

U-Pb ZIRCON AGES OF POST-OROGENETIC GRANITIC MAGMATISM IN APIAÍ FOLDED BELT (PARANÁ STATE, SOUTHERN BRAZIL): PETROLOGICAL AND GEOTECTONIC SIGNIFICANCE

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The Apiaí Folded Belt (AFB) is a domain of the southern portion of Ribeira Belt, and in Paraná and São Paulo States, southern Brazil, is composed of metavolcano-sedimentary rocks, of low to medium metamorphic grade, grouped in the Açungui Supergroup (Fiori, 1993; Campanha & Sadowski, 1999). The Neoproterozoic granitic rocks represented by the Cunhaporanga, Três Córregos and Agudos Grandes batholiths intrude the supracrustal rocks and both are affected by latter granitic stocks. In this paper, it's presented new lithochemical and geochronological data for Morro Grande (MG) and Serra do Carambeí (SC) granites (Figs. 1, 2).

The neoproterozoic Cunhaporanga, Três Córregos and Agudos Grandes batholiths are calc-alkaline, metaluminous, I-type and magmatic arc-related granites. It is mostly represented by hornblende biotite monzogranites to granodiorites with U-Pb zircon ages ranging between 630 and 600 Ma (Gimenez Filho et al., 2000; Guimarães, 2000; Prazeres Filho, 2000; Prazeres Filho et al., 2001; Janasi et al., 2001).

The Morro Grande granite (MG) (Chiodi Filho et al., 1987; Prazeres Filho, 2000) covers an area of approximately 70 km² (Fig. 2). It is intruded into the metavolcano-sedimentary rocks of Votuverava Formation developing thermal aureole with metamorphic assemblages in the albite-epidote hornfels facies. The studied portion of MG is constituted by leucocratic, porphyritic, isotropic, light grey biotite monzo to sienogranites, with idiomorphic K-feldspar fenocrystals of up to 3 cm in a matrix with K-feldspar, plagioclase, quartz and biotite. The accessory minerals are zircon, apatite, titanite, fluorite and opaques.

The Serra do Carambeí granite (SC) (Fuck et al., 1967; Guimarães, 2000) is intruded into the Cunhaporanga batholith, covering an area of approximately 22 km². It is composed of a red, inequigranular, medium to coarse-grained biotite alkali-feldspar granite. Presents xenomorphic texture with crystals of quartz, mesoperite and interstitial biotite. The accessory minerals are zircon, apatite, fluorite and opaques.

The MG (SiO₂= 71%) and SC (SiO₂= 77%) are weakly peraluminous rocks, with low CaO (0.14 to 1.68%), Al₂O₃ (12.11 to 12.88%), Sr (<5 to 110 ppm) and Ba (<10 to 571 ppm) and high Y (149 to 43) for SC in relation to MG. In the chondrite normalized REE patterns (Nakamura, 1977) for these rocks, it is noticed a different behavior of REE for the two granites. The SCG is depleted in LREE and enriched in HREE with LaN= 46 and YbN= 58, against LaN= 150 and YbN= 20 of the MG. The SC compared to MG presents a strong negative anomaly of Eu with Eu/Eu*=0.005, against Eu/Eu* = 0.25 of the MG (Fig. 3).

Conventional multi-grain U-Pb (zircon) dating of the crystallization age of the two granitic stocks was obtained in 3 and 4 zircon fractions, respectively of biotite sienogranite from MG and of biotite alkali-feldspar granite from SC. The zircon grains in both granites are prismatic with a ratio length/width ~ 2:1, rich in inclusions and fractures. Opaque crystals just happen in SC granite (see Fig. 4).

The U-Pb data presented in the figure 4 indicate an upper intercept age of 564±3 Ma (MSWD=0.55) for MG granite and of 569±2 Ma (MSWD= 1.5) for the SC granite. Both ages are interpreted to be the time of crystallization and emplacement of these rocks. The zircon fractions yield a very discordant result caused by lead loss, possibly due to metamictization, evidenced by the opacity of the zircon crystals and by the high U content (up to 1000 ppm - SC granite).

The MG and SC granites mineralogical characteristics (presence of the fluorite), petrographic features (xenomorphic textures) and lithochemical behavior, such as the low CaO, Ba and Sr, the high Y, Hf and Zr contents, as well as the negative anomalies of Eu, are suggestive of A-type rocks formed in a post to non-orogenic setting. The Joaquim Murtinho, Cerne and Piedade granites, in the State of Paraná (Figs. 1, 2), also could be formed in similar setting.

The lithochemical differences between the MG and SC granites should reflect different sources or different petrological histories to granitic rocks produced in same geotectonic setting.

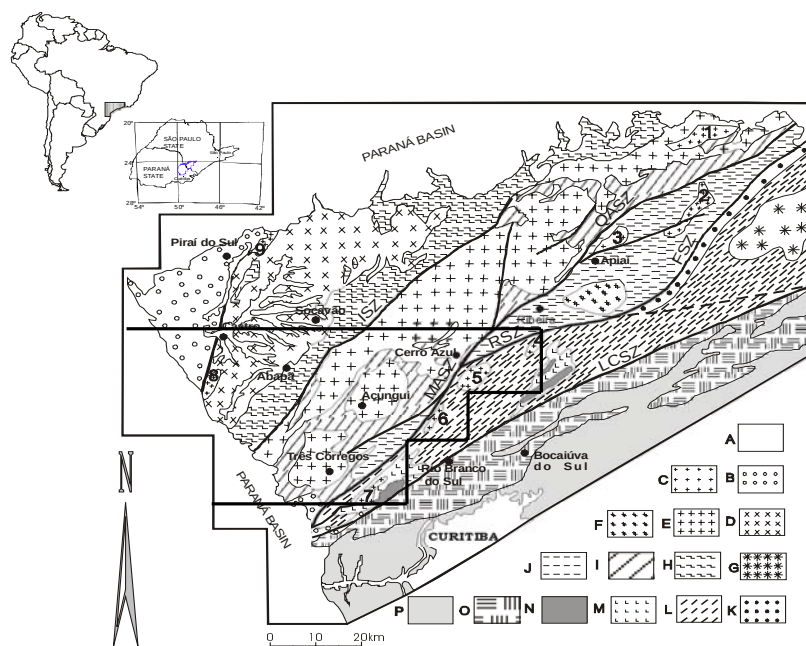


Figure 1. Geological sketch of part of the Ribeira Fold Belt in parts of the states of Paraná and São Paulo, Brazil, with location of studied area. (Mod. Campanha et al. 1987; Siga Jr, 1995; Basei et al. 1997; Campos Neto, 2000. A) Fanerozoic Cover, B) Neoproterozoic III/Eopaleozoic Basin; Apiaí Folded Belt; C) Granitic Stocks : 1- Capão Bonito, 2- Espírito Santo, 3- Apiaí, 4- Varginha, 5- Morro Grande, 6- Piedade, 7- Cerne, 8- Serra do Carambeí, 9- Joaquim Murtinho. Arc Related Neoproterozoic Calc-Alkaline Granitic Batoliths : D) Cunhaporanga; E) Três Córregos; F) Itaoca; G) Agudos Grandes. Açungui Super Group : H) Itaiacoca Group; I) Água Clara Formation; J) Lageado Subgroup ; K) Iporanga Formation ; L) Votuverava Formation ; M) Perau/Betara Formation; N) Granitic Basement Nuclei. Curitiba Microplate - O) Capirú Formation; P) Atuba Complex.

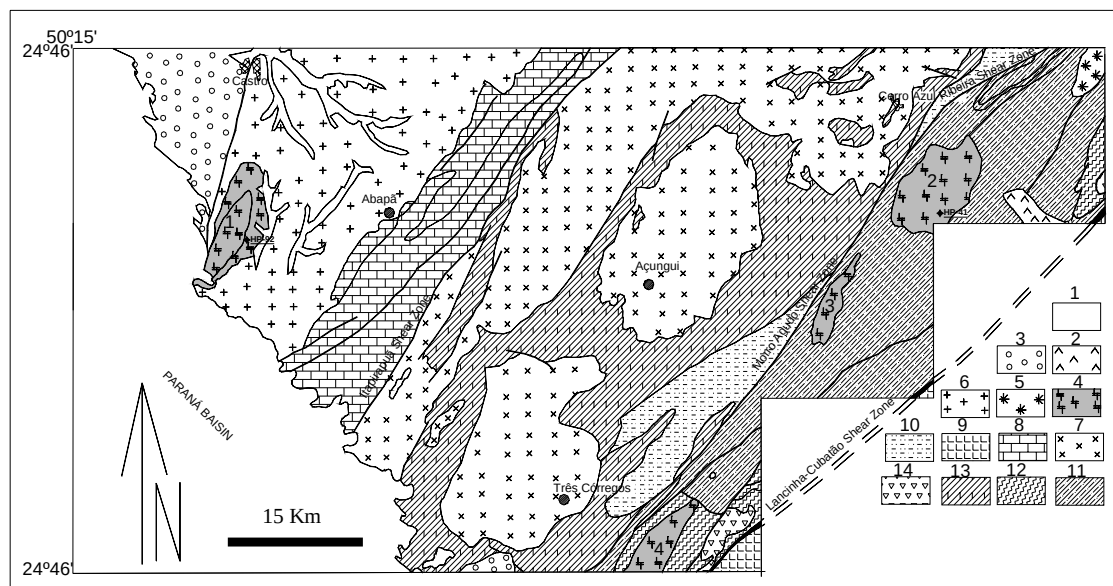


Figure 2. Detailed geological map of studied area. (Mod. Fiori, 1990; Prazeres Filho et al. 1998; Guimarães, 2000). Fanerozoic Units : 1) Recent deposits and Parana Basin, Alkaline rocks; Eocambrian/Neoproterozoic Units: Castro Group; Neoproterozoic Units: 4) Post to non- orogenic granites – 1, Serra do Carambeí, 2) Morro Grande, 3) Piedade, 4) Cerne; 5) Sin to late- orogenic granites: Varginha; Arc related granites: 6) Cunhaporanga Batholith and 7) Três Córregos Batholith; Metavulcanic-sedimentar sequences: 8) Itaiacoca, 9) Capirú, 10) Ribeira; Mesoproterozoic Units: Metavulcanic-sedimentar sequences: 11) Votuvera, 12) Perau, 13) Água Clara; Mesoproterozoic/ Paleoproterozoic Units: 14) Granitic nuclei.

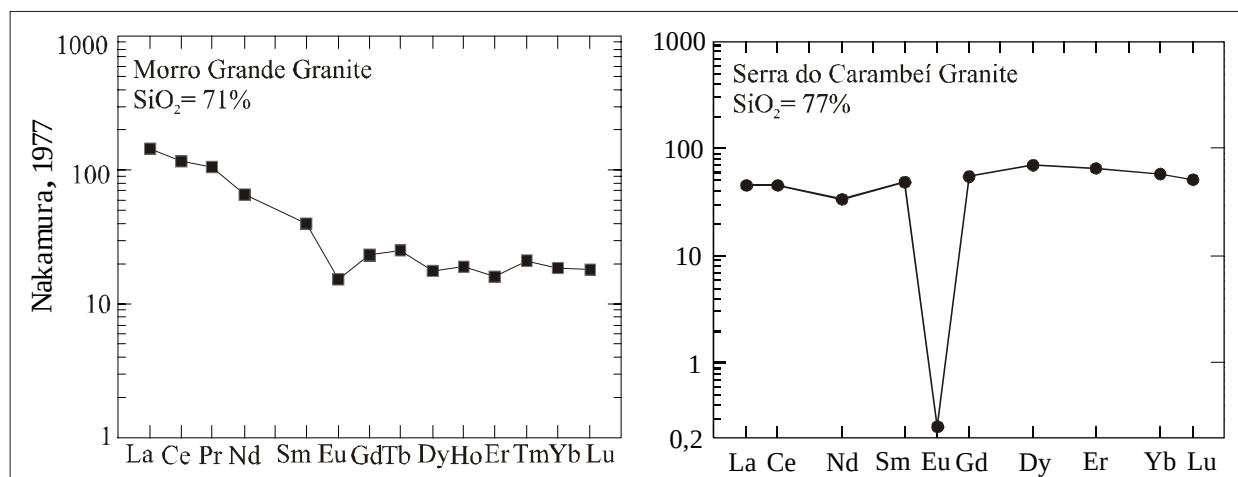


Figure 3. Nakamura normalized REE diagrams.

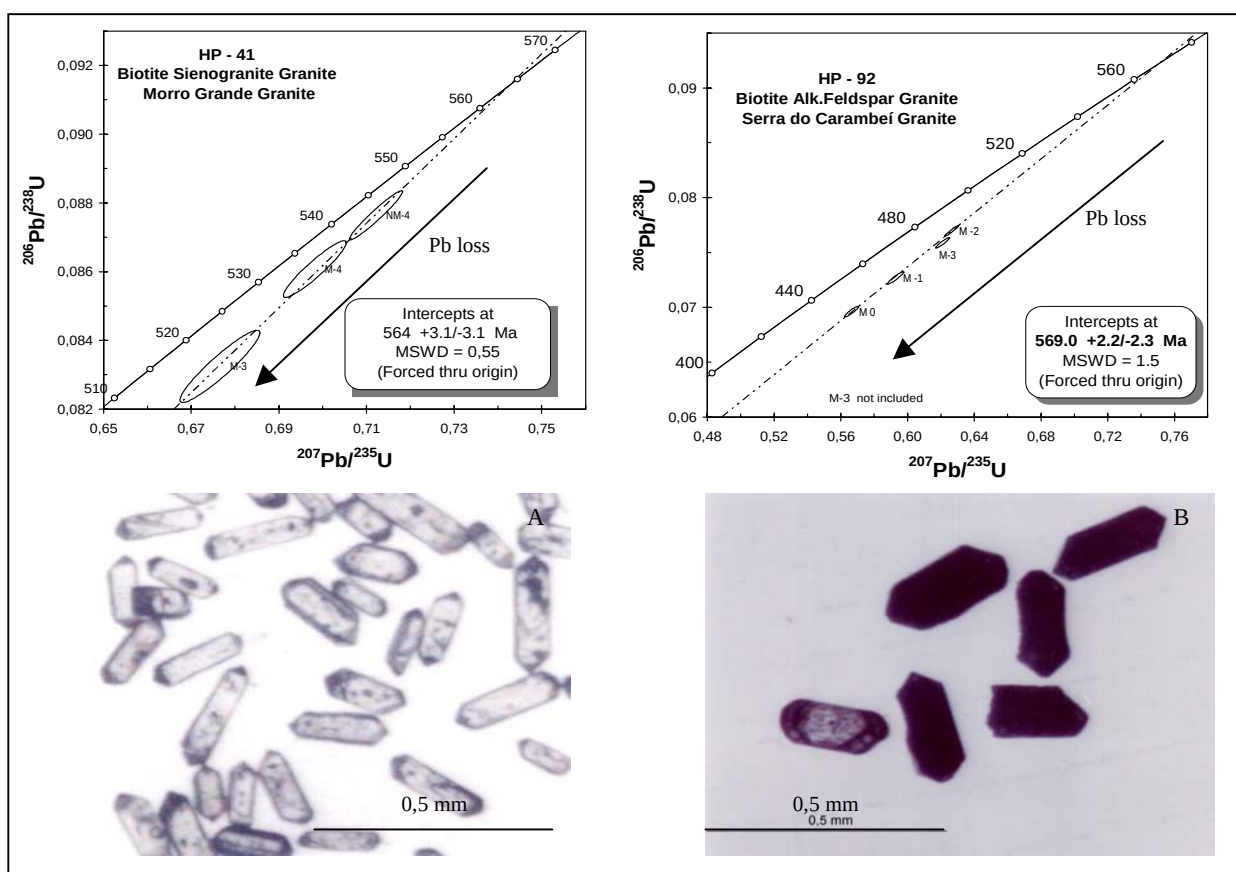


Figure 4. U-Pb Concordia diagrams for zircon grains from biotite sienogranite (MG, sample HP-41) and biotite alkali-feldspar (SC, sample HP-92). And photomicrograph of zircon from: A) Morro Grande Granite and B) Serra do Carambeí Granite.

The 564 and 569 Ma ages obtained in this work are younger than other granitic stocks from AFB, correlated to the MG and SC, for example, the Apiaí Granite, with U-Pb zircon age of 605 ± 3 Ma (Hackspacker et al., 2000) and the Varginha Granite, with U-Pb zircon age of 603 ± 23 Ma (Basei et al., submitted). However, the ages of MG and SC are similar to the U-Pb zircon ages of 580 ± 3 Ma of the Capão Bonito Granite (Leite, 2003) and of 564 ± 8 Ma of the Serra da Bateia Granite (Janasi et al., 2001) and they constrain main period of the late to post-non-orogenic transition in the AFB.

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