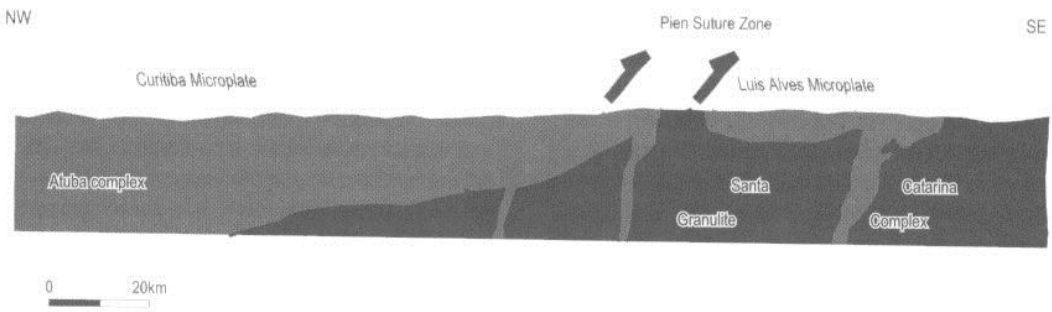


FIGURE 6 - Pien Suture Zone: geological cross section throughout the collisional limit between Curitiba and Luis Alves microplates. Mafic-ultramafic rocks (black pods) are interpreted as remnants of the Neoproterozoic oceanic crust. The age of the collision process can be estimated around 600 Ma, based on the ages of the post-collision intrusive granitoid and the Campo Alegre volcano-sedimentary basin (dated by zircon c. 595 Ma) and the deformed calc-alkaline I-type magmatic epidote bearing granitoid of the Rio Pien Batholith (c. 615 Ma).

Luis Al ves and Curitiba microplates

The terranes that constitute the basement of the norihem part of southem Brazil, from Apiaí (Ribeira) to Brusque (Dom Feliciano) fold belts, can be grouped in two distinct geotectonic units: Luís Alves and Curitiba microplates (Basei et al., 1992). These domains are separated by the NE-trending Pien Suture Zone, extending along the southem limit of a Neoproterozoic calc-alkaline granitoid belt generated in the southem border ofthe Curitiba Microplate, as a consequence ofthe northwestward subduction of the oceanic crust between these geotectonic units (Machiavelli et al., 1993; Harara, 1996, Basei et al., 1998). The microplates in question are represented in Figure 5 that shows the continuation to the north ofthe geological map presented in Figure 1.

An important landmak in the evolution of the Luis Alves and Curitiba domains is represented by expressive non-deformed granite génesis of alkaline-peralkaline nature (Sen-a do Mar Suite) as well as by intense volcanism, related to the development of severa! extensional basins (Corupá, Campo Alegre and Guaratubinha). The main time interval (600 +/-10 Ma) ofthe formation of these rocks is restricted to the final stages of the Brasiliano and the begin of Rio Doce orogénesis. These granitoids and basins are represented oniy in the geológica! profile (figure 6).

Curitiba Microplate

In its northem portion it is overlain by thick metasediment sequences (Capiru and Setuva formations), which have paleogeographic affinities with this Microplate. These metasediments were not deposited in the same basin of the metasediments of the Apiaí (Ribeira) fold belt (Votuverava and akin), which occurs exclusively north of the Lancinha Shear Zone. The Lancinha-Itariri Shear Zone wouid rqaresent, at the surfáce, the trace of an important suture that sepárales the Curitiba Microplate from the terranes located north of it. The gneissic-migmatitic rocks that occur in this microplate were called Atuba Complex (Siga Jr. et al., 1995) being predominantly constituted by banded migmatitic amphibole gneisses, of Paleoproterozoic age, which underwent intense deformation and migmatization during the Neoproterozoic. Within these gneisses, which are regíonally metamolphosed in the amphibolite facies, nuclei of high metamorphic-grade rocks of predominantly chamo-enderbitic composition occur. These rocks are preferentially distributed in the northem portion of these terranes, the best exposition occurring in the Peruíbe región (Itatins Massif), Southeastei-n Sao Paulo State. The Paulo Leminski Quany, in Curitiba City, is another site of excellent expositions.

For the Atuba Complex (Curitiba Microplate) previous LT-Pb data obtained for the zircons from the gneissic-granulitic rocks are concur to 2,100 Ma (Siga Jr. 1995; Siga Jr. et al. 1995; Picaneo et al. 1998). An additional determination for the Paulo Leminski Quarry resulted in 2,105.4 ± 3.1 Ma (Basei et al 1999b), confirming previous data. This age was obtained for zircons extracted from chamo-enderbitic, sometimes pegmatoid

portions, which occur within tonalitic, médium- to dark-gray granulitic gneisses. Whole rock Rb-Sr isochrons and K-Ar cooling ages are always Neoproterozoic. On the other liand, Nd model ages for metamorphic rocks are predominantly Archean.

Luís AÍves Microplate

It is characterized as a cmstal segment where high-grade rocks of regional expression constitute the Santa Catarina Granulitic Complex (Hartmann et al.,, 1979). Its north-northwestem limit is defined by the Pien Suture Zone; it extends a littie below Blumenau city, where it is overlain by anchimetamorphic sediments of the Itajaí foreland basin (DFB). It is the oniy crustal block of the Brazilian southeastem sector that had already been cold (below the 300°C isotherm) since the Paleoproterozoic, not undergoing Neoproterozoic tectono-thermal supeiposition. The high-grade rocks are predominantly orthoderived with subordmate contribution of kinzigitic gneisses, quartzites and calc-silicate gneisses, besides the local occurrence of BIFs. Compositionally they are chamo-enderbites, predominating depleted types that present a pattem very similar to the Scottish Lewisian Complex granulites (Basei et al., 1998).

The presence of mafic-ultramafic rocks is a constan!, oecurring with different dimensions, shapes and generations. The Barra Velha Mafic-Ultramafic Complex (without peridotites) represents the major occurrence of these rocks. Recent studies involving l:50,000-scale cartography, allowed the characterization, in the ambit ofthe complex, of expressive áreas formed by biotite gneisses, amphibole gneisses and amphibolite-facies migmatites which do not show any trace or even relicts of Iligh-grade parageneses. Associated with these rocks and passing to migmatitic gneisses, an important magmatism occurs, represented by hololeucocratic, quartz-feídspatic pink granitoids. These granitoids, despite bemg strongly deformed, do not show the structural complexity easily found in the majority ofthe high-grade rocks.

For the Santa Catarina Granulite Complex, reworked oider data, plus new age determinations, allowed to define an age of 2,350 ± 30 Ma as representative ofthe main period of high-grade metamorfísm. These ages were obtained from the analysis of several populations of "potato shape"-type zircons (rounded, brown, and translucent). m the same rocks, a second population of zircons was aiso identified,, constituted by slightíy rosy, transparent, biterminated prismatic crystals (2x1 to 3x1), which yielded ages between 2.2 and 2.3 Ga (Basei et al, 1999b).

Still in the Luís Alves Domain, in the Ibirama región, dating of a defomied rosy leucogranite revealed an age of 2,012 ± 21 Ma (Basei et al., 1999b). This age is inteipreted as representing the time of the granítoid emplacement, and as it is closely associated with the migmatites and gneisses that lack high-grade parageneses, this age indicates the time of amphibolite-facies metamorphism, which aífected the complex regionally.

In Figure 5 the existence of two Paleoproterozoic high-grade belts is suggested. The first crops out along the northem portion of the Atuba Complex (Curitiba Microplate) being represented by a discontinuous orthogranulitic belt (mangerites to chamockites); the second, with predominant distribution in the ambit of the Luís Alves Microplate, is the main constituent ofthe Santa Catarina Granulitic Complex.

The agreement between U-Pb ages obtained for three different localities of the Curitiba Microplate allows us to confidently state that the Atuba Complex high-grade metamorphism occurred at 2,100 ± 10 Ma. The zircons of this domain, even with SFIRIMP analyses, lack evidences of a preterite crustal history, suggesting (despite the Archean Nd model ages) that the generatíon and high-grade metamorphism (including deformation and migmatization) of these igneous rocks were practically simultaneous. Subsequentíy, in Neoproterozoic III, these rocks were aífected, to different degrees, by deformation, migmatization and amphibolite-facies metamorphism. Therefore, the Atuba Complex is a Neoproterozoic unit that had a polycyclic evolution starting at the Paleoproterozoic.

The geologic history of the Santa Catarina Granulitic Complex differs greatly from that pointed out by the zircons ofthe Curitíba Microplate. The híghiy discordant behavior of ite zircons can be mainly attributed to crustal heritage that was not recognized in the Atuba Complex granulites. This suggests that,, m this case, the magmatic and metamorphic episodes were separated by a conspicuous time gap. Another very important difference between these complexes refers to the lack of Neoproterozoic superposition m the Luís Alves Microplate terranes. The gneissic-migmatitic rocks that constitute this domain regionally present K-Ar ages oider man 1,700 Ma. The Santa Catarina Granulitic Complex can be considered as a Paleoproterozoic complex that underwent polycyclic evolution, where the main metamorphic and deformational events occurred at 2,350 and 2,100 Ma.

The first granulite facies metamorphísm of the Santa Catarina Granulitíe Complex (ca. 2,350 Ma) precedes ca. 250 Ma its equivalent in the Atuba Complex (ca. 2,100 Ma). However, the fact that the ages around 2,100 Ma occur in a conspicuous manner in both microplates allows us to suppose that these entities couid have formed a single block during the Paleoproterozoic that were separated (ca. 800 Ma) and reunited again (ca. 610 Ma) in the Neoproterozoic.

THE RIO DE LA PLATA CRATON

The Rio de La Plata Craton (Almeida et al., 1973; Fragoso Cesar and Soliani Jr, 1984; Dalla Salda et al. 1988), groups the majority of the pre-Neoproterozoic terranes of Southeastem Brazil and Uruguay, as well as northeastem Argentina. It is a geotectonic unit mostiy covered by the Paleozoic sediments of the Paraná Basin that served as foreland for the development of DFB southem portion. Certain geological

characteristics contribute to fürther subdivisions giving way to regional ñames. In Argentina, the occurrence of Precambian-Eopaleozoic basement gneisses is rare, being the main exposition área (not represented m Fig. 1) restricted to the Tandília región.

m this paper, the diíferent segments that constitute the Rio de La Plata Craton are grouped in two main units: Taquarenbó (RS) - Rivera (UY) - Nico Pérez (UY) and Piedras Altas (LTY). The main differences that allow such distinction are based on the fací that the first unit presents Archean Nd model ages and that it was dtíferently afifected by Neoproterozoic-Cambrian thermal-tectonic events characteristic ofDFB. On the other hand, the Piedras Altas terrane represents a juvenile crustal segment of Paleoproterozoic age that had not been intemally heated since 1.75 Ma ago.

Taquarembó-Rivera-Nico Pérez Blocks

Due to geologic and geochronologic similarities the Taquarembó, Rivera and Nico Pérez occurrences can intégrate a single block where granulitic rocks oecur within a gneissic-migmatitic unit. The granulitic rocks predomínate in the northem portion of this segment (Taquarembó Block - RS) and occur subordinately in the Rivera-Valentines región (UY), whereas in the Nico Pérez terrane gneisses and migmatites of amphibolite facies predominate.

The oíd terranes of the westem portion of the Rio Grande do Sul shield occur south of the Ibaré shear zone, which sepárales this segment from the Neoproterozoic Sao Gabriel Block. In the Taquarembó BÍock the Santa Mam Chico Compíex best rqiresents the granulitic rocks. m this Paleoproterozoic complex containing Archean protoliths (Hartmann et al., 1999) orthoderived bimodal rocks, depleted in lithophile elements, varying between acid to basic terms predominate. Subordinately, sillimanite gneisses, anorthosites and pyroxenites occur, metamorphosed in the granulite facies reaching pressures of 10 kbar and 800°C (Hartmann, 1998). Sedimentary covers, acid volcanics and post-tectonic, Neoproterozoic to Cambrian granitoid rocks are frequent on this gneissic domain (Soliani Jr. 1986).

Whole-rock Rb-Sr and Pb-Pb isochrons, distributed between 2,030 and 2,500 Ma and obtained from analyses of different metagranitoids, mark the characteristic geochronologic pattem for this basement segment. The few Nd model ages indicate Archean valúes with strongly negative SN^O). In a recent paper, Hartmann et al. (1999) presented SHRIMP results for a metabasait and a metatrondhj emite of the Santa María Chico Complex. Both rocks presented very similar radiometric pattems, with inherited zii-cons indicating 2.13 and 2.55 Ga as the ages ofthe igneous protolith, and a smaller number of zircons, considered as metamorphíc by the authors, yielding 2.01 and 2.05 Ga, interpreted as representative of the age of the high-grade metamorphism that affected this complex.

In Uruguay, the Rivera and Nico Peres domains are geologically very similar to the Taquarembó domain with several gneisses and migmatites occurring cióse to the granulitic rocks. Long mylonitic belts and reliéis of supracrustal rocks of médium to high metamorphic grade, as well as granitic intmsions of different ages and compositions attest the geological complexity of this crustal segment. m its eastem end the Nico-Perez terrane presents a metavolcano-sedimentary unit (Pavas Formation, Preciozzi et al., 1985) composed by quartzites, conglomérales, füchsite-bearing mica schísts, marbies and orthoamphíbolites, the metamorphism reaching the high amphibolite facies (gamet-sillimanite).

The long magmatic and metamolphic history of this domain can be built with the Rb-Sr ages for metagranitoids of the Corrales región (Cristalina de Rivera Island) that yielded valúes around 2,272 Ma in Rb-Sr isochrons (Soliani Jr., 1986; Cordani and Soliani Jr., 1990), proving that the Transamazon Cycle (Paleoproterozoic) was responsible for the metamolphism of the basement gneisses. The 1,760 Ma-oíd Illescas rapakivi granite (Bossi and Campal, 1992), as well as K-Ar ages of 1,253 Ma for neoformed muscovites from mylonites of its eastem border (Campal et al, 1995) strongly suggest that Mesoproterozoic thermal-tectonic evente took place in the Nico Pérez terrane. Additionally, this domain was affected by Neoproterozoic shear zones (Bossi and Campal, 1992) and intruded by porphyritic granites and granodiorites with Rb-Sr ages distributed between 689 and 664 Ma. Isotropic K-feídspar granites are much younger, around 580 Ma oíd. mitial ^{8} Sr/^{86}Sl• ratios clearly show that mese granitoids did not originate from melting of basement gneisses (Soliani Jr., 1986). The lack of radiometric determinations in zircons, together with the Archean record of the Nd model ages, allows to suggest a probable evolution from reworking of Archean protoliths for the Rivera-Nico Pérez block.

In Argentina, the geological and radiometric information related to the basement of the Rio de La Plata Craton is scarce and concentrated in the Sen-a de Tandil región. Buenos Aires province. m this área gneisses and migmatites occur with different metagranitoids, including data for mylonitic anatexites, which present a Paleoproterozoic geochronological pattem. Rb-Sr isochron ages are distributed between 2,150 and 1,770 Ma including grey gnaisses to rosy leucogranites (Várela et al., 1988;

Ramos et al., 1990; Dalla Salda et al., 1992). Aeid and basic metavolcanic rocks (Lema and Cucchi, 1981; Teruggi et al., 1988), later to the main defbrmation, are recognized within the regional gneisses.

The sedimentar cover of the Tandil región corresponds to a group of NW-SE trending lithostratigraphic units that received several local ñames (Tandil Group, La Tinta Formation, Loma Negra Formation, and Sierras Bayas Formation, among others). It is

constituted by a non-metamorphosed siliciclastic to carbonatic sequence, being the interval between deposition and diagenesis 800 Ma (Pothe de Baldis et al., 1983; Poiré, 1993) and 720 Ma (Bonhomme and Cingolani, 1980) respectively estimated using microfossil and stromatolite associations and radiometric data.

Some basement granitoids presented K-Ar ages between 790 and 870 Ma (Linares, 1977) characterizing the Neoproterozoic supeiposition on this domain, whích allows its correlation with the other reactivated segments of the Rio de La Plata Craton. However its is interesting to point out that despite being situated cióse to the eastem border of fhis cratonic domain, which couid suggest its relation with fhe DFB magmatism, the ages obtained for this granitoid show a time relation very cióse to the observed in the Sao Gabriel Block magmatism characteristíc of the westem portion of Rio Grande do Sul, Brazil.

Piedra Alta Terrane

The Piedra Alta terrane (PAT) occupies the southwestem end of the Uruguayan shield being separated from the Nico Pérez Terrane by the Sarandy del Y shear zone. It is constituted by a group of orthoderived rocks where gneisses and migmatites of diíferent compositions predominate. Anatectic granitoids are frequently observed (Cerro Colorado), generally associated with basic magmas and magma mixing and mingling phenomena (Fernandez and Preciozzi 1974, Bossi and Navarro 1988, Dalla Salda et al. 1988, Bossi et al. 1993).

Three EW-trending segments of metavolcano-sedimentary rocks, folded and metamorphosed to various degrees (Arroyo Grande, San José and Montevideo belts) can be observed within a gneissic-migmatitic unit. As before, the temí San José belt, stretching out between Cerro de San Juan (W) and Cerro Fray Marcos (E), was proposed to ñame several metamorphic units represented by the Paso Severino, San José and Cerros de San Juan formations. Variations along the trend, in the metamorphic grade and in the lithostratigraphic organization are frequent. m the San José Formation carbonatic rocks, sericitic phyllites, quartzites and important lenses of basic metavolcanic rocks are described.

PAT shows no evidence of Neoproterozoic orogenies (deformation, metamorphism or granite génesis) The available Rb-Sr and K-Ar cooling ages are restrict to the 1.9 and 2.2 Ga interval (Hart 1966, LTmpíerre and Haípem 1971, Cingolani et al., 1990, Cingolani et al. 1997, Preciozzi and Boume 1992), being grouped in three major intensáis: 1.7 - 1.9 Ga, 1.9 -2.2 Ga and up to 2.2 Ga. A non-deformed mafic dyke swami is the last manifestation of magmatic activity recorded in PAT with K-Ar and Ar-Ar valúes around 1780 +/'- 30 Ma (Bossi et al. 1993).

Recent data including Rb-Sr (2094 +/- 28 Ma, Ro = 0.70174) and Sm-Nd (1949 +/- 24Ma, Ro=0.51003) whole rock isoclirons were interpreted (Preciozzi et al, 1999b) a.s

the age of metamolphic episode that can be recognized in the entire Rio de La Plata Craton. The same authors present for the Isla Mala Granodiorite (intrusive in the San José supracrustal rocks) a U-Pb zircon age of 2088 +/- 12Ma from three fractions of prismatic, well-formed zircons. Tliis age is interpreted as related to zircon crystallization, cióse to the granodioritic intrusión. SHRIMP ages around 2.07 Ga obtained by Bossi et al. (1999) for two granitoid plutons, including the Isla Mala, confirmed the Paleoproterozoic pattem previously detemiined by other radiometric data,

Based on geochronological and isotopic data it is possible to point out that the geológica! evolution of PAT occurred in a time interval not longer than 300 Ma comprised between 2.4-2.3 Ga (mam accretion of its protoliths) and 2.1-2.0 Ga (magmatísm, metamorphism and deformation) which makes it the oniy juvenile Paleoproterozoic geotectonic unit observed in southem Brazil and Uruguay. Additionally, this unit was not intei-nally affected by the Brasiliano episode being already stable and cold around 1.7 Ga which clearly differentiates it from the other units that constitute the Rio de La Plata Craton.

SAO GABRIEL BLOCK (RS)

OccuiTÍng exclusively m the NW portion of the basement in the Rio Grande do Sul State, the Sao Gabriel Block (SGB) is the oniy tectonic domain formed by rocks generated m the Brasiliano Cycle in south Brazil and Uruguay that do not belong to the Dom Feliciano Belt.

Soliani Jr. (1986) showed that, contrarily to what was considered at the tune, that the majority of the gneissic rocks that constitute the block were not as oíd as supposed, but were formed in the Neoproterozoic during the Brasiliano orogeny, possibly as a marginal basin, developed in the eastem border of the Rio de la Plata Craton. Subsequent studies were carried out by severa! authors such as Fragoso Cesar (1991), Babinski et al. (1996), Leite (1997), Leite & Hartmann (1997) and more recently, Remus et al. (1999), and demonstrated that great part of the material forming orthoderived rocks was incorporated in the crust aiso in the Neoproterozoic, fací that differentiates them from the terranes that constitute the DFB, characterized by crustal reworking.

The basement of the Sao Gabriel Block is constituted by a series of orthoderived gneisses varying from diorites, tonalítes to trondhjemites possibly generated in a island are context (Leite & Hartmann 1997). Within these gneisses, grouped in the Cambaí Complex, harzburgites, serpentinites and basalts represent remnants of ophiolitic sequences as well as occasional intensely deformed dioritic rocks.

The main deformation in me gneisses is marked by the development of a shear foliation associated with intense transposition and generatíon of a metamorphic

banding in amphibolite facies conditions. Kinematic indicators suggest a main eastward transport of the whole set. This nappe-associated transport direction was characterized by several studies such as Tommazi et al. (1994), Fragoso Cesar et al. (1997) and Leite (1997).

Another important metamorphic unit is formed by volcanic-sedimentary rocks of the Vacacaí Complex that include phyllites, pelitíc schists, marbies, quartzites, metaconglomerates, amphibolites and calc-silicate rocks, and subordinately metamolphosed tholeiitic to alkaline basalts and komatiitíc magnesian schists (Bittencourt & Hartmann 1994). The regional metamorphism that affects these rocks varies from low greenschist to médium amphibolite facies (Hartmann et al. 1990).

U-Pb, Rb-Sr and K-Ar ages for the metamorphic rocks cluster between 0.62 and 0.75 Ga (Soliani Jr. 1986, Babinski et al. 1995, Leite et al. 1997). Detritic zircons extracted from albite mica schists from the Ca9apava granite surroundings yieled valúes that suggest an important source with age between 800 and 900 Ma. This age,, oider than for the regional orthogneisses, was oniy characterized in the Passinho diorites (Leite et al. 1997, Remus et ai. submitted, Hartmann et al. 1998), representing intensely deformed, discontinuous igneous bodies recognized among other orthogneissic rocks.

Volcano-sedimentary basins ofthe Marica and Santa Bárbara types are distributed along the whole block, unconformably resting on regional gneisses. Locally, they present a gentíe defbrmation related to block tilting or open isopachous folditig that can represent a fine foliation ofvery low metamolphic grade. Rhyolitic volcanic rocks ofthe Tupanci and Acampamento types are abundant, with the Hilario volcanics, which occur within the Santa Bárbara unit presenting shoshonitic characteristics.

Varied granitoids with tardi- to post-tectonic characteristics and alkaline affinities, such as Cacapava, Lavras do Sul and Sao Sepe granitos, intrude all other rocks, many times producing contad metamorphism aureoles. The U-Pb ages by SHRIMP obtained at the rims of the zircon costáis from the Lavras and Cacapava granitoids indicated respectively 580 and 541 Ma, representing their emplacement time (Leite 1995). The Lavras granite is intrusivo in the Marica Group volcano-sedimentary units (foreland basin/intemal molasse).

The ages observed for the granitoid rocks with magmatic are affmities, the geológica! context of the observed petro-tectonic associations, as well as the tectonic vergence opposite to the preferentíal DFB transport sense, support the suggestion of an evolution distinctive for the Sao Gabriel Block in relation to DFB. The magmatic history of this crustal segment began 150 to 200 Mu before the beginning of the DFB granitic magmatism. The generation of the Sao Gabriel terrane is linked to the consumption of an ocean that existed at 900-800 Ma between the Rio de La Plata Craton and the gneissic-migmatitic rocks of the Encantadas type, which represent the basement of the

metavolcano-sedimentary sequences of the Schist Belt (Porongos Complex). During the Neoproterozoic III this región, as a consequence of the Granite Belt colusión, underwent intense tectonic reactivation. The section in Fig. 4 illustrates the present situation.

THE PUNTA DEL ESTE TERRANE (UY)

The Punta del Este Terrane (PET) was defíned by Preciozzi et al. (1999) as a series of gneisses and migmatites formed in the 1000-900 Ma interval that were intensely reworked during the Rio Doce orogeny (600-500 Ma). Therefore, mainly based on U-Pb radíometric ages, these authors proposed that the terranes situated east of the Atféres-Cordilheira Shear Zone shouid not intégrate the Granite Belt, suggesting that this crustal segment represent in South América terranes related to the Namaqua Belt recognized in the southwestem portion of the African continent. Similar terranes have not been recognized in Brazil and Argentina.

In the PET context, three major groups can be characterized: a mainly orthoderived, gneissic-migmatitic basement, a low-grade metasedimentaiy cover, the Rocha Group and a post-tectonic series that includes alkaline granitoids and acid volcanic rocks. This compartimentation can be recognized in the figures 1 and 4.

The basement is constituted by gneissic rocks rich in quartz, biotite and andesine, aíso presenting gamet and musco vite. They correspond, in general terms, to high-metamorphic grade rocks with parageneses including ahuandine, quartz, cordierite, and sillimanite (Masquelin 1990). Compositionally tonalitic gneisses predominate, exilibiting intense NE-SW foliation. Mafic rocks and varied paraderived gneisses occur as enclaves and large roofpendants within the orthoderived rocks. Still m the basement domain lenses of protomylonitic rocks can be found where ocellar granitoids and migmatitic áreas stand out, being the predominant leucosome composed of biotite-muscovite leucogranitoids.

U-Pb ages m zircons from tonalitic granitoids indicate valúes between 1000 and 900 Ma that were interpreted as representing the generation tune for these rocks. This must aiso have been the age ofthe high-grade metamoqAism that affects great parí ofthe regional gneisses. On the other hand, anatectic mobilizates related to migmatite leucosomes yield Cambrian valúes around 520-540 Ma (Precio zzi et al. 1999, Preciozzi et al. m preparation), indicating that the (superposed) metamorphic conditions during the Rio Doce orogeny reached at least the amphibolite facies.

PET metasedimentary cover mainly occurs m the proximity of La Paloma and Rocha cities, being constituted by an essentially metasedimentary siliciclastic sequence represented by the Rocha Group. Despite polyphasic deformation and low to médium metamorphic grade affecting these turbidites, preserved primary structures are frequent such as plane-parallel stratification, cross-bedding, hummocky and massive

levéis with graded bedding (Fragoso Cesar 1987, Sanches Bettucci & Mezzano 1993). Considering that the PET basement correlatos with the Namaqua Complex gneisses, the Rocha Group is tentatively correlated with the Gariep Group supracrustal units.

The Cerro de Aguirre Formation (Campal & Gancio 1993) represents a volcanic rock pile of intermedíate to acid composition that presents open folds with N30-40E axial orientation, where locally the development of a plañe axial cleavage can occur. Several isotropic, circumscribed granitoids represent the last important magmatic manifestations affecting PET. These alkaline-filiated granitoids are represented by the Santa Tereza and José Ignacio bodies. Rb-Sr ages given by isochrons combining minerals and whole rock data, as well as ages obtained exclusively for minerals, present valúes between 611-590 Ma and 550-537 Ma for the José Ignacio and Santa Tereza granitos respectively.

It is here suggested that the Gariep-Rocha basin wouid not have undergone considerable oceanic opening, but localized development of oceanic crust (Maniiora Terrane). Therefore, the main branch of the Adamastor ocean (Hartnady et al. 1985) was developed west of the Gariep-Roclia Belt and ite consumption generated the Granito Belt. The closing of the Gariep-Rocha basin and the following deformation of the supracrustal pile occurred around 545 Ma as a consequence of the eastward transport of the Granite Belt against African terranes. It is ofthis time the obduction ofthe volcanic rocks (oceanic crust) of the Marmora Terrane over the metasedímentary units of the Port Nolloth Zone (FrinuTiel et al. 1998). It is possible that the separation ofPET and its African equivalents occurred oniy during the Pangea breakup and the opening of the Atíantic Ocean.

JUXTAPOSITION OF THE DFB DIFFERENT UNITS

As previously presented, the different segments of the Dom Feliciano Belt and the adjacent teiTanes have distinct geológica!, stmctural characteristics and ages. These differences are inteqareted as resulting from geológica! histories particular of each segment.

The Scliist Belt presents a polyphasic, metamorphic-deformational evolution with the late deformational phases associated with re-folding of the metamorphic foliation that characterizes it. The main deformational phase is characterized by folds with NE axes and low-dipping SE axial planes and development of a S_1 transpositional foliation. This framework was generated between 750 and 640 Ma during the Brasiliano orogeny associated with nappes with NW transport (Basei 1985).

Most of the magmatic evolution of the Granite Belt took place between 620 and 590 Ma. The generation of the oider calc-alkaline suites is associated with the subduction phase of parí of the Adamastor Ocean and íts deformation was generated with the colusión between the Granite and Schist Belts that oecun-ed around 600 Ma, Soon

after this collisional phase, the intrusión of late, isotropic, alkaline granitoids related to the Pedras Grandes and Dom Feliciano Suites took place culminating around 590 Ma.

Reactivations of the main previous mylonitic belts with transcurrent, sinistral characteristics and of higher temperature in the southem portion of the Belt (RS and UY) and dextral and of low temperature in the northem portion (SC), took place as a result from of importan! directional transpressional movement of the belt. The best estimation for this phase is represented by Ar-Ar ages around 534 ± 3 Ma (Phillip 1998) for high-angle shear zones ofthe Cangucu and Pinheiro Machado regions (RS). In Santa Catarina, this process was oider, as indicated by K-Ar ages for neoformed micas from fhe mylonitic rocks of the Major Gercino Shear Zone, with preferential valúes around 569 Ma (Passarellí 1997).

As a result from the convergence of the Schist and Granite Belts, the foreland basins were generated in the foreland, whose diachronic filling took place from the Vendían in Uruguay to ca. 560 Ma in Santa Catarina. The collisional phase deformations that began around 600 Ma in inmost regions of the Granite Belt, caused in the Schist Belt, reactivations and development of thrust faults and re-folding with SE-dipping axial planes, reaching the foreland basins oniy around 535 Ma. m these basins, these deformations were characterized by thrust faults and gentle folds with NW vergence that locally developed plane-axial cleavage in low greenschist conditions.

In summary, the metamorphic and deformational history of the three DFB segments falls within the 750 and 530 Ma interval. Initially, in a not well established tectonic context, the Schist Belt main phase of deformation and metamorphism took place around 750 Ma, and cióse to 640 Ma was transported against its foreland located west (Luis Alves Microplate and Rio de La Plata Craton). Around 620 Ma E subduction of the existing oceanic crust (Adamastor) and the generation of the Granite Belt took place in a magmatic are context. Around 600 Ma the colusión between the Granite Belt and the Schist Belt took place and the foreland basins started to form. Around 570 Ma an important mass transport oecurred parallel to fhe direction of the belt and the last post-collisional granitoids were generated. Cióse to 535 Ma the belt deformation reached the foreland basins and reactivated severa! high angle shear zones.

CORRELATIONS WITH THE AFRICAN COUNTERPART

The interest in correlating terranes at opposite margins of the South Atlantic Ocean reflects a natural curiosity of both the researchers who work in the eastem South-America and of those who study southwestem África. Porada (1989), Hartnady et al. (1988), Trompette (1994), Hanson et al. (1998), Hoffinan (1999) are among the most recent works.

The major problem of past reconstructions stands in the fact that they focused on the direct correlation between the metasedimentary rock belts observed on both sides of

the Atlantic. Therefore, several papers proposed, in our understanding incorrectly, direct correlations between the South-African Kaoko/Gariep Belts with their possible South-American Brusque/Porongos/Lavalleja equivalents. Despite presenting similar ages (Pan-African/Brasiliano), a closer exam and mainly the recent inflow of a great number of radiometric data, these fold belts are signifícantly different, ruling out tectonic modeis that state that they formed a large and single sedimentary basin since the beginning oftheir geológica! histories.

Considering that the youngel- Graníte Belt cannot be the magmatic are associated wíth the development of the Dom Feliciano Schist belts, the sediments of the probable basin associated with this are wouid laclí on the South-American side. In an analogous way, on the African side, the rocks representative of the magmatic are that must have existed during the framework ofthe Kaoko/Gariep paleobasin are absent.

The tectonic model presented in this paper (figure 7), based on radiometric ages and isotopic signatures, suggests that the magmatic are active during the deposition of the Kaoko (Coastal Damara)/Gariep units in a possible back-arc basin, wouid be presentíy represented in the eastem portíon of the South-American contínent. It is here proposed that this magmatic are developed in the 620-590 Ma period, was generated from the subduction of an E-trending oceanic crust under the oíd terranes of the African side, with the DFB Granito Belt representing its roots.

The main argument to suggest that the plunge ofthe oceanic crust musí have been east-and not westward as stated by previous works, is the Granite Belt Sm-Nd signature, totally different from the pattem observed m the other South-American tectonic domains. Model ages (T_{DM}) for the Granite Belt are systematically younger (between 1.2-1.7 Ga, clustering in the 1.4-1.6 Ga interval) than those for the Schist Belt units (granitic and metasedimentary rocks with valúes around 2.0 Ga) and much younger than those found in the Luis Alves-or even Rio de La Plata-type basement units (> 2.1 and mainly clustering around 2.7-3.2 Ga).

The geochemical affínity of the are magmatism may have been much higher to the con'espondíng material in the overriding píate (active margin) where the are was installed than to the material of the opposite píate (passive margin). It is here suggested fhat this shouid be the explanation for both the isotopic differences between the are and the terranes located west, and the similarities between the Granite Belt and the SW African magmatism. Therefore, this suggests that the lithosphere above the subducting píate, melted for the generation of the Granite Belt, diífers from the one that continúes westwards, once the granitoids of similar age have a different isotopic signature.

Therefore, ifon the South-American side model Nd ages between 1.2 and 1.6 Ga are characteristics of the Granite Belt, valúes in the same interval are common in several

regions of the South-African portion. Mesoproterozoic ages predominate for the rocks of the Damara western portion (región between the Walvis Bay/Karibib/Huab River) with the Palmental-type calc-alkaline granitoids and intra-plate syenites to granitos presenting model ages between 1.1-1.5 Ga (McDermott 1986; MeDemiott and Hawkesworth, 1990). A veiy similar pattem was aiso found for metaluminous A-type granitoids ofthe Damara central región (Jung et al. 1998). Valúes in the same interval are equally common in the Neoproterozoic Mozambique Belt in Tanzania, where several metapelites and chamockites located in the eastem portion ofthe belt present Nd model ages between 1.1 and 1.5 Ga (Móller et al. 1998). On the other hand, Archean ages (Limpopo Belt, xenoliths in Kaapvaal and some of the basement nuclei within the Damara metas ediments) or Paleoproterozoic (Namaqua and xenoliths within the deformed granitoids of the Namaqua belt) are characteristics of the rocks associated

with the basement ofthe Neoproterozoic covers (Harris e.t al. 1987, Reid 1997, Móller et al. 1998).

Part of the metasediments of the Damara (notably Rossing and Kuiseb) and Ñama (mainly Kuibis and Schwarzrand) show Nd model ages similar to those obtained for the Granite Belt, suggesting that this must have been an important source for these metasediments,, reinforcing the model of an evolution in a back-arc basin for the Kaoko and Gariep units and consequently ofhinterland for the Ñama.

Figure 8 represents a hypothetical section of DFB and Kaoko/Gariep ca. 500 Ma ago, soon afíer the building of westem Gondwana. The double vergence ofthe thmsts shouid have resulted from the several collisions involved in the formation of both belts. The westward collisional tectonics involving the Granite Belt must have developed on the South-American side around 600 Ma, whereas oniy after 545 Ma ago the eastward thmsts placed these granitoids on the supracrustal units of the African side in a synchronous manner to their metamorphic peak (Frimmel & Frank, 1998) and reactivated the structures ofthe South-American side deforming the foreland basins. On the African side, basins of similar ages (e.g. Ñama) underwent deformation oniy aíter 506 Ma ago (FrimmeÍ & Frank op. cit.).

FINAL REMARKS

As presented in the beginning of this paper, a tectonic model involving northwestward subductíon of an oceanic crust producing the Granite Belt and, in back-arc conditions, the Schist Belt, is not accepted. Such model, despite representing a logical reading of the petrotectonic zoning of DFB, when examined in detall, presents several problems that invalídate it.

Within the general picture, all westem part of southeastem Brazil and eastem Uruguay is chara cterized by oíd domains, grouped in the Rio de La Plata Craton (RS and LTY) and Luis Alves MÍcroplate (SC), over which the main mass transport oecurred, generating the Dom Feliciano Belt.

In the westem región, the Luis Alves MÍcroplate and the Piedras Altas Terrane (part of the Uruguayan Rio de La Plata Craton) were preserved from the Neoproterozoic tectonics which affected in a signifícant way the other oíd domains (Taquarembó Block, RS, and the Nico Perez-Valentine Terrane, LIruguay), causing general heating (rejuvenation of the K-Ar ages in biotites and amphiboles) and generating several granitoid bodies.

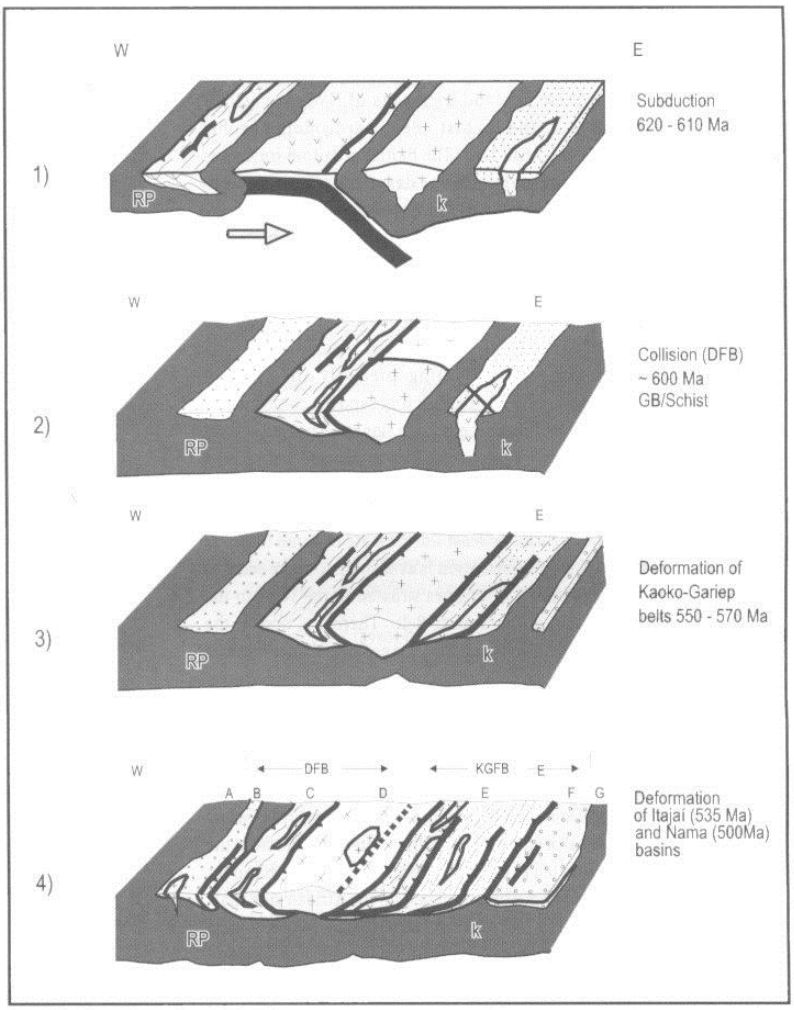
In the Dom Feliciano Belt domain, the Sehist Belt presents metamorphic valúes around 120 Ma, oider than those obtained for the formation and emplacement of the oider granitoids recognized in the adjacent Granite Belt. Therefore, it is necessary to dissociate the Schist Belt main metamoqAic phase from the Granite Belt. At the time of the beginning of its generation (-620 Ma) the supracrustal rocks have already reached their metamorphic climax and even undergone the tectonics that threw them on their foreland by means of NW nappes that characterize the Schist Belt tardi-metamorphic deformation (-640 Ma). The biotite granitoids intrusive in the supracrustal rocks, despite presenting ages comparable with the Granite Belt magmatism, have petrologic, geochemical and isotopic characteristics that differentiate them from the latter. The development of an intense contact metamorphism aureole between these granitoids and the main foliation ofthe metamorphic rocks ofthe Schist Belt is common.

The dífficulty in precising the time of sedimentation of the Schist Belt units and the confírmation, as a íünction of the isotopic signature, that the source área for the provenance of the material that constitute the supracrustal rocks (at least for Santa Catarina for which better ínformation is available) is be attributed neither to the oíd terranes located west ñor to fhe Granite Belt younger rocks, led several authors to classify the Schist Belt as a suspect terrane (Basei & Hawkesworth 1993, Fragoso Cesar et al. 1998). Therefore, despite the Schist Belt being better known, the geológica! uncertainties are still great making a precise tectonic positioning of mis cmstal segment impossible.

The Granite Belt magmatic development (between 620 and 590 Ma) wouid be associated with the generation of a mature magmatic are with important crustal participation, generated from eastward subduction, evolving m a distinct geographic position and m a dissociated manner from the terranes located west. The probable back-arc basin for this belt wouid be situated on the arican side (part of fhe Coastal Damara/Kaoko/Gariep belts). In this context the Ñama basm wouid be a hinteriand and not foreland basin, as suggested in previous works.

FIGURE 7 - Hypothetical sketch for the evolution of Kaoko/Gariep - Dom Feliciano belts from subduction (620 Ma) to final deformation (500 Ma) of late volcano-sedimentary basins.
A - Foreland (Luís Alves Microplate and Rio de La Plata Craton);
B - Foreland basins (Itajaí, Camaquã and El Soldado); C - South-American schist belts and intrusive granitoid (Brusque/Porongos/Lavalleja);
D - Granite Belt (Florianópolis, Pelotas and Aiguá arc-related batholiths);
E - South African schist belts and granitoid intrusives (Kaoko/Gariep + Rocha); F - Nama Basin;
G - Kalahari Craton. Filled triangles: thrust faults; open triangles: subduction zones; dashed line: inferred place where the opening of South Atlantic might had occurred. In the present tectonic interpretation it is considered that the basic volcanic rocks of tholeiitic affinity recognized in the Gariep Belt (Marmora Terrane) was not related to a large ocean but to a narrow internal sea developed during extension conditions occurred in a back-arc basin environment.

FIGURE 8 - 500 Ma schematic reconstruction of Kaoko/Gariep - Dom Feliciano belts. The proposed model considers the generation on the African side of a magmatic arc (Granite Belt) produced by the subduction of oceanic crust eastwards. The tectonic vergences were imposed on fold belts by their collisions with the Granite Belt. On the South American side the collision took place around 600 Ma and only c. 50 Ma later in southwestern Africa.
The 1.2 - 1.7 Ga Nd model age pattern recognized for the Granite Belt and its similarity with the Sm/Nd signature of the Neoproterozoic magmatism observed in southwestern Africa was a very important element in defining the model proposed.



The geometric distribution and great part of the structural features presently obsen^ed m the units that compose the Dom Feliciano Belt wouid have been generated in the Proterozoic-Cambrian transition, after the collisional phase that juxtaposed the Granite

to the Schist Belt. The foreland basins (Itajaí, Camaquá, AiToyo del Soldado-Piriápolis) were produced in a foreland m answer to the approxünation of the Granite Belt (600-560 Ma) and not, as has always been consensus, generated during the deformational tectonics of the oider (750-640 Mu) Schist Belt. Therefore, mese basins musí be understood as syn- to tardi-collisional foreland basins ofthe Rio Doce orogeny.

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REFERENCES:

Almeida, F.F.M. de, Amara]., G., Cordani, U.G. & Kawashita, K. - 1973 - The precambrian evolution of the South American Craton margin south of the Amazonas river. m: Naü-n, A.E. and Stehii, F.G. editors. The ocean basin and margins. Plenum, New York, ppl411-1446

Almeida, F.F.M de; Hasui, Y.; Brito Neves, B.B. de & Fuck, R.A. - 1981 -Brazilian Structural Provinces; an introduction. Earth Sci. Rev., Amsterdam, 17 (1/2): 1-29

Appí C.J. & Cruz, C.E.S. - 1990 - Estratigrafía de seqüéncias na Bacía do Itajaí. In: Congr. Bras. Geol., 36, Natal, 1990. Anais, ... Natal, SBG, V.l, p. 93-106.

Babinski, M., Chemale, F., Hartmann, L.A., Van Schmus, W.R. & Silva, L.C. -1995 - Acresgao juvenil no bloco Sao Gabriel e retrabalhamento cmstal no cinturao Dom Feliciano durante o ciclo Brasiliano: evidencias isotópicas. VI Simposio Sul Brasileiro de Geología, Porto Alegre, RS, Brazil, Extended Abstracts, pl05-107

Babinski, M., Chemale, F., Hartmann, L.A., Van Schnnus, W.R. & Silva, L.C. - 1996 - Juvenile Accretion at 750-700 Ma in Southem Brazil. Geology, 24(5):439-442

Babinski, M., Chemale, F., Hartmann, L.A., Van Schmus, W.R. & Silva, L.C. - 1997 - ü-Pb and Sm-Nd geochronology ofthe Neoproterozoic Granitic-Gneissic Dom Feliciano Belt, Southem Brazil. J. S. Amer. Earth Science., 10(3-4):263-274

Basei, M.A.S. - 1985 - O Cinturao Dom Feliciano em Santa Catarina. Unpublished thesis submitted for the degi-ee of Doctor of Philosophy, LIniversity of Sao Paulo, Sao Paulo, SP, 191p

Basei, M.A.S.; Kawashita, K. & Siga JR., O. - 1987 - Idade, características litoestratigráficas e estruturais do Grupo Itajaí, SC. In: South- Brazilian Congress of Geology,3,Curitiba, PR, vol.l: 93-106.

Basei, M.A.S., Siga Jr., O., Machiavelli, A. & Mancini, F. - 1992 - Evolucao tectónica dos terrenos entre os cinturoes Ribeira e Dom Feliciano. Rev, Bras. Geoc., 22(4):216-221.

Basei, M.A.S. & Hawkesworth, C. J. - 1993 - O Magmatismo do Cinturao Dom Feliciano (SC) e sua importancia no estabelecimento das principáis descontinuidades cmstais da regiáo sul-brasileira. In: Primer Simposio Internacional del Neoproterozoico-Cambrico de la Cuenca del Plata - La Paloma-Minas, LJruguai. Bol. Res. Ext., Tomo D,
n°41

Basei, M.A.S. & Hawkesworth, C.J. - 1994 - The Granito Belt on the Eastem Part of Southem Brazil and Uruguay. In: Eighth Intemational Conference on Geochronology, Cosmochronology and Lsotope Geology, Berkeley, LISA. Abstracts, U.S. Geológica! Survey Circular 1107, p.22.

Basei, M.A.S.; Campos Neto, MC. & Siga Jr., O. - 1994 - Geología do Grupo Bmsque na Regiáo de Canelinhas, Se. Resumes do XXXVIII Congresso Brasileiro de Geología, SBG, Camboriú-SC.

Basei, M.A.S., Siga Jr., O., Cordani, U.G, Sato, K. & Lima, P.S. de - 1999a - The Magmatism of the Itajaí Basin, SC, Southem Brazil, and its importance to defíne the Proteozoic - Phanerozoic limit, II South American Symposium on Isotope Geology,
Actas, 287 - **290p, Córdoba, Argentine**

Basei, M.A.S., Siga Jr, O., Reís Neto, J.M. dos, Passarelli, C.R., Prazeres, H.l, Kaulfüss, G., Sato, K. & Lima, P.S. de - 1999b - Paleoproterozoic Granulitic Belts of the Brazilian Southem Región (PR-SC) . n South American Symposium on Isotope Geology, Actas, 291-294, **Córdoba, Argentine**

Bitencourt, M.F. & Hartmann, L.A. - 1984 - Reconhecimento geoquímico dos xistos magnesianos da regiáo do Passo Feio, Caapava do Sul, RS. m: Congresso Brasileiro de Geología, 33, Rio de Janeiro, SBG, Anais, 6, 2607-2614p

Bonhomme, M. & Cingolani, C. - 1980 - Mineralogia y geocronologia Rb-Sr y K-Ar de fracciones finas de la Formación La Tinta, Provincia de Buenos Aires. Asociación Geológica Argentina Revista XXXV(4):519-538

Bossi, J. & Navarro, R. -1993 - Geología del Uruguay, Universidad de la República, Montevideo, 970p

Bossi, J. & Campal, N. - 1992 - Magmatismo y tectónica transcurrente durante el Paleozoico Inferior en Uruguay. In: Gutierrez-MarcoJ.G., Saavedra, J. & Rábano, I. (eds.):Paleozoico Inferior de Iberoamérica, 343-356p, Universidad de Extremadura.

Bossi, J., Campal, N., Civetta, L.; Girardi, V.A., Mazzuchelli, M., Negrini, L., Rivalenti, G., Fragoso César, A.R.S., Sinigoi, S., Teixeira, W. and Piccirillo, E. - 1993 -Early Proterozoic dike swarms from westem Uruguay: Geochemistiy, Sm-Nd isotopes and petrogenesis. Chemical Geology, 106: pp. 263-277.

Bossi, J. and Navarro, R. 1988: Geología del Uruguay. Depto. Publ. Universidad República, Montevideo, 1.1, 453 pp.

Bossi, J., Hartmann, L.A., Pifieyro.D., Leite, J.A.D., McNaughton, N.J. - 1999 - Geological and Geochronological Constraints on the Paleoproterozoic Evolutíon of the Isla Mala Granitic Suite, Uruguay. II South American Symposium on Isotope Geology, Actas, 295 - 299p, Córdoba, Argentine

Caldasso, A. L. da S., Camozzato, E., Ramgrab, G.E. & Silva, M.A. S. da, - 1988 -Os granitóides Valsunganaa, Guabimba e Faxmal no contextodos metamorfitos do Complexo Bmsque, SC, m: Cong. Bras. Geol., 35, Belem, SBG. V.3; p. 1104-1116

Caldasso, A. L. da S., Krebs, A.S.J., Silva, M.A. S. da, Camozzato, E. & Ramgrab, G.E. - 1995 a- Programa de Levantamentos Geológicos Básicos 1: 100.000; Folha Brusque (SG-22-Z-D-II-1), SC, Brasilia, CPRM, 243pp

Caldasso, A. L. da S., Krebs, A.S.J., Silva, M.A. S. da, Camozzato, E. & Ramgrab, G.E. -1995 b- Programa de Levantamentos Geológicos Básicos 1: 100.000; Folha Botuverá (SG-22-Z-D-I-2), SC, Brasilia, CPRM, 303pp

Campal, N. & Gancio F. - 1993 - Asociación volcanitas-piroclastitas de los Cerros Aguirre (dpto. Rocha): una nueva Formación y sus implicancias en la evolución del brasiliano en Uruguay. I Simposio Internacional del Neoproterozóico-Cambrico de la Cuenca del Plata, 2(44), La Paloma, Uruguay

Campal, N., Gaucher, C. , Schipilov, A. & Bossi, J. - 1995 - El Uruacuano en el Uruguay: evidencias geológicas paleontológicas y radiométricas. In: 6 Simp. Sul-brasileiro de Geología. Bol. Res. Expandidos. Porto Alegre, Brazil, p 97-99.

Castro, N. A. de; Basei, M.A.S. & Crósta, A. P. - 1999 -Catinga Suite: W (Sn-Mo) specialized and other intrusive granitoids m the Brusque Group, Neoproterozoic of Santa Catarina, Southem Brazil. Rev. Bras. Geoc. (in the press)

Chemale Jr., Babinski, M., Van Schmus, W.R.. Wiidner, W. & Lima, E. F. - 1997 - U-Pb and Sm-Nd isotopic studies of Neoproterozoic to early Paleozoic belts in southem Brazil. I South American Symposium on Isotope Geology, Campos do Jordao, SP, Brazil, Extended Abstract, p71.

Cingolani, C., C. Spotumo and Bonhomme, M. 1990; Resultados mineralógicos y geocrono-lógicos sobre las unidades Piedras de Afilar, Lavalleja y Barriga Negra, Rep. Oriental del Uruguay. In: Primer Congr.Urug.Geol., Montevideo, v.l: 11-24.

Cingolani, C., Várela, R., Dalla Salda, L., Bossi, J., Ferrando, L., Piñeyro, D. and Schipilov, A. 1997: Rb / Sr geochronology from the Rio de la Plata Craton of Uruguay. In: South American Symp. on Isotope Geology, Sao Paulo, 1: 73-75.

Cordam, U.G., Halpem, M. & Berenholc, M. - 1974 - Comentarios sobre as determina^oes geocronológicas da Folha Porto Alegre, In: Carta Geológica do Brasil ao millonésimo, folha Porto Alegre (SH-22) e folha Lagoa Mirim (SI-22). DNPM, Ministerio de Ninas e Energia, Brasilia, 70-84p.

Cordani U. G. & Soliani Jr. E. - 1990 - Idades K/Ar e Rb/Sr das Ilhas Cristalinas de Rivera e Acegua (Uruguai e Rio Grade do Sul) e seu enquadramento geotectonico regional. Anais Academia Brasileira de Ciencias, 62:145-156.

Dalla Salda, L.H., Bossi, J. and Cingolani, C. 1988: The Rio de la Plata Cratonic Región of Southwestem Gondwanaland. Rev. Episodes, 11(4): 263-269.

Dalla Salda, L.H., Franzese, J.R. & Posadas, V.G. - 1992 - The 1,800 Ma mylonite-anatectic granitoid association in Tandília, Argentina. In: Basement Tectonics
7, 161-174 R. **Masón** (eds) **Nethedands.**

Fernández A. & Preciozzi F., 1974. La formación Arroyo Grande y los granitoides asociados. Cong. Bras. Geol., Anais, SBG, 28:213-216,Porto Alegre,Brasil.

Femandes, L.A.D., Menegat, R., Costa, A.F.U., Koster, E., Porcher, C.C., Tommasi, A., Kraemer, G., Ramgrab, G.E., Camozzato, E. - 1995a - Evolucao Tectónica do cinturáo Dom Feliciano no Escudo sul-riograndense: Parte I - urna contribui9áo a partir do registro geológico, Revista Brasileira de Geociéncias, 25(4):
351-374,

Femandes, L.A.D., Menegat, R., Costa, A.F.LT., Koster, E., Porcher, C.C., Tommasi, A., Kraemer, G., Ramgrab, G.E., Camozzato, E. - 1995b - Evolucao Tectónica do cinturáo Dom Feliciano no Escudo sul-riograndense: Parte II - urna contribuicáo a partir das assinaturas geofísicas. Revista Brasileira de Geociéncias,
25(4):375-384

Fragoso Cesar, A.R.S. - 1980 - O Craton do Rio de La Plata e o Cinturáo Dom Feliciano no Escudo LJruguaio-Sul Riograndense. Congr. Bras. de Geol., Anais, SBG, 31, Camboriú, 5:2879-2891

Fragoso Cesar, A.R.S. & Soliani Jr., E. - 1984 - Compartimenta9ao Tectónica do Craton Rio de La Plata. XXXD.I Congr. Bras. Geol., Rio de Janeiro, Anais, 2426 - 2434p

Fragoso Cesar A.R.S., Figueiredo, M.C.H. de, Soliani Jr., E. & Faccini, LT.F. - 1986 - O Batoíito Pelotas (Proterozóico Superior/ Eopaleozóico) no Escudo do Rio Grande do Sul. Congr. Bras. de Geol., Anais, SBG, 34, Goiánia, 3:1322-1343

Fragoso Cesar, A.R. - 1991 - Tectónica de Placas no Ciclo Brasiliano: As orogenias dos cinturoes Dom Feliciano e Ribeira no Rio Grande do Sul. Unpublished thesis submitted for the degree of Doctor of Philosophy, University of Sao Paulo, Sao Paulo, SP. 362p

Fragoso Cesar, A.R. S., Machado, R. & Gómez Rifas, C. - 1987 - Observacoes sobre o Cinturáo Dom Feliciano no escudo uruguaio e corretees com o escudo do Rio Grande do Sul. In: Simp. Sul-Bras. Geol., 3. Curitiba, SBG, v.2,p 791-809

Fragoso Cesar, A.R. & Machado, R. - 1997 - Neoproterozoic terranes of the Gaucho shield (southem Brazil and Uruguay). I South American Symposium on Isotope Geology, Campos do Jordao, SP, Brazil, Extended Abstract, 65-67.

Fragoso Cesar, A.R.S., Machado, R., Philipp, R., Mello, F.M., Endo, I., Nimmer, A.R., Preciozzi, F.P., Fambrini, G.L. & Sayeg, H.S. - 1998 - Terrenos Suspeitos a sul da Placa Sanfranciscana (SE da Plataforma Sul-Americana). Actas del II Congreso LIruguayo de Geología, Punta del Este, LIruguay, 1-6.

Fragoso Cesar, A.R., Ferreira Filho, W. da S., Fambrini, G.L., Machado, R., Riccomini, C., Almeida, R.P. de, Pelosi, A.P.M.R. & Janikian, L. - 1999 - Significado Tectónico do Magmatismo Rodeio Velho no Rift Guarítas (Eopaleozóico do Rio Grande do Sul, Brasil). I Simposio sobre Vulcanismo e Ambientes Associados, Abstrae ts, Gramado, RS, pl6.

Frantz, J.C. & Jost, H. - 1983 - Petrología dos granitos estañíferos do Rio Grande do Sul. Actas I Simp. Sul-Bras. De Geol. Porto Alegre, 49-67p

Frimmel, H.E. - 1995 - Metamorphic evolution ofthe Gariep Belt. S. Afr. J. Geol., 98(2): 176-190

Frimmel, H.E., Almond, J. & Gresse, P.G. - 1998 - Birth of Gondwana, Gariep Belt Field Trip (Gondwana 10 field guide), 75p

Frimmel,, H.E. & Frank, W. - 1998 - Neoproterozoic tectono-thermal evolution of the Gariep Belt and its basement, Namibia/South África. Precambrian Research, 90(1998)1-28

Gaucher, C. & Sprechmann, P. - 1998 - Grupo Arroyo del Soldado: Paleontología, Edad y Correlaciones (Vendiano-Cambrico Inferior, Uruguay). Actas del II Congreso Uruguayo de Geología, Punta del Este, Uruguay, 183-187p.

Guacher, C., Sprechmann, P. & Schipilov, A. - 1996 - Upper and Middie Proterozoic fossiliferous sedimentary sequences of the Nico Pérez Terrane of Uruguay:
Lithostratigraphic units, paleontology, depositional environments and con-elations. N. Jb. Geol. Palanont. Abh. 199(3):339-367p

Halinann, S.E., Mantovani, S.M.M. - 1993 - Struetural Framework ofthe Southern Brazilian Shield: the perspective from the Gravity models. 111 Intem. Geoph. Congress, Anais, SBGF, Rio de Janeiro, 2,: 1078, 1083p.

Hanson, R.E., Martin, M.W., Bowring, S.A. & Munyanyiawa, H. - 1998 - U-Pb zircon age for the Umkondo dolerites, eastem Zinibabwe: 1.1 Ga large igneous province m southem Africa-east Antartica and possible Rodinia coiTelations. Geology, v26(12):l 143-1146

Harara,, M.O (1996) Análise estrutural, petrológica e geocronológica dos Utotipos da regiao de Píen (PR) e adjacéncias. Sao Paulo, Unplublished PVD thesis presented to the Institute of Geosciences - USP- 196p.

Harris, N.B.W., Hawkesworth, C.J., Van Calsteren, P. & McDermott, P.F. -1987 - Evolution of continental crust in southem África. Earth and Planetary Science Letters, v83, 85-93

Hart S. - 1966 - Radimetric ages in Uruguay and Argentina and their implications conceming continental drift. Geological Soc.Am.Annual Meetíng, 86pp, San Francisco.

Hartmman, L. A., Silva,, L.C. and Orlandi-, V. - 1979 - O Complexo Granulítico de Santa Catarina, Acta Geológica Leopoldensía, 6: 94-112.

Hartmann, L.A., Tindie, A. & Bítencourt,, M.F. - 1990 - O metamorfismo de fácies anfibolito no Complexo Passo Feio, RS, com base em química dos minerais. Pesquisas,
17(1-2), 62-71

Hartmann, L.A. - 1998 - Deepest exposed crust of Brazil - Geochemistry of Paleoproterozoic depleted Santa Maria Chico granulites: Gondwana Research, v.l, p331-341.

Hartmann, L.A., Silva, L.C., Remus, M.V.D., Leite, J.A.D. & Philpp, R.P. - 1998 - Evolu^ao Geotectónica do Sul do Brasil e Uruguai entre 3.3Ga e 470 Ma. Actas del n Congreso Uruguayo de Geología, Punta del Este, Uruguay, 277-284p.

Hartmann, L.A., Leite, J.A.D., McNaughton, N.J., Santos, J.O.S. - 1999 - Deepest exposed crost ofBrazil-SHRIMP establishes three events. Geólogo', v27(10):947-950

Hartnady, C., Joubert, P. & Stowe, C. - 1985 - Proterozoic Crustal Evolution in Southwestem África. Episodes, v.8(4):236-244

Hasui Y., Cameiro C. dal R. & Coimbra A.M. - 1975 - The Ribera Folded Belt. Rev. Bras. Geoc., 5: 257-266.

Hoífman, P.F. - 1999 - The brake-up of Rodinia, birth of Gondwana, tme polar wander and the snowball Earth. Joumal ofAfrican Earth Sciences,V28(l):17-33

Jost, H. - 1981 - Geology and Metallogeny ofthe Santana da Boa Vista región, South Brazil. Umpublished thesis submitted for the degree of Doctor of Philosophy,
University **of** Athens, **Georgia,** USA, **208p**

Jost, H. - 1982 - Condícoes de metamorfismo de urna fracao da faixa de Dobramentos Tijucas no Rio Grande do Sul. Acta Geológica Leopoldénsia.4: 27-60

Jung, S., Mezger, K. & Hoemes, S. - 1998 - Petrology and geochemistry ofsyn- to post-collisional metaluminous A-type granites - a major and trace element and Nd-Sr-Pb-0-isotope study from the Proterozoic Damara Belt, Namibia. Lithos, v45, 147-175

Krebs, A.S.J., Lopes, R.da C. & Camozzato, E. - 1990 - Caracteriz9ao faciológica do Grupo Itajaí na Follia Botuverá (SC). m.: Congr. Bras. Geol., 36, Natal, 1990. Anais,
.., Natal, SBG.V.l.p. 82-92.

Koester, E. — 1995 - Evolu9ao geológica do magmatismo sintectónico á Zona de Cisalhamento Transcorrente Dorsal do Cangu9u, regiao de Encruzilhada do Sul (RS).

Unpublished thesis submitted for the degree ofMaster of Philosophy, University of Rio Grande do Sul, Porto Alegre, RS, 240p

Leite, J.A.D. - 1995 - Datacao SHRIMP U-Pb em zircoes e o exemplo de dois corpos graníticos contrastantes no escudo sul-riograndense. VI Simposio Sul Brasileiro de Geología, Porto Alegre, RS, Brazil, Extended Abstracts, p5-12.

Leite, J. A. D. - 1997 - A origem dos harzburgitos da Sequéncia Cerro Mantiqueiras e implíca96es tectónicas para o desenvolvimento do Neoproterozóico na por9ao oeste do Escudo Sul-Riograndense. Unpublished thesis submitted for the degree of Doctor of Philosophy, Federal University ofRio Grande do Sul, RS, Brazil. 224p

Leite, J.A.D. & Hartmann, L.A. - 1997 - Neoproterozoic evolution of Cerro Mantiqueiras región in southernmost Brazil: evidence from coupled SHRE^IP zircon dating and Nd, Sr isotopic data. I South Amerícan Symposium on Isotope Geology, Campos do Jordao, SP, Brazil, Extended Abstract, 167-169.

Leite.J.A.D., Hartmann, L.A., Femandes, L.A.D., McNaughton, N.J., Soliani Jr., E., Koester, E., Santos, J.O.S. & Vasconcellos, M.A.Z - Zircon U/Pb SHRIMP dating of Gneissic Basement of Dom Feliciano Belt, Southernmost Brazil. (submitted to Joumal of South American Earth Sciences)

Lema, H. & Cucchi, R. - 1981 - Hallazco de Metavulcanitas en el Cerro Tandileufü, Provincia de Buenos Aires. Asociación Geológica Argentina, Revista,
XXXVI(l): 103-104

Linares, E. - 1977 - Catalogo de edades radiometricas determinadas para la República Argentina. Asociación Geológica Argentina., serv.B, 4, Buenos Aires.

Lopes, R. da C., Wiidner, W., Sander, A. & Camozzato, E. - 1999 - Alogmpo Guantas: Aspectos Gerais e Considera9oes sobre o Posicionamento do Vulcanismo Rodeio Velho (EnceiTamento do Ciclo Brasiliano ou mstala^áo da Bacía do Paraná?). I Simposio sobre **Vulcanismo e Ambientes Associados,** Abstraéis, **Gramado, RS, pl7.**

Maack, R. - 1947 - Breves noticias sobre a geología dos estados do Paraná e Santa Catarina. Arq. Biol. Tecnol., 2 : 63-154.

Machiavelli, A.; Basei, M.A.S. & Siga Jr., O. - 1993 - Suíte Granítica Rio Pien: um arco magmático do Proterozóico Superior na Microplaca Curitiba. Geochimica Brasüiensis, 7(2):113-129.

Mantovani, S. M., Hawkesworth, C.J. & Basei, M.A.S., 1987 - Nd and Pb isotope studies bearing on the crustal evolution of southeastem Brazil. Rev. Bras. Geoc., 17(3): 263-269

May, S.E., - Pan-African Magmatism and Regional Tectonics of South Brazil -1990- Unpublished thesis submitted for the degree of Doctor of Philosophy, The Open University, UK, 327p

Marques, J.C., Jost, H., Roisenberg, A. & Frantz, J.C. - 1998 a - Eventos ígneos da Suíte Metamórfica Porongos na área da Antiforme Capané, Cachoeira do Sul, southem Brazil, Rev. Bras. Geoc., 28(4):419-430

Marques, J.C., Jost, H-, Roisenberg, A. & Frantz, J.C. -1998 b- Rochas metassedimentares, geología estrutural e metamorfismo da suíte metamórfica Porongos na área da Antiforme Capané, Cachoeira do Sul -RS. Rev. Bras. Geoc. 28(4):467-472

Masquelin, H. 1990: Análisis estructural de las zonas de cizalla en las migmatitas de Punta del Este - Uruguay. Rev. Estudos Tecnológicos, Acta Geológica Leopoldensia, 13(30): 139-58.

Masquelin, H.C. & Sanches Bettucci, L. - 1993 - Propuesta de evolución Tectono-sedimentária para la cuenca de Piriápolis, Uruguay. Rev. Bras. Geoc. 23(3): 313-322

McDermott, P. F. - 1986 - Granito petrogenesis and crustal evolution studies in the Damara Pan-African orogenic belt, Namibia. Unpublished thesis submitted for the degree of Doctor of Philosophy, The Open University, UK, 303p

McDermott, P.F. & Hawkesworth, C.J. - Intracrustal recycling and upper-crustal evolution: A case study from the Pan -African Damara mobile belt, central Namibia. Chemical Geology, 83(1990)263-280.

Moller, A., Mezger, K. & Schenk, V. - Crustal Age Domains and íhe Evolution of the Continental Cmst in the Mozambique belt of Tanzania: Combined Sm-Nd, Rb-Sr and Pb-Pb Isotopic Evidence. Joumal ofPetrology, v39(4):749-783

Pain P.S.G-, Leipnitz, 1.1., Rosa, A.N. Z. da & Rosa, A. A. S. da- 1997 -Preliminar report on the occun-ence of Chancelloria sp. In the Itajaí Basin, southem Brazil. Rev. Bras. Geoc. 27(3):303-308

Passarelli, C.R. - 1996 - Análise estrutural e caracterizacao do magmatismo da Zona de Cisalhamento Major Gercino, SC. Sao Paulo. Unpublished fhesis submitted for the degree ofMaster ofPliilosophy, University of Sao Paulo, 179 pp.

Passarelli, C.R., Basei, M.A.S., Ahrendt, H., Wemmer, K. & Siga Jr. O. - 1997 - Geochronological evolution of Major Gercino shear zone, south Brazil. I South-American Symposium on Isotope Geology, Ext. Abstracts, Campos cío Jordáo, S.P., Brazil, 231-233p

Phillip, R. P. -1998 - A Evolu9ao geológica e Tectónica do Batolíto Pelotas no Rio Grande do Sul. Umpublished thesis submitted for the degree of Doctor of Philosophy, University ofSao Paulo, Brazil, Vol 1, 25 5p

Pican90 J. Tasssinari, C.C.G., Cordani, U.G. andNutman, A. P. (1998) - Idades U-Pb (SHRIMP), Sm-Nd e Rb-Sr em rochas do MacÍ90 de Itatins (SP): Evidencias de Evolucao Policíclica. Na. Acad.Bras.Ci.,70 (1) 139-150.

Poiré, D.G. - 1993 - Estratigrafía del precambrico sedimentario de Olivarria, Sierras Bayas, Provincia de Buenos Aires, Argentina. XII Congreso Argentino y II Congreso de Exploración de Hidrocarburos. Actas 7, n: (1-11)

Porcher, C.C., McNaughton, N.J., Leite, J.A.D., Hartmann, L.A. & Femandes, L.A.D. - 1999 - Idade Shrimp em zircáo: vulcanismo ácido do Complexo Metamórfico Porongos. I Simposio sobre Vulcanismo e Ambientes Associados, Abstracts, Gramado, RS,pllO.

Porcher, C.C., McNaughton, N.J., Leite, J.A.D., Hartmann, L.A. & Femandes, L.A.D. - Geochronology of Proterozoic basement-cover relationships in the southem Brazilian Porongos Belt (submitted to Precambrian Research)

Preciozzi, F., Spotumo, J., Heinzen, W. & Rossi, P. - 1985 - Memoria Explicativa de la Carta Geológica del LTruguay a la escala 1/500.000. DINAMIGE - M.I.E.M., 90p.

Preciozzi, F. & Boume, J. - 1992 - Petrography and geochemistiy ofthe An-oyo de la Virgen and Isla Mala plutons, Southem Uruguay: Eariy Proterozoic implications. Jour. South Ainer. Earth Sci., 6: 169-181.

Preciozzi, F., Masquelin, H. & Basei, M.A.S. - 1999a - The Namaqua / Grenville Terrane of Eastem Uruguay. II South American Syniposium on Isotope Geology, Actas, 338 -340p, Córdoba, Argentine

Preciozzi, F., Basei, M.A.S. & Masquelin, E. - 1999b - New Geochronological data from the Piedra Alta Terrane (Rio de La Plata Craton), II South American Symposium on Isotope Geology, Actas, 341 -343p, Córdoba, Argentine

Porada, H. - 1979 - The Damara-Ribeira orogen ofthe PanAfrica-Brasiliano cycle in Namibia (Southwest África) and Brazil as interpreted in terms of continental collision. Tectonophysics 57(2-4): 237-265, Australia.

Porada, H. - 1989 - Pan -African rifíing and orogénesis in southem to equatorial África and eastem Brazil. Precambrian Research 44, 103 - 136.

Pothe de Baldis, E.D-, Baldis, B. & Cuomo, J. - 1983 -Los fósiles precambricos de la Formación Sierras Bayas (Olavarria) y su importancia intercontinental. Asociación geológica Argentina Revista XXXVni(l): 73-83

Quintas, M.C.L. - 1994 - O embasamento da Bacía do Paraná: reconstm9ao geofísica de seu arcabouco. Unpublished thesis submitted for the degree of Doctor of Philosophy, University of Sao Paulo, Sao Paulo, SP, 218p

Ramos, V. A., Leguizamon, A., Kay, S. M. & Teruggi, M. - 1990 - Evolution Tectónica de Las Sierras de Tandil (Provincia de Buenos Aires). XI Congreso Geológico Argentino, San Juan, 1990, ActasII,357-360

Reid, D.L. - 1997 - Sm-Nd age and REE geochemistry of Proterozoic arc-related ígneous rocks in the Richtersveid Subprovince, Namaqua Mobile Belt, Southem África. Joumal ofAfrican Earth Sciences, v24(4)621-633

Remus, M.V.D. - 1998 - Metalogénese do Cobre e Evolucáo crustal da regiao de Ca9apava do Sul-RS, Unpublished thesis submitted for the degree of Doctor of Philosophy, Federal University ofRio Grande do Sul, RS, Brazil.

Remus, M.V.D., Hartmann, L.A., McNaughton, N.J. & Fletcher, I.R. - 1999 -SHRIMP U-Pb zircon ages ofvolcanism from the Sao Gabriel Block, southem Brazil. I Simposio sobre Volcanismo e Ambientes Associados, Abstraéis, Gramado, RS, pllO.

Remus, M.V.D., Hartmann, L.A., McNaughton, N.J., Groves, D.I. & Fletcher, I.R. - The link between hydrothermal epigenetic copper mineralization and the Cacapava Granito ofthe Brasiliano Cycle m southem Brazil. (submitted to JSAES)

Rostirolla, S. - 1991 - Tectónica e sedimentacao da Bacía do Itajaí-SC. Unpubíished mastershíp díssertatíon presented to the Escola de Minas, Universidade Federal de Oui-o Preto, 132p.

Rozendaal.A., Gi-esse, P.G, Scheepers, R. & Le Roux, J.P. - 1999 -Neoproterozoic to Early Cambrian Crustal Evolution of the Pan-African Saldania Belt, South África. Precambrian Research, v97 (3-4):303-323

Salamuni, R., Bigardía, J.J. & Takeda, F.K. - 1961 - Consídera^oes sobre a estratigrafia e tectónica da Serie Itajaí. Curitiba, PR. Bol. Par. Geografía, (415):188-201.

Sander, A. - 1992 - Petrología e litogeoquímica de urna parcela da sequéncia vulcano-sedimentar do complexo metamórfíco Brusque na regiao do Ribdrao do Ouro,
SC. Unpublished thesis submitted for the degree of Doctor of Philosophy, Federal University ofRio Grande do Sul, RS, Brazil, 167p

Sanches Bettucci, L., 1998 - Evolución Tectónica del cinturón Dom Feliciano en la región Minas-Piriápolis, República Oriental del Uruguay. Unpublished thesis submitted for the degree **of Doctor of Philosophy, Facultad Ciencias** Exactas y **Naturales,** University **of Buenos** Aires. **234p.**

Sanches Bettucci, L. & Mezzano Burgueño, A. - 1993 - Análisis sedimentológico y faciológico de la Formación Rocha (ex-Grupo Rocha). Rev. Bras. Geoc. 23(3) :323-329

Schukowsky, W., Vasconcellos, A.C.B.C. & Mantovam, M.S.M. - 1991 -Estrutura9áo dos terrenos Pré-Cambrianos da regiao sul do Brasil e oeste do Uruguai:
um estudo por modelamento gravimétrico. Rev. Bras. de Geofísica, 9(2):275-287

Siga JR., O -1995 - Dominios tectónicos da regiao sudeste do Paraná e nordeste de Santa Catarina: Geocronologia e Evolugao Crustal. Umplublished PhD thesis presented to the Institute of Geosciences - ÜSP, 290 p.

Siga Jr., O; Basei, M.A.S.; Reis Neto, J.M dos, Machiavelli, A. & Harara, O.M. -1995 - O Complexo Atuba: Um cinturao Paleoproterozóico intensamente retrabalhado no Neoproterozóico. Bol.IG-USP, Ser.Cient., 26: 69-98.1995

Silva, L.C. da & Días, A. A. - 1981 - Os segmentos mediano e setentrional do Escudo Catarinense: I - Geologia. Acta Geológica Leopoldénsia. Sao Lepoldo, RS, 5(10):3-120.

Silva, L.C. da, Oliveira, J. M. P., Aumond, J. J., Lopes, R. M. M., Eipper, J. & Ferro, G. - 1985 - Caracterizacao petrográfica da Sequéncia (Meta) Vulcano-sedímentar Rio do Oliveira (Cinturáo do Itajaí Mírim, SC) In: Simp. Sul-Bras. GeoL, 2, Florianópolis, **SBG,pll-23.**

Silva, L. C. da, Hartmann, L. A., McNaughtoon, N.J., Fletcher, I. R., -1997 -Shrimp U/-Pb Zircon Dating of Neoproterozoic Granitic Magmatism and Collision in the Pelotas Batholith, Southemmost Brazil, Intemational Geology Review, V.41(l):531-551p.

Soliani Jr., E. -1986 -Os dados geocronológicos do Escudo Sul-riograndense e suas implica9oes de ordem geotectónica, Unpublished thesis submitted for the degree of Doctor ofPhilosophy, University of Sao Paulo, Sao Paulo, SP, 425p

Teruggi, M.,Leguizamon, M.A. & Ramos, V.A. - 1988 - Metamorfitas de Bajo Grado con afinidades oceánicas en el basamento de Tandil: sus implicaciones geotectónicas, Provincia de Buenos Aires. Asociación Geológica Argentina, Revista, XL.ni(3):366-374

Tessari, R.I. & Picada, R.S. -1966 - Geología da Quadricula de Encruzilhada do Sul, RS, Boletim da Divisao de Fomento a Produ9ao Mineral, DNPM, Rio de Janeiro, 124: 1-147

Trompette, R. - 1994 - Geology of Westem Gondwanaland 2000 - 500Ma. The Pan-African / Brasíliano amalgamation ofSouth América and adjacent África, Baikema, Rotterdam, 350p.

Tommasi, A., Femandes, L.A.D., Machado, R.P., Kraemer, G. & Koester, E. -1994 - mcorporacao de Liscas do manto á crosta continental ñas poi^oes extemas do cinturao Dom Feliciano - Evidencias de urna Zona de Cisalhamento de Escala Litosférica. Pesquisas, 21(2): 79-84

Umpierre, M. and Halpem, M. 1971: Edades Rb-Sr en rocas cristalinas del sur de la República Oriental del Uruguay. Asociación Geológica Argentina, Buenos Aires, tXXVI, 2: pp. 133-151.

Várela, R., Cingolani, C. Dalla Salda, L. - 1988 - Geocronologia Rb-Sr en granitoides del basamento de Tandil, Provincia de Buenos Aires, Argentina, II Jom.Geol. Bonarenses, Actas: 291-304, Bahía Blanca

Zanini, L.F.P., Branco, P.M., Camozzato, E. & Ramgi-ab, G.E. - 1997 - Programa de Levantameníos Geológicos Básicos 1: 100.000; Folhas Florianópolis e Lagoa, Brasilia, CPRM, 252pp.