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Sr AND Pb ISOTOPE EVIDENCE FOR THE ORIGIN OF SKARN, SULFIDES AND FLUOR MINERALIZATIONS RELATED TO THE ITAOCA GRANITOID, SE BRAZIL.

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This study was undertaken to understand the skarn, fluor and sulfides mineralizations genesis, which occur inside the Itaoca body in southeastern Brazil, based mainly on Sr and Pb isotopic evidences.
The Itaoca granite is situated 350 km southwest of Sao Paulo city, and it's intrusive into mid-Proterozoic metasedimentary sequences, affected by late-Proterozoic low grade metamorphism of Ribeira Fold Belt. The mineralized granitoid is hosted by phyllites, carbonaceous phyllites, schists, quartzites, marbles and metalimestones. These terrigenous and carbonatic sediments developed within a back-arc basin environment during the time period 1.8 - 1.5 Ga ago (1). Two metamorphic episodes have been overprinted in these sequences, the older one between 1.4 to 1.1 Ga., and the younger around 700 Ma (2).
These metasediments include some fluorites and epigenetic and stratabound Pb-Ag ore deposits, some of them located near the contact with Itaoca Granitoid.

The studied granitoid comprises monzogranite, quartz-monzonites, quartz-syenites and granites corresponding to a high-potassium peraluminous calc-alkaline trend. Metasomatic alteration processes produced albitized rocks and transitional types ranging from microcline-rich granites to albitites. In some places, mainly related to shear zones, there are greisens derived from post-magmatic fluids. Metasedimentary and subordinated metabasic volcanic rocks are found in the middle of granitic body as roof pendant. Skarn type mineralizations appears associated with this roof pendant. The skarnization is related to the post-magmatic processes which took place within the granitoid. The skarn deposits are grouped in two major types, garnet-pyroxene skarn (endoskarn) and garnet-wollastonite-skarn. Scheellite-Powellite and wollastonite are the main ore minerals (3).

Samples from the pink quartz-monzonites yielded an Rb-Sr isochronic age of 692+/-27 Ma, with an $^{87}Sr/^{86}Sr$ initial ratio of 0.7096+/-0.0002. This age is considered as the time of the main granitic emplacement. On the other hand, samples from metasomatized monzogranites, when plotted in Rb-Sr isochronic diagram, exhibit considerable dispersion, nevertheless some points seem to define a linear array with a slope wich correspond an age of 620+/-79 Ma, with the Sr initial ratio around 0.710. This preliminary age

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could be estimated as the epoch of the post-magmatic processes to which the skarnization is linked. The high initial ratio value obtained for the granitoids suggests a crustal source for their parental magmas.

The $^{87}Sr/^{86}Sr$ ratios of calcite gangue skarn fall in a relatively narrow range (0.7103-0.7109),which coincide with the values obtained for the host marbles (0.7100-0.7110). Nevertheless the Sr isotopic compositions of the wollastonite from the skarn (0.7092-0.7093) are less radiogenic than the host marbles, and are in agreement with the Sr isotopic composition of the granitoid at 650-600 Ma. This fact suggests that the Sr of the wollastonite skarn mineralizing fluids may have derived mainly from the granitoid intrusion responsible for the skarn. The combined evidences of Sr isotope determinations together with petrographic and geochemistry data (3) allow us to consider a magmatic origin for the skarn mineralization.

Within some shear zones which cross cut the Itaoca Granitoid fluorite mineralizations appears associated with mylonite-gneisses, quarz veins and greinses. In general these mineralizations comprise disseminated, yellow, white and violet fluorites. These fluorite veins have $^{87}Sr/^{86}Sr$ isotopic compositions around 0.7114, higher than that of the skarn fluids. Considering that the host metasedimentary units include abundant fluorites ore deposits, it is possible that the fluids have been leached from the fluorites occurrences hosted by metalimestones.

Using the method for dating mineralizations by the Rb-Sr system (4), the fluorite forming-age has been calculated about 520+/-30 Ma, which coincides with the estimated age of the main time of shear zones motion.

Associated to the quartz-veins hosted in fractures of the Itaoca Granitoid, some sulfide mineralizations occur. The veins chiefly consists of quartz, pyrite, chalcopyrite, pyrrotite, galena and molibdenite. In some places sulfide mineralizations appears as dissemination within breccias with tourmaline.

In order to understand the sulfide genesis, Pb isotopic compositions were carried out on galenas from these mineralized quartz veins and from the epigenetic and stratabound Pb-Ag ore deposits which appears within the host metasedimentary rocks.

The Pb isotopic ratios of the sulfides mineralizations within the granitoid are very similar that of the Pb-Ag ore deposits hosted in metasedimentary units, and the values when plotted in standard lead isotopic diagram fall within a small area between the fields for epigenetic and stratabound deposits, which indicate that the sulfide mineralizations show the same Pb isotopic pattern found in the nearby ore depostis. These observations are broadly consistent with the conclusions that the supracrustals units are the source of lead and possible other metals of sulfide mineralizations inside the granitoid. Thus, it can be considered that during the late Proterozoic event, remobilizations of hydrothermal

solutions was a more significant metallogenetic process for the formation of the studied sulfide mineralizations.

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