PETROGENESIS AND Mo, U MINERALIZATIONS IN EARLY PROTEROZOIC CHARNOCKITES AND GRANITES FROM THE ITABERABA DISTRICT (BAHIA,BRAZIL)

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The surroundings of Itaberaba city, State of Bahia, northeast Brazil, represent a transitional interface between the Archean Jequié Nucleus and Salvador - Curaçá Mobile Belt, and have been affected by deformational, metamorphic-anatectic and granitic intrusion processes at 2.15 Ga (Fernandes et al., 1990, Fernandes, 1991).

The **Itaberaba** and **Pedra d'Água** massifs are the most important granitic bodies in such region. The biotite-garnet granites of the **Itaberaba massif** have been intruded during a deformation phase (Fn+1) which generated the N-S foliations, and their texture registers magmatic flow, subsolidus and solid-state deformation. Petrographic and geochemical data indicate that plagioclase + biotite fractional crystallization has given rise to the lithological diversity in this massif, from porphyroid biotite-granites to hololeucocratic garnet and biotite-bearing differentiates in lenses and dikes. A fine-grained facies registers the same variation and its origin is attributed to quenching processes. An equigranular biotite-garnet facies is present in the massif, but this differentiation scheme can not be applied to it, and there is a possibili-ty of its being not comagmatic with the rest of the massif.

The **Pedra d'Água hypersthene-granite** ("charnockite") contains also biotite and garnet, and has been affected by Fn+1 in solid state. Its mineralogy, relict textures, the paragenesis in its enclaves and fluid inclusions indicate that it has crystallized from an aqueous fluid poor magma, in a granulite facies setting.

A number of **small granitic bodies** can be found over the district. Most of these centimetric to metric bodies lie on Fn+1 foliations, although a molibdenite-bearing granitic dyke has been emplaced along the NW-SE Fn foliation, and folded later by Fn+1 folds. Small N-S granitic dykes intruded in kinzigites show-evidences of mingling between anatectic leuco-somes and allochthonous magmas.

The major and trace elements distribution shows that metamorphism has not changed the chemical composition of these rocks. These granites can be characterized as a leucogranitic, strongly peraluminous silica and alkali-enriched association (Figs. 3, 4).

Trends defined by major and trace elements of these rocks show chemical resemblan-ces to Australian S-type and two-mica French granites, although one can also find analogies with I-type granites and biotite-cordierite granites of mantle-crust hybrid origin.

This granitic association has possibly been generated by anatexis of meta- to peraluminous crustal rocks (including metasedimentary and even tonalitic/dacitic types). An important pelitic or greywacke contribution can be deduced from: i) petrographic features (lack of intermediate or basic components, nature of accessory minerals and enclaves); ii) major, trace-element and REE distribution, with Eu negative anomalies and HREE depletion even in the most "primitive" facies (Fig. 5); iii) high Sr initial ratios (Ro=0,706).

Nevertheless, the granites from the Itaberaba district show calc-alkaline to alkaline transitional features due to alkali enrichment, and share some characteristics with monzonitic series granites. These resemblances can be ascribed either to a subordinate mantellic component or to anatexis of granulitic crust, which may give rise to granites with even A-type affinities. Available experimental data indicate that high P_{CO_2} during anatexis can produce silica and alkali-enriched magmas.

These granites host a number of **molybdenite** showings and **Uranium** enrichment goes up to twenty times the granitic average. Molybdenite deposition took place due to orthomagmatic-pegmatitic and high-T hydrothermal processes, since it is found as disseminations in granites and aplo-pegmatites and in quartz veins. Previous assessment of ore grade has shown it to be uneconomic, and one would not expect to find hidden Mo,U deposits, due to magma dryness and deep intrusion environment. Nevertheless, Mo, U association in these granites can serve as a guide to exploration by spectrometric or cintilometric methods. Molybdenite deposition has occurred at high temperatures (T=720°C, 3.5kb), in the presence of a vapour phase containing CO_2, Cl, (F), as one can deduce from: i) the available fluid inclusion data (Giuliani & Fernandes, 1990); ii) enrichment of SiO_2, Na_2O, P_2O_5, F, Cl, Li, W and possibly U in the molybdenite-mineralized rocks, and high contents of Cl, Pb, Zn, Li, Nb, Zr, U, Th, U/Th in barren granites close to the mineralized area; iii) high HREE contents and negative Eu anomalies in the mineralized granites and surrounding barren rocks (Fig. 5).

The metamorphic host rock do not show U, Mo or incompatible element enrichment. If analogous rocks acted as sources of these magmas, U, Mo concentration must have been favored by low volume of granitic liquids due to high P_{CO_2}. Mo and U enrichment related to a subordinate mantellic magma component can not be excluded.

These rocks have been emplaced in an orogenic environment possibly related to a crustal collision involving the Salvador-Curaçá Mobile Belt, the Jequié Nucleus and the Lençóis Block, according to geotectonic evolution models proposed elsewhere. Geobarometric or gravimetric data to prove west-wards crustal thickening are lacking. Regardless of the geometry of this hypothetical collision zone, the study of these granites and mineralizations has allowed one to conclude that the peraluminous Transamazonian granite lineament linking the Jacobina and Contendas-Mirante belts has a metallogenetic specialization in Be(W,Mo)-Mo(U)-U, from Jacobina southwards to Itaberaba and Contendas-Mirante respectively.

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FIGURE CAPTIONS

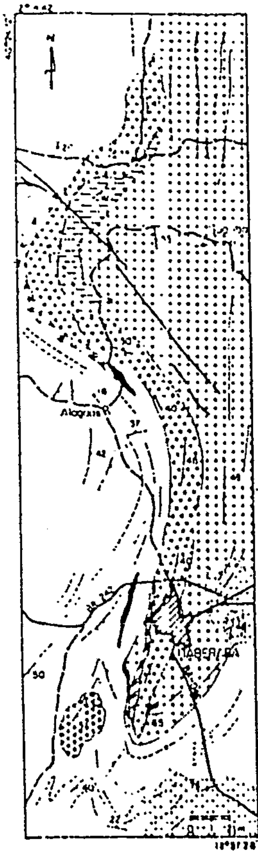
FIG. 1 - 1-Porphyroid biotite-granites; 2-Even-grained garnet-biotite granites; 3-Fine-grained biotite granites: 4-Hornblende-biotite leucogranites; 5-Hyperstene-biotite±garnet granites; 6-Biotite even-grained granites; 7-Biotite±garnet±hypersthene granites with gneissic schlieren and enclaves; 8-Hypersthene-hornblende gneisses of tonalitic to granitic composition; 9-Biotite-garnet-cordierite-sillimanite (±spinel±orthoamphibole) gneisses with amphibolites and granitic leucosomes.

FIG. 2 - 1-Pedra D'Água Massif; 2-Itaberaba Massif; 3-Minor granitic bodies. A-Alkali granites; B-Sienogranites; C-Monozogranites; D-Granodiorites. (Fernandes, 1991, after La Roche et al., 1980).

FIG. 3 - I=Leucogranites. Simbols as in Fig.3

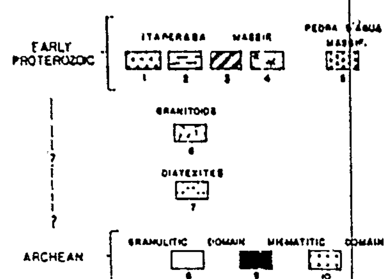
FIG. 4 - I=Boundary defined by Irvine & Baragar (1971); Ii, boundary defined by Irvine & Baragar (1971, page 532); K=boundary defined by Kuno (1966); R=Uncertainty due to analythical methods (Richwood, 1989). (Fernandes,1991, after Rickwood,1989).

FIG. 5 - Chondrite-normalized REE (Fernandes, 1991, after Evensen et al., 1978) A-Itaberaba Massif.(1)-Porphyroid biotite-granite; (2) - Pegmatitic biotite-leucogranite ocurring as lenses in (1). (3)-Garnet-biotite granites (fine-grained facies); (4)-Garnet-biotite even-grained facies. B-Pedra D'Água Massif (5), (6) southwestern border hypersthene-biotite granites; (7) Barren granites close to molybdenite mineralization site; (8) Silica-enriched molybdenite-bearing

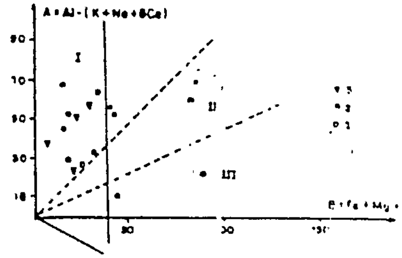


ITABERABA

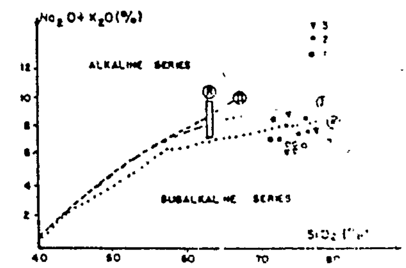
(1)



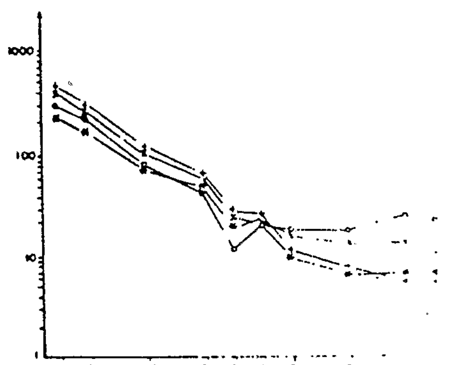
EARLY PROTEROZOIC
ITAPERABA MASSIF
PEDRA D'ÁGUA MASSIF
GRANITOIDS
DIATEXITES
ARCHEAN
GRANULITIC DOMAIN
MIGMATITIC DOMAIN



A = Al - (K + Na + 2Ca)



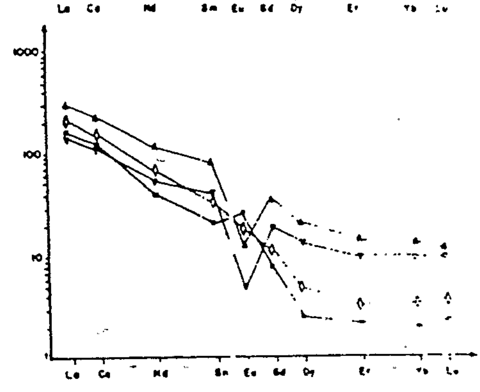
$Na_2O + K_2O$ (%)
ALKALINE SERIES
SUBALKALINE SERIES
SiO_2 (%)



La Ce Nd Sm Eu Gd Dy Er Yb Lu

(2)

$R_2 = 6Ca + 2Mg$
$R_1 = 4Si - 11(Na + K) - 2(Fe + Ti)$



La Ce Nd Sm Eu Gd Dy Er Yb Lu

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