



TECTONOTHERMAL EVENTS IN PARANAGUÁ TERRANE: GEOCHRONOLOGICAL RECORDS AND THEIR SIGNIFICANCE IN THE RIBEIRA BELT.

Cury, L.F.¹; Siga Junior, O.²; Sato, K.²; Harara, O.M.M.; Basei, M.A.S.².

1 Departamento de Geologia da Universidade Federal do Paraná (DEGEOL-UFPR); 2 Centro de Pesquisas Geocronológicas, Instituto de Geociências da Universidade de São Paulo (CPGeo-IGc-USP). cury@ufpr.br

ABSTRACT

The Paranaguá terrane is mainly constituted by a arc-related granitic complex, spread in a large NE-SW elongated stripe, about 250 km long and 30 km wide, located in southern Ribeira Belt, southeastern Brazil. As country rocks of these l.s. granites, metasedimentary rocks of the Rio das Cobras Sequence outcrops in a disrupted folded belt, and gneissic-migmatitic rocks of the São Francisco do Sul complex occurs like split basement nuclei in the southern Paranaguá terrane. Different generations of granites were formed during the magmatic arc development with petrographic and lithogeochemical and isotopic similarities, suggesting emplacement stages during a late collisional event. Older ages between 620-610 Ma suggesting presence of a relatively early magmatism relative to the first stage of subduction in southern Paranaguá terrain. The main magmatic period is characterized by U-Pb (zircon) Neoproterozoic records, with ages between 600-580 Ma, quite close to metamorphic peak of Rio das Cobras sequence, with U-Pb (monazite) age at 599 ± 5 Ma, relative to garnet-sillimanite-kyanite-schist located in a thrust collisional shear zone. Although, U-Pb ages (zircon) between 530-480 Ma obtained in crystals rims of deformed granitoids and late leucogranitic veins, related to the final Gondwana agglutination throughout Cambro-Ordovician's Buzios Orogeny.

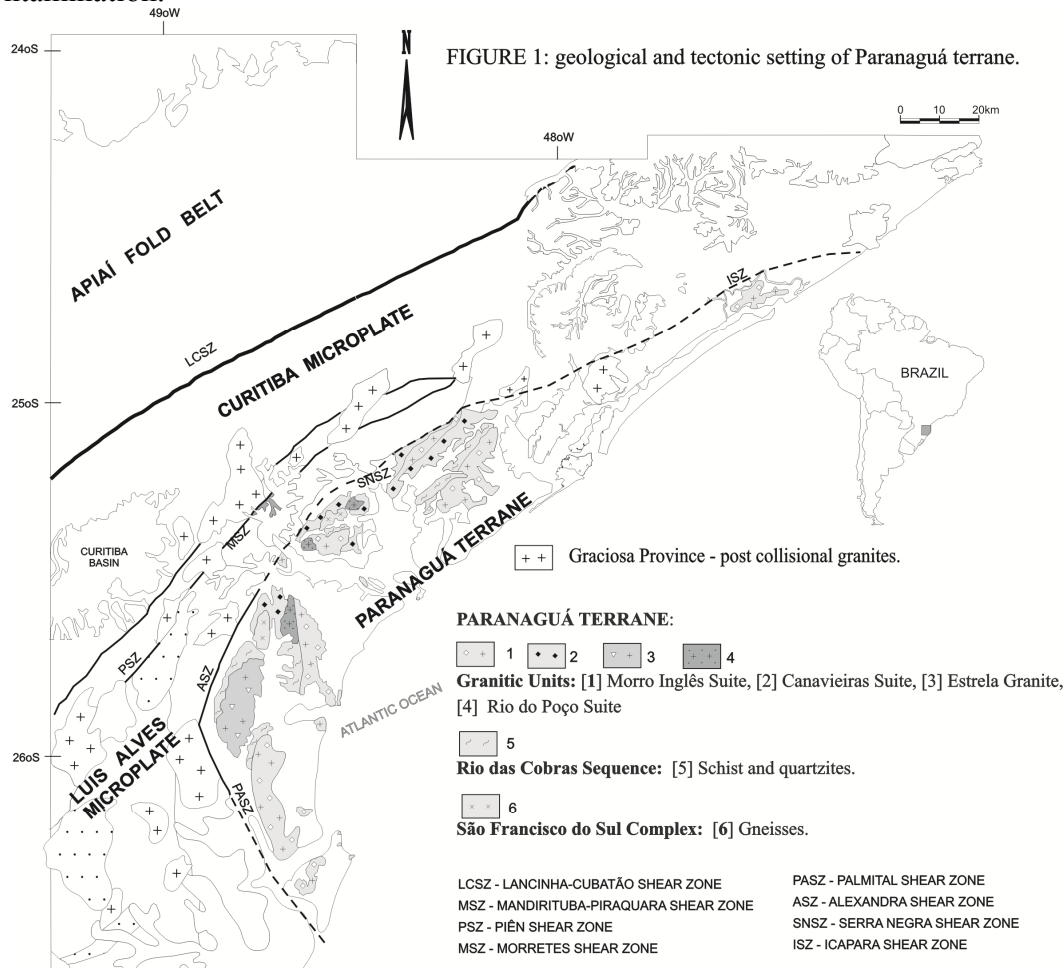
GEOLOGICAL SETTING

The Paranaguá Terrane is composed of precambrian geological units distributed in a NE-SW elongated swath, about 250 km long and 30 km wide, in south-southeastern Brazil, within the States of São Paulo (northern Paranaguá terrane), Paraná and Santa Catarina (southern Paranaguá terrane). This terrane is mainly constituted by an igneous complex, represented by the Morro Inglês, Rio do Poço and Canavieiras-Estrela suites. The country rocks of these l.s. granites are gneissic and gneissic-migmatitic rocks of the São Francisco do Sul Complex and metasedimentary rocks of the Rio das Cobras Sequence.

The Morro Inglês Suite is the most expressive unite in Paranaguá Domain, being mainly represented by leucocratic rocks in gray tonalities, with medium to thick-grained porphyritic texture, frequently foliated, composed by megacrystals of K-feldspar (2 to 10cm), plagioclase (An₁₂₋₂₀), quartz, hornblende \pm biotite and accessory phase composed by sphene, apatite, epidote, allanite and zircon. Mafic enclaves with spheroidal to angular shapes are often observed, in most composed by diorites and amphibolites with fine-grained equigranular texture. Lithochemical signatures are compatible with arc magmatic-generated granitic rocks, with high-K to shoshonitic calc-alkaline character and relatively high contents of Ba, Nb, Zr, Rb, Sr, Th and K₂O. This pattern resembles the one observed in sin- to late-collisional



environments related to mature magmatic arcs, with sources modified by crustal contamination.



The Canasvieiras Suite outcrop in the western section along shear zones, showing leucocratic rocks in gray to rosy colors, with medium to fine-grained inequigranular texture, that usually exhibit deformation features characterized by cataclastic and mylonitic thermes. The mineralogy is composed by k-feldspar, plagioclase, quartz and biotite, with sphene, allanite and zircon as accessories. Comparatively, the Morro Inglês Suite rocks present higher values of K₂O and smaller values of Na₂O than the rocks of the Canavieiras-Estrela Suite. Both suites show important variations of Ba and Sr, high values of Rb and Zr, and medium-to-high values of Nb and Y.

The Rio do Poço Suite outcrops as restricted bodies along the Paranaguá Domain, in most represented by leucocratic and hololeucocratic rocks with medium to fine-grained equigranular texture, frequently foliated as magmatic flow. The mineralogy is composed by K-feldspar, quartz, plagioclase (An₈₋₁₅), biotite ± muscovite and accessories represented by apatite (with dimensions about 1 -1,5mm), allanite, epidote and zircon. The geochemical data allows recognizing a sub-alkaline signature with a peraluminous association. The REE patterns of Rio do Poço and Morro Inglês suites are quite similar, denoting an enrichment of all elements in this suite, which present a marginally peraluminous character, with HREE-depleted rocks, without an Eu negative anomaly.



GEOCHRONOLOGY

Petrographic, structural and geochronological data suggest that the Morro Inglês, Canavieiras-Estrela and Rio do Poço suites emplacement occurred during a late stage of the collisional event. U-Pb (zircon) ages of these suites are very close and does not allow a clear separation of them. A high concentration of ages between 600-580 Ma represent the main magmatic period of the Paranaguá Terrane. Although less frequent, older ages between 620-610 Ma were obtained in the three suites, suggesting the presence of a relatively early magmatism in this terrane's evolution. U-Pb (zircon) ages obtained in crystals borders, as well as in late leucogranitic veins, are distributed between 560-480 Ma. These ages must be related with important thermotectonic events of the Cambro-Ordovician Buzios Orogeny.

The metasedimentary rocks of the Rio das Cobras Sequence occur as elongated strips, with little areal expression. In the southern portion of the Paranaguá Terrane, green schist (biotite zone) paragenesis are present (Serra da Prata – PR), while in the central and northern portions there are amphibolite facies paragenesis up to granulite facies in association with kyanite-garnet-sillimanite-K feldspar (Guaraqueçaba – PR e Iguape -SP). U-Pb zircon analysis of the high-grade gneisses show a concentration of ages between 1.8-2.1 Ga. The analytical spots in zircon borders yield ages of 611 ± 39 Ma. U-Pb monazite ages yield a relatively younger interval of 599 ± 5 Ma, probably related with the metamorphic peak.

The São Francisco do Sul Complex is represented by gneisses composed of diorites, quartz-monzodiorites, granodiorite, trondhjemitic and monzogranites. In the Guaratuba and Guaraqueçaba region (Central Paranaguá Terrane) migmatization features are frequent, with garnet and tourmaline-bearing granitic leucosomes. U-Pb analysis yield Paleoproterozoic (2.173 ± 18 Ma), Neoproterozoic (626 ± 25 Ma) and Cambro-Ordovician (510-490 Ma) zircon crystallization ages.

Unit	Sample	Rock	Method	Ages
S. Francisco do Sul Complex	BP-84a	gneiss	U-Pb (zr) IDTIMS	626 ± 25 Ma; 2072 ± 48 Ma
S. Francisco do Sul Complex	BP-288	gneiss	U-Pb (zr) LAICPMS	510 ± 50 Ma; 2173 ± 18 Ma
S. Francisco do Sul Complex	BP-69	gneiss	K-Ar (biotite)	530 ± 10 Ma
Rio das Cobras Sequence	BP-145	ky-grn-schist	U-Pb (zr) LAICPMS	611 ± 39 Ma
Rio das Cobras Sequence	BP-133	ky-grn-schist	U-Pb (mz) IDTIMS	599 ± 5 Ma
Canavieiras-Estrela Suite	BP-42	monzogranite	U-Pb (zr) LAICPMS	638 ± 10 Ma
Canavieiras-Estrela Suite	BP-104	mylonite	K-Ar (biotite)	531 ± 10 Ma
Canavieiras-Estrela Suite	BP-128	mylonite	K-Ar (biotite)	504 ± 10 Ma
Morro Inglês Suite	BP-14	monzogranite	U-Pb (zr) IDTIMS	582 ± 10 Ma
Morro Inglês Suite	BP-289	monzogranite	U-Pb (zr) IDTIMS	588 ± 7 Ma
Morro Inglês Suite	BP-196	monzogranite	U-Pb (zr) LAICPMS	610 ± 7 Ma; 540 ± 13 Ma
Morro Inglês Suite	BP-104	monzogranite	U-Pb (zr) LAICPMS	601 ± 7 Ma
Morro Inglês Suite	BP-148	monzogranite	U-Pb (zr) LAICPMS	617 ± 10 Ma
Morro Inglês Suite	BP-196	monzogranite	K-Ar (biotite)	544 ± 19 Ma
Rio do Poço Suite	BP-10	leucogranite	U-Pb (zr) SHRIMP	616 ± 7 Ma
Rio do Poço Suite	BP-10	leucogranite	U-Pb (zr) LAICPMS	598 ± 20 Ma
Rio do Poço Suite	BP-73	leucogranite	K-Ar (biotite)	520 ± 15 Ma

Table 1: Synthesis of geochronological data of Paranaguá terrane.

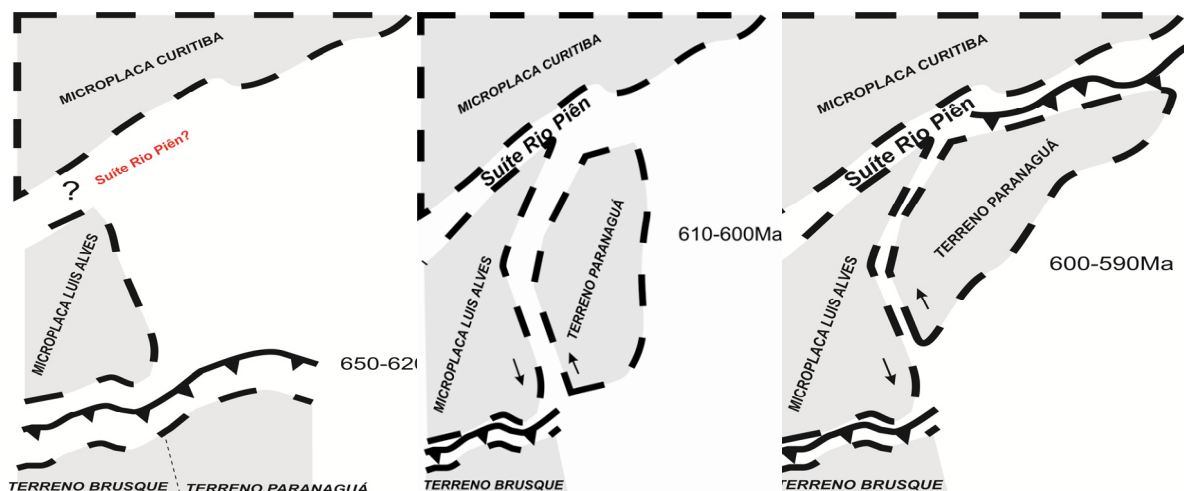


TECTONIC SETTINGS

The limit of the Paranaguá Terrane with the Luis Alves and Curitiba microplates is tectonic, characterized by the Palmital and Alexandra transcurrent shear zones in its southern portion and by the Serra Negra and Icapara thrusts in its northern portion.

Both Palmital and Alexandra transcurrent shear zones (Southern Paranaguá Terrane) present sinistral kinematic with oblique component, marked by the coexistence of strike-slip and down-dip lineations. The Serra Negra and Icapara shear zones represent a large collision front, located in the Northern Paranaguá Terrane, with north-northwest vergence and oblique components (strike-slip and down-dip lineations). The transition between these two distinct tectonic styles is given by N-S or NNW-SSE faults associated with a transpressive regime, with lateral ramp characteristics.

The observed structural pattern suggest that the emplacement of the Northern Paranaguá Terrane is due to nappe tectonics towards north-northwest. This collision is probably related with the Neoproterozoic agglutination setting of the western Gondwana Supercontinent.



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