Catinga suite: W-(Sn-Mo) specialized granitoids in the Brusque Group, Neoproterozoic of the State of Santa Catarina, southern Brazil

Neivaldo A. Castro [1], Miguel A.S. Basei [2] and Alvaro P. Crósta[1]

(1) State University of Campinas, Institute of Geosciences, 13081-970, Campinas, SP, Brazil; (2) University of São Paulo, Institute of Geosciences, C.P. 11348, São Paulo, SP, 05422-970, Brazil

The Catinga Suite (CS) comprises the Catinga and Tijucas stocks, and hosts important metallic ore occurrences currently known in the Brusque Group (BG) (old wolframium mine of Cêrro da Catinga and related Sn-Mo, greisen occurrence; Fig. 1). The BG granitoids can be divided[1] in the Valsungana Suite (porphiritic granitoids of calcium-alkalic affinity) and the Guabiruba Suite (fine-grained to equigranular granitoids, with two-mica portions, alkalic affinity and potentially favourable for W, Sn, Mo, Be and F). More recent studies[2,3] adopted the same division for the granitoids and revealed a minimum age of 647 ± 12 Ma (U-Pb in zircons) for the Valsungana Suite[2].

The mineralization at the Cerro da Catinga mine occurs in quartz veins orientated N65E/70SE, cutting the metasediments of the Botuverá Sequence, generally parallel to its foliation[1,4]. Wolframite is associated with muscovite, tourmaline, pyrite and kaolinized-feldspar. Reserves of 6200 m. tons. of ore (137 m. ton. of WO_3) are mentioned[1,4].

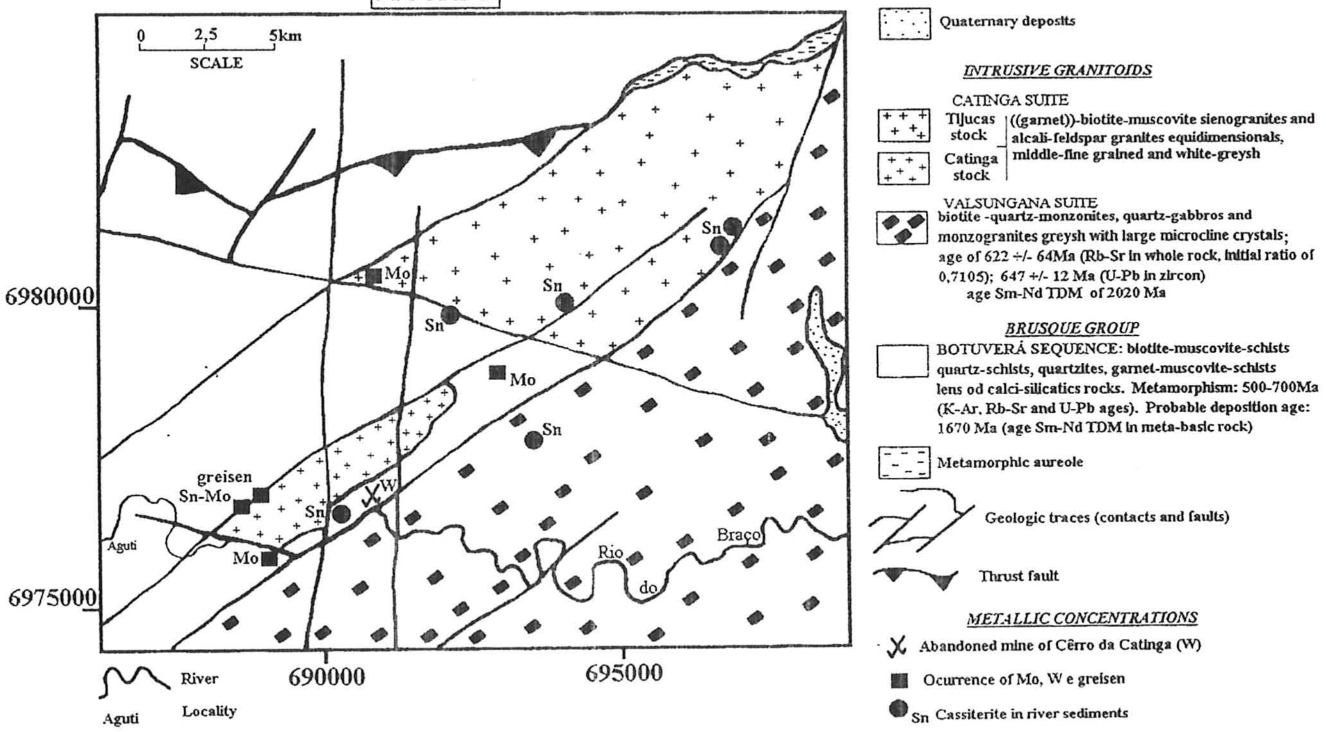
Recent petrographic and geochemical studies have complemented the results previously presented[5], which depict the following characteristics for CS:

i) the CS represent nearly 10% in volume of the intrusive granitoids of the Brusque Group (BG) and comprises two N50-60E-oriented stocks, which are in contact with the Valsungana granitoids and metasediments of the Botuverá Sequence. Occurring close and associated with these stocks are the Cerro da Catinga mine, Sn-Mo occurrences and areas of greisen alteration (Fig. 1);

ii) petrographic characteristics of the CS granitoids include equigranular, isotropic textures and white-greyish colors. The suite comprises garnet-biotite-muscovite sienogranites and alkali-feldspar granites, with albite contributing up to 50% in volume of alkali-feldspar (Fig. 2). Muscovite occurs sometimes as primary crystals and sometimes it does not. In the later case, muscovite constitutes the late accessory, together with chlorite, fine opaques and fluorite (always present);

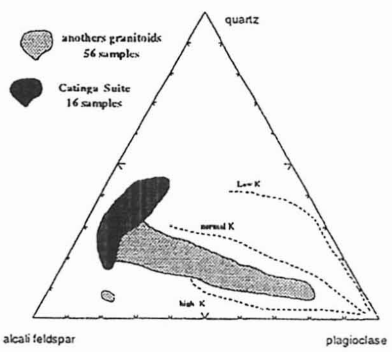
iii) analysis of major elements of the CS reveals higher values of SiO_2 and Na_2O (74-78.5% and 3.5-4.5%, respectively) when

FIGURE 1



compared to other intrusive granitoids of the BG. On the other hand, they showed lower values of CaO, MgO, TiO_2, MnO and P_2O_5. Like other intrusive granitoids of the BG, the CS granitoids also show alkalic characteristics, being placed in the alkalic field of the TAS diagram. This is also shown in the log $(CaO/(Na_2O+K_2O))$ diagram of Brown[6], where the CS and the other intrusive granitoids of the BG are placed in the lower limit of the alkali-calcic serie. The A/NK ratio (around 1) x A/CNK ratio (around 1), also supports this idea, placing the CS very near the peralkalic field;

FIGURE 2: QAP diagram



iv) distribution of the trace elements is characterized by an increase in Rb, Y and Nb and a decrease in Sr, V, Ni and Zn. This increase in Rb, Y and Nb places the CS granitoids in the WPB field of the diagram proposed by Pearce et al.[7] ;

v) the REE pattern found in the CS is unique when compared to other intrusive granitoids of the BG, with virtually no LREE fractionating and a constant negative anomaly in Eu (Fig. 4). The other intrusive granitoids of the BG show a greater fractionating of LREE in relation to HREE and the negative anomaly of Eu is not noticeable.

In conclusion, the CS represents the most evolved granitoid suite in the domain of the GB, with related W, Sn and Mo ore occurrences, as well as areas of greisen-type alteration. Petrographic and geochemical data indicate that these granitoids

FIGURE 3: same fields on the figure 2

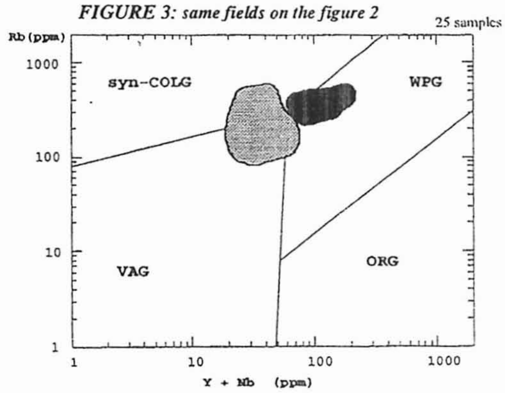
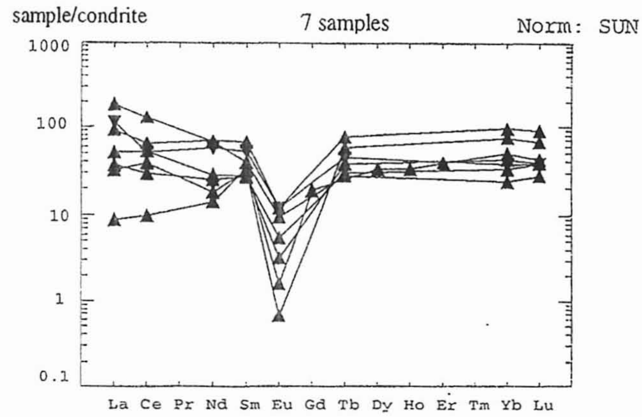


FIGURE 4: **REE patterns for Catinga Suite**



may have been differentiated from the porphyritic terms of the Valsungana Suite through a pronounced fractionating of plagioclase and K-feldspar, possibly under the influence of F-rich fluids (similar to the fractionating scheme proposed by Dostal and Chatterjee[8]). There is, however, a lack of isotopic data to corroborate this evolution. Available isotopic data[2,9] indicate that the majority of the granitoids in the BG were generated under crustal conditions, with initial $^{87}Sr/^{86}$ rations between 0.7105 (Valsungana granite) and 0.7210 (São João Batista granite) and Sm-Nd age around 2020 Ma (Valsungana granite). These conclusions are in accordance with the main characteristics of the CS granitoids, such as a crustal origin and reducing conditions (presence of white-greyish feldspars and brown-reddish biotite), and also in accordance with the type of metalic ore obnrved there (W-Sn-Mo, in contrast with Au-Cu-Pb-Ag, etc., usually found in granites wich have a high mantle signature).

References

1. Trainini, D. R. et al., Projeto Vidal Ramos-Biguaçu. Porto Alegre, DNPM/CPRM, 303 p. (1978)
2. Basei, M.A.S., São Paulo, 190 pp., Ph.D. thesis, IG/USP. (1985)
3. Caldasso, A.L.S. et al., XXXV Congr. Bras. Geol., V. 3, p.1104-1116 (1988)
4. Silva, L.C. et al., Principais depósitos minerais do Brasil. DNPM, V. 2, cap. 33, p.417-426, (1986)
5. Castro, N.A. & Basei, M.A.S., VI Simp. Sul Bras. Geol., p.82-84 (1995)
6. Brown, G. C., In Thorpe, R.S. (ed.). Andesites. John Wiley and Sons, p.437-469 (1982)
7. Pearce, T.H. et al. Journal of Petrology, 25:956-983 (1984)
8. Dostal, J. & Chatterjee, A.K., Chemical Geology. 123:67-88 (1995)
9. Mantovani, M.S.M., et al. Rev. Bras. Geol., 17:263-268 (1987)