POST-OROGENIC MAGMATISM AND SEDIMENTATION IN NEOPROTEROZOIC EXTENSIONAL REGIMES IN THE BRAZILIAN SOUTHERN REGION

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INTRODUCTION

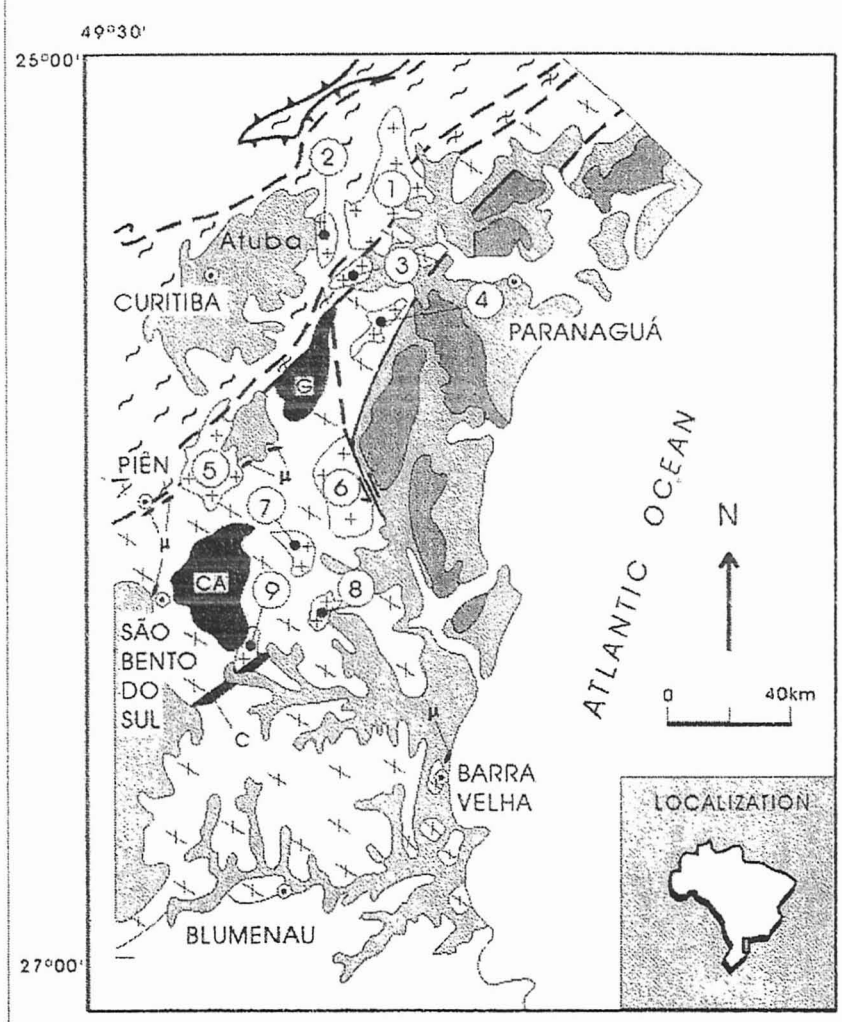
The geotectonic configuration observed in the gneissic-migmatitic terrains located between the Ribeira (North) and Dom Feliciano (South) belts represent an agglutination of distinct entities, produced by subduction processes followed by collisions. The present tectonic scenario was established during the end of the Neoproterozoic, continuing up to the Cambrian-Ordovician, as a result of collage processes related to the Brasiliano/Pan-African Megacycle. In this period, the collision of Congo/São Francisco, Kalahari, and Paranapanema cratons produced the amalgamation of all the existing blocks among these large continental masses. In the southeastern sector of Paraná State and northeast of Santa Catarina State (Figure 1) three major continental segments can be distinguished by their distinct geologic characteristics, separated by expressive shear zones: Luís Alves, Curitiba and Paranaguá Domains.

The Luís Alves microplate is characterized by gneissic-granulitic terrains formed during the Archean (2,800-2,600 Ma) and the Paleoproterozoic (2,200-1,900 Ma), placed at isotherms below 300°C during the Neoproterozoic (K-Ar in amphiboles and biotites of 2,000-1,700 Ma). On the other hand, the Paleoproterozoic gneissic-migmatitic terrains (2,200-1,800 Ma) of the Curitiba segment are characterized by intense deformation, migmatization and granitization in the Neoproterozoic (620-600 Ma), reflecting a relatively deep position at that time (isotherms above 500°C). The Paranaguá segment, distinct from the others, is represented by an igneous complex formed during the Neoproterozoic (620-570 Ma). Compressive tectonic regimes predominated in the ambit of the Curitiba segment between 620 – 600 Ma, whereas in the Paranaguá block this interval extends up to 570 Ma, remaining on isotherms above 300°C up to *ca.* 480 Ma.

An important landmark in the evolution of the Luís Alves and Curitiba domains is represented by expressive granite genesis of alkaline-peralkaline nature, as well as by intense volcanism, related to the development of several extensional basins.

VOLCANO-SEDIMENTARY BASINS

In general, a lower sedimentary sequence predominate in the Campo Alegre, Corupá and Guaratubinha basins, represented by polymictic conglomerates, sandstones, arkosic sandstones and silty-sandy sediments, suggesting fluvial to lacustrine depositional environments, with progressively decreasing energy. On these sediments expressive volcanic manifestations occur, of basic, intermediate and acid natures, as well as the deposition of varied pyroclastic rocks: tuffs, ignimbrites, pyroclastic breccias with intercalations of epiclastic, pelitic to psammitic sediments (Citroni, 1998). The deformations are brittle, associated with tilting and plastic deformations, being more intense in the Guaratubinha and Corupá basins (tilts of the order of 20-40°).



LEGEND

CENOZOIC DEPOSITS AND PALEOZOIC SEDIMENTS OF PARANÁ BASIN.

LITOLOGICAL UNITIES OF AÇUNGUI AND SETUVA GROUPS (RIBEIRA BELT - NORTH) AND ITAJAÍ AND BRUSQUE GROUPS (DOM FELICIANO BELT - SOUTH).

POST OROGENIC MAGMATISM AND SEDIMENTATION OF EXTENSIONALS REGIMES

VOLCANIC-SEDIMENTARY BASINS: CAMPO ALEGRE (CA), GUARATUBINHA (G), CORUPÁ (C).

ALKALINE-PERALKALINE GRANITOIDS: GRACIOSA (1), ANHANGAVA (2), MARUMBI (3), SERRA DA IGREJA (4), AGUDOS DO SUL (5), MORRO REDONDO (6), DONA FRANCISCA (7), PIRAÍ (8), CORUPÁ (9).

PARANAGUÁ TECTONIC DOMAIN

GRANITOIDS (MORRO INGLÊS, RIO DO POÇO, CANAVIEIRAS, ESTRELA), GNEISSES, MIGMATITES AND SHISTS.

CURITIBA TECTONIC DOMAIN

RIO PIÊN SUITE: DEFORMED CALK-ALKALINE POTASSIC GRANITOIDS.

ATUBA COMPLEX: BANDED GNEISSES, MIGMATITES AND AMPHIBOLITES.

LUÍS ALVES TECTONIC DOMAIN

GRANULITIC ORTOGNEISSES WITH MAFIC-ULTRAMAFIC LENSES (μ), QUARTZITES, BANDED IRON FORMATIONS, PARAGNEISSES.

ALKALINE – PERALKALINE GRANITE GENESIS

The granitic massifs show quartz-syenitic to syenitic variations and mafic minerals that present evolution trends from weakly metaluminous to strongly peralkaline. In this evolution, fayalite (Corupá and Morro Redondo) and clinopyroxenes (aegerine/augite) occur, sometimes with calcic-sodic amphibole to totally sodic (riebeckite) rims. The rocks are usually leucocratic, medium- to coarse-grained, and rosy to gray. They present granular textures, are hypidiomorphic, and contain in varied proportions quartz, microcline, plagioclase (albite-oligoclase), normally perthitic to mesoperthitic, biotite, (Ca-Na) amphibole, and more rarely (Na-Ca) clinopyroxene and fayalite. The main accessory minerals are titanite, zircon, apatite, opaque minerals and sometimes fluorite.

GEOCHRONOLOGICAL DATA

The geochronologic study carried out for this magmatism involved Rb-Sr (whole rock isochrons), U-Pb (in zircons), Sm-Nd (model ages - T_{DM}) methods and additionally, in the case of the granitoids, the K-Ar method (amphiboles and biotites), summarized in Table 1.

The U-Pb (zircons) and Rb-S isotopic data obtained for granitic rocks of alkaline-peralkaline nature, as well as for rhyolites from the Campo Alegre and Guaratubinha basins, indicate the 600-570 Ma interval as important in the generation of this magmatism, and relatively high initial $(^{87}Sr/^{86}Sr)_i$ ratios (above 0.707). The Sm-Nd model ages (T_{DM}) fall between 2,200-1,850 Ma, characterizing periods of mantle differentiation in the Paleoproterozoic for the crustal protoliths of these granitic and rhyolitic rocks. ε_{Nd} values, when calculated for the time of formation of these rocks (600 Ma), are negative (between –7 and –15), suggesting a relatively long time of crustal residence. K-Ar data (amphiboles and biotites) for the granitic massifs mainly concentrate in the 585-540 Ma interval, reflecting the cooling period of these rocks.

CONCLUSIONS:

This expressive magmatism is here interpreted as resultant from tectonic regimes of extensive nature, which affected the Brazilian southern portion, immediately after the end of the Neoproterozoic compressive regimes associated with the development of the adjacent fold belts. Such extensive tectonic regimes are here interpreted as adjustments to reach greater stability, after the thickening caused by the preceding compressive events.

The main time interval (600-570 Ma) for the formation of these rocks is, on the other hand, quite close to that obtained for the Paranaguá segment (615-570 Ma, Basei et al. 1990 e Siga Jr. 1995), allowing an alternative hypothesis, where the generation of this magmatism would result from lithospheric thinning produced in the craton that results from this juxtaposition.

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	Campo Alegre (rhyolite)	Guaratubinha (rhyolites)	Agudos do Sul	Anhangava	Corupá	Graciosa	Morro Redondo	Marumby / Serra da Igreja
Rb-Sr (WR) Isochrons (Ri)	~570 (~0.707)	570±10 (0.70947)	570 ± 22 (0.70735 ± 0.0008)	600 ± 20 (0.71930 ± 0.00542)	550 ± 26 (gray) (0.70703 ± 0.0010)	584 ± 12 (0.70796 ± 0.00018)	~580 (~0.710)	
U-Pb (zircons)	528±29	628±28	594 ± 26		580 ± 6 (gray)	594 ± 64	589 ± 37	
Sm-Nd (T_{DM})	2,200-1,850		2,085	1,852	1,942		1.978	
K-Ar (minerals)			580-540 (amph./ biot.)	550 ± 17 (biot.)	535-525 (amph.)	585-520 (biot.)	565± 20 (amph.)	580-500 590-580 (amph./biot .)

Table 1 – Available radiometric determinations for the granitoid magmatism of the Serra do Mar Suite and volcanism associated with the extensional basins.