Sr AND S ISOTOPIC COMPOSITIONS FROM THE CAMPO LARGO AURIFEROUS DISTRICT, PARANÁ STATE, SOUTHERN BRAZIL

Jefferson de Lima Picanço[1] and Colombo C. G. Tassinari[1]

[1]Instituto de Geociências, Universidade de São Paulo, Brazil. jpicanco@usp.br

Keywords: Sr and S isotopes, geochronology, gold deposits, granitoids

INTRODUCTION

The auriferous deposits in the Campo Largo area are located in the southern part of the Apiaí fold belt, Paraná State, Brazil. These deposits are related to shear zones hosted by the Passa Três stock, a post-tectonic granitoid body intrusive in metavolcano-sedimentary sequences of the Açungui supergroup.

GEOLOGICAL SETTING

The granitoid stock has a NE-elongated shape, with 5 km^2 of area. Strike slip shear zones related to the Cerne fault, an important regional shear zone, control its emplacement. Cataclastic deformation occurs along fractures, and the rock takes the appearance of a crackle breccia. The Passa Três stock has dominant syenogranitic composition, and consists of major quartz, perthitic microcline and minor albite, displaying an inequigranular, medium to coarse-grained hypidiomorphic texture. The more common mafic minerals are biotite an amphibole, strongly substituted for chlorite, hematite, sphene and rutile. Are also present trace to accessory pyrite, with exsolved chalcopyrite, hematite, rutile and goethite. Carbonate minerals, like ferrous dolomite and calcite occurs as fine crystals with quartz, introduced along conjugate veinlets.

The granitoid body has undergone a pervasive alteration, responsible for microclinization, muscovitization, chloritization and carbonatization. These alteration processes could have obliterate the chemical characteristics of the granitoid body, that had presumably a high potassium calc-alkaline or even shoshonitic signature. The REE-normalized diagram shows an steep pattern, with high depletion on heavy rare earth and no europium depletion.

The auriferous quartz-sulfide veins are better developed in shear zones internal to the stock, which the most important ore zone now exploited are the Barreiro zone. However, there are some subeconomical veins enclosed in the host supra-crustals. The ore veins should have until 1,5 m thick in transtensional positions (N50-60W), attenuate to centimeters in tranpressional ones (N70-80E). In all these veins there are the development of illite-rich (argillic) and muscovite-rich (phillic) fringes. Hydrothermal breccias, vugs and cavities are also common. The gangue minerals comprise quartz, muscovite, fluorite, dolomite, calcite and minor barite. The ore mineralogy consists of pyrite, chalcopyrite, bornite, gold and aikinite. The gold is mostly related to pyrite fractures.

ISOTOPE GEOLOGY

The results presented here correspond a new Rb/Sr whole-rock determinations of the host syenogranitic body slightly affected by the hydrothermal processes. Were also presented $^{87}Sr/^{86}Sr$ on carbonate and sulfides and ^{34}S on sulfides from the main mineralized zone.

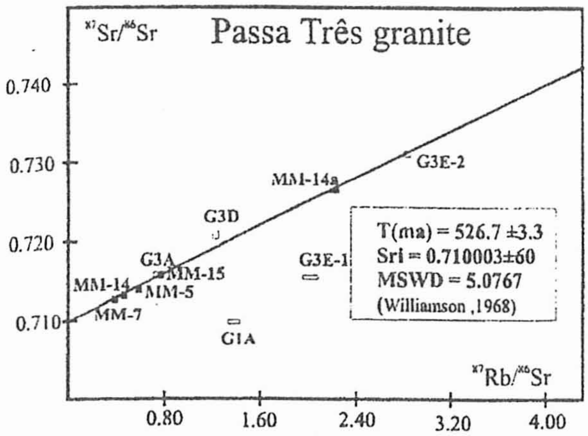

Figure 1 – Rb/Sr isochronical diagram for the Passa Três granite. The filled squares represent the less alterated samples; the unfilled represent the most alterated samples

The samples of syenogranites and one microgranular enclave (MM-14a) plotted in a Rb/Sr isochronic diagram show an age of 527 ± 3 ma (Sr_i 0,71003 ± 60, MSWD 5,07 – figure 1) for seven points. The sample G3E-2, that exhibits strong evidence of argillic hydrothermal alteration, also fit the isochron. On the other hand, the samples G1A, G3D and G3E-1 were excluded of age calculations, because they showed evidence of open system behavior. The high value of the initial ratio may denote the presence of crustal components in the syenogranitic magma genesis.

Seven mineral separates of calcite and sulfides analyzed for $^{87}Sr/^{86}Sr$ are shown in table 1 . The data of measured Sr (Sr_m) from carbonates are constrained between 0,711- 0,713. There is no evidence of spatial or temporal relationship between these results, and all of them are higher than the initial ratio of the granitoid (0,710). The lowest Sr_m values for sulfides are around 0,71160, close to carbonate values. The higher ones, between 0,713 - 0,71786, represent sulfide material from argillized zones and also from gouge of late faults. There are also differences between values from pyrites and data from chalcopyrite, which usually has higher Sr_m values. Some values from the gouge zones would have small quantities of Rb, by the influence of latest K-rich fluids.

Two data from ^{34}S of pyrite and chalcopyrite are also shown in table 1. These data has an slightly negative value, and were interpreted as a magmatic origin. On the other hand, $^{16}O/^{18}O$ data on quartz from the granitoid and the altered zone obtained by Piekarz (1992) suggest some influence of crustal material, with values between 8-12 ‰.

CONCLUSIONS

The Rb/Sr ages (527 ± 3 Ma isochron) and the hydrotermal alteration are coeval, showing that the hydrothermal process occurred practically during the granitoid emplacement. The high granitoid Sr_i (0,710) indicates the presence of crustal materials in parental magma. The Au mineralization seems to be orto-magmatic, based on the few ^{34}S data (from -1.7 to -0.97). Nevertheless, the $^{16}O/^{18}O$ and $^{87}Sr/^{86}Sr$ isotopes in gangue minerals also suggest the contribution of supracrustal fluids. These results suggest a complex interaction occur between hydrothermal fluids and the host-rocks in both granitoid emplacement and in the generation of Campo Largo auriferous veins.

REFERENCES

Piekarz, G.F., 1992. O Granito Passa Três e as mineralizações auríferas associadas. Campinas. 221 pp. Dissertação. UNICAMP 1992.

Williamson, I. 1968. Least-squares fitting of a straigh line. Canadian Journal of Physics. 46:1845-1847.

Table 1: Sr and ^{34}S results from of Campo Largo auriferous District

N^{O} LAB	sample	Rock	MAT	Rb(ppm)	Sr(ppm)	$^{87}Rb/^{86}Sr$	$^{87}Sr/86Sr$	$^{34}S_{CDT}$
13629	MM-5	granite	WR	168.8	845.2	0.5784±48	0.71413±9	
13630	MM-7	granite	WR	133.8	1028.8	0.3764±31	0.71281±9	
13635	MM-14	granite	WR	152.6	972.5	0.4543±38	0.71337±9	
13636	MM-15	granite	WR	158.3	632.3	0.7251±61	0.71588±9	
13638	MM-14a	Enclave	WR	512.59	669.33	2.2205±309	0.72637±8	
13631	G1A	Altered granite	WR	254.3	533.5	1.3800±390	0.70980±9	
13632	G3A	Altered granite	WR	191.4	727.3	0.7621±63	0.71581±9	
13633	G3D	Altered granite	WR	264.8	682.4	1.1246±94	0.72005±9	
13634	G3E-1	Altered granite	WR	244.8	351.2	2.0210±57	0.72546±9	
13639	G3E-2	Hydrothermal rock	WR	132.4	136.2	2.820±80	0.73120±10	
13733	MP-2	Qz-vein	Carb				0.71342±10	
13735	G4-C	Altered granite	Carb				0.71271±8	
13736	MP-10	Carbonate vein	Carb				0.71180±7	
13737	MP-11	Carbonate vein	Carb				0.71327±8	
13738	V1C	Qz-vein	Carb				0.71265±9	
13739	MM-23	breccia	Carb				0.71171±6	
13740	MM-24	Carbonate vein	Carb				0.71103±9	
13831	MP-1	Qz-vein	Py				0.71229±11	-1.7
13832	MP-1	Qz-vein	Cpy				0.71560±15	
13833	MP-2	Qz-vein	Py				0.71160±9	
13834	MP-2	Qz-vein	Py				0.71692±19	
13835	V-13	Qz-vein	Py				0.71159±09	
13836	V-14	Qz-vein	Py				0.71190±09	
13837	MP-6	Altered granite	Py				0.71318±08	
13838	MP-7b	Qz-vein	Cpy				0.71204±12	-0.97
13839	MM-16	Qz-vein	Py				0.71786±12	
13840	MM-25	Fault gouge	Py				0.71479±9	
13841	MM-27	Fault gouge	Py				0.71234±10	

WR: whole-rock; carb: carbonate; py: pyrite; cpy: chalcopyrite.