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"A-type" Neoproterozoic magmatism of the Graciosa Province, S-SE Brazil: a review

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Neoproterozoic "A-type" silicic provinces are widespread in continental Brazil. They were emplaced during extensional regimes related to Gondwana amalgamation events. Specific petrological features attest the recognition of two coeval "post-collisional" provinces in southeastern Brazil: Itu and Graciosa Provinces. In the Graciosa Province, granites and syenites build several isolated plutons, plutonic and volcano-plutonic complexes, emplaced in low crustal levels during a relatively short time interval, close to ca. 580 Ma.

Contemporaneous high-K gabbro-dioritic and dioritic rocks as well as some basic and silicic volcanics occur in small proportions. A poor known charnockitic-like rock occurs in at least one pluton. The main granitic and syenitic series crystallized from high-T melts and are grouped in the alkaline and aluminous petrographic associations.

The aluminous association is made mainly of metaluminous to slightly peraluminous biotite (\pm hornblende) monzo- and syenogranites formed under variable oxi-red conditions.

Relatively oxidizing varieties (f_{O_2} close to the TMQAI buffer) bearing allanite, titanite, magnetite and ilmenite are largely dominant over relatively reduced varieties (f_{O_2} close to the QFM) with allanite and ilmenite. *Hypersolvus* metaluminous alkali-feldspar syenites, quartz syenites, and peralkaline alkali-feldspar granites constitute the alkaline association, crystallized in relatively reduced environments ($f_{O_2} \gg$ QFM). Syenites present fayalite, Ca-pyroxenes and Ca- and Na-Ca amphiboles while Na-pyroxenes and Na- and Na-Ca amphiboles are the main mafic minerals in the peralkaline rocks. Chevkinite and ilmenite (\pm magnetite, titanite) are typical accessory minerals.

Late, contrasted hydrothermal alteration environments, styles and products characterize these magmatic series. In general the late- to post magmatic crystallization stages in both associations followed increasing oxidation trends and the late-formed minerals fill in mirolitic cavities and fractures as well as appear interstitial to or substituting the primary phases. Typically, evolved peralkaline alkali-feldspar granites develop an exotic "agpaitic" late- to post-magmatic HFSE- and REE-rich mineral assemblage, while albite granites and a variety of greisens, some of them cassiterite-bearing, are related to biotite granites, mainly of the relatively reduced types.

The main geochemical features of the Graciosa Province are akin to A-type provinces elsewhere. All series are rich in alkalis; the relatively oxidized rocks of the aluminous series evolve from slightly magnesian to typical ferroan while the alkaline series as well as the relatively reduced aluminous series are highly ferroan and Ca-, Sr-, and Ba-poor. As expected, the alkaline series are relatively enriched in the HFS and RE elements; a remarkable positive correlation does exist between these elements and the Agpaitic Index. Available and incoming isotopic data (Sr-Nd-Pb-Hf) of typical rocks from the province point towards contributions from sources relatively evolved. Even the gabbro-diorites and the *hypersolvus* rocks from the alkaline association present crustal-like isotopic signatures and