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THE TRACE ELEMENT CONTENTS OF MUSCOVITE AND K-FELDPAR AS PROSPECTION AID FOR TA AND NB-RICH PEGMATITES IN THE PEGMATITE DISTRICT OF ARAÇUAÍ (MINAS GERAIS, BRAZIL)

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INTRODUCTION

The Araçuaí Pegmatite District (APD) is found in the State of Minas Gerais at about 500 km north of Belo Horizonte (Fig. 1). It is part of the Eastern Brazilian Pegmatite Province (EBPP) as defined by Paiva (1946), Putzer (1976) and Correia Neves et al. (1986).

In the APD, many very different pegmatites are found very close to each other. The composition and texture range from simple zoned feldspar-mica and extremely spodumene-rich pegmatites to well zoned rare-metal pegmatites. The whole area is covered by laterites and the pegmatite bodies do not form large outcrops. Therefore, quick and cheap prospection methods are needed in order to discriminate pegmatites which are highly prospective for Ta and Nb mineralisation from barren pegmatites.

The pegmatites of the APD are found mostly in Proterozoic paragneisses. The late to post-tectonic granitoids are coeval with the pegmatites and form a large part of the APD. The granitoids range in composition from pegmatite granites to two-mica leucogranites, biotite granites and subordinate granodiorites (Correia Neves et al. 1983, Pedrosa Soares et al. 1987, Silva et al. 1987). Rb-Sr whole-rock isochrons indicate that the granites are of Cambrian to Ordovician age (Siga jr. 1986, Sá 1977). Peraluminosity and initial $^{87}Sr/^{86}Sr$ ratios of 0.7113 and 0.7125 (Siga jr., 1986), define them as S-type granites. No pegmatite aureoles can be found around the pegmatite granites although they could be proposed as parental granites. Neither the shape, nor the distribution of the pegmatites show any relation to lineaments as deduced from aerophotographs.

The pegmatites of the APD are actually the only spodumene, i.e. lithium-ore producers in Brazil.

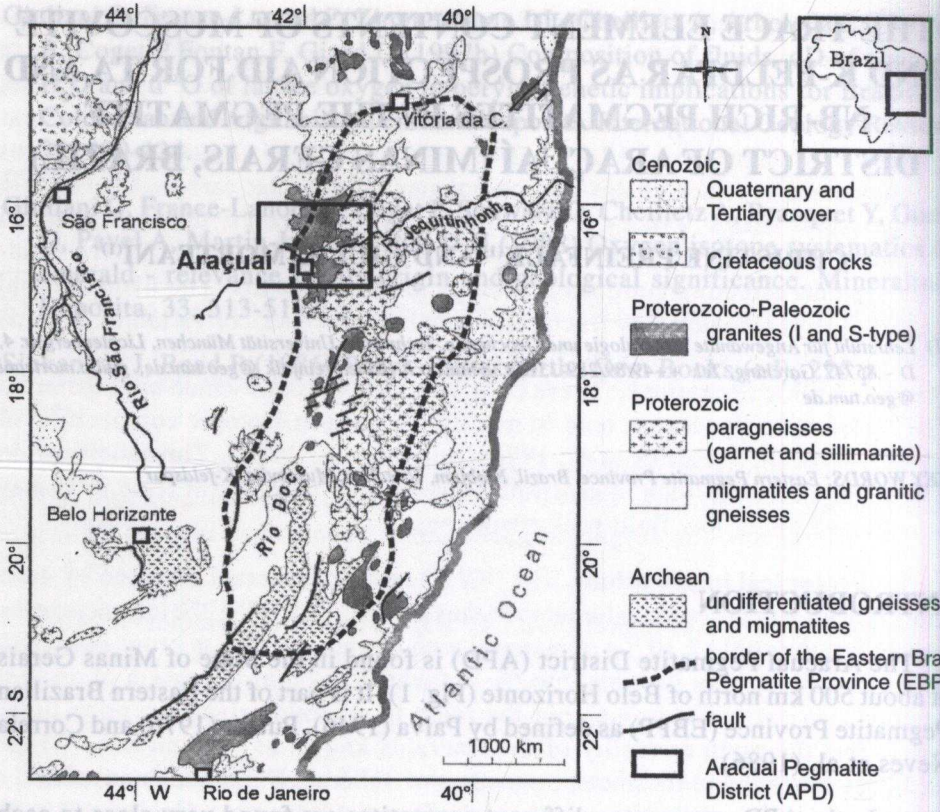


Fig. 1: Geological sketch map showing the Eastern Brazilian Pegmatite Province (EBPP) as defined by Paiva (1946), Putzer (1976), and Correia Neves et al. (1986) as well as the localisation of the Araçuaí pegmatite district.

Beus (1966), Cerny (1982, 1991, 1994), Cerny et al. (1985), Cerny & Burt (1984), Gaupp et al. (1984), Gordiyenko (1970, 1971, 1976), London (1990), Solodov (1971), and Trueman & Cerny (1982) suggest that the trace element contents in K-feldspar and muscovite are very useful geochemical indicators to estimate the potential for Nb and Ta mineralisation in pegmatites.

According to field observation, 35 individual pegmatites were sampled and 230 K-feldspar and 90 muscovite samples were analysed. The analyses of major and of many trace elements in K-feldspar and muscovite could be performed in the required short time with a fully automated Siemens XRF.

The use of the trace elements will be demonstrated on hand of Cs vs. K/Rb and Cs vs. Ta plots for K-feldspar and muscovite.

In Fig. 2 the Cs content is plotted versus the K/Rb ratio for K-feldspar together with the boundaries discriminating between significant Be, Li-Be and Li-Cs-Be-Ta mineralisation according to Trueman & Cerny (1982). The data which are found in the field indicating an economic Cs-Li-Be-Ta mineralisation correspond

to three of the studied pegmatites (Igrejinha, Cachoeiro and Jorge). This makes them interesting targets for further exploration and mining for Ta and Nb. This diagram can be used also to characterize the potential for Cs and Li mineralisation. The pegmatite of Igrejinha results to be extremely rich in pollucite and contains also consistent amounts of spodumene. The feldspar data of the Urubu pegmatite, which is well mineralised with petalite, pollucite, amblygonite, and beryl, plot in the area which defines pegmatites with a high potential for a viable Li and Be mineralisation. Most muscovite samples of the studied pegmatites plot in the Cs vs. K/Rb diagram in the field which defines the highly differentiated rare-element class pegmatites according to Cerny & Burt (1984) (Fig. 3). Only a few muscovite samples of the pegmatites of Arqueana, Limeira, Campinus, Paineira, João Pego, Sta. Clara, Bruno and Maxixe plot in the field of the muscovite-class pegmatites.

In Fig. 4, the Cs content is plotted versus the Ta content for muscovite. With increasing Cs content also Ta values increase. This indicates an increase of Ta content in muscovite with increasing differentiation. Many muscovite samples have Ta contents above 20 ppm indicating a potential for Ta mineralisation according to Beus (1966). Only a few muscovite samples show Ta contents above the much more restrictive limit for a potential Ta mineralisation (65 to 75 ppm) set by Gordiyenko (1970).

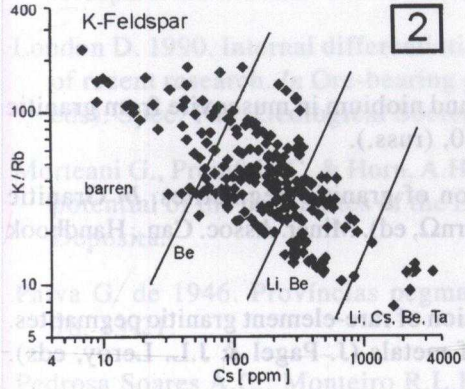
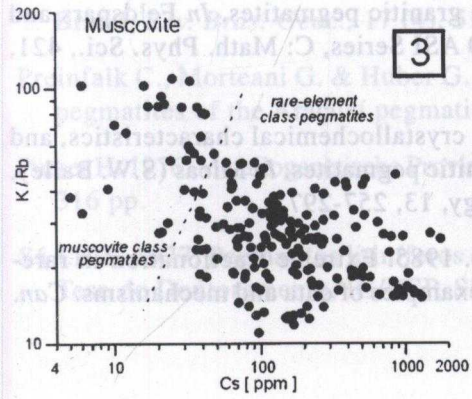
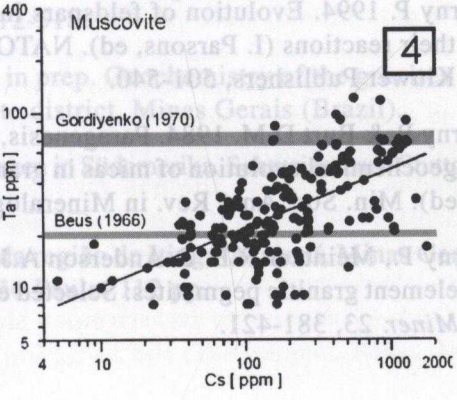


Fig. 2. Plot of Cs versus K/Rb for K-feldspar. The discriminating lines aregiven according to Trueman and Cerny (1982).

Fig. 3. Plot of Cs versus K/Rb in muscovite. The discrimination line is given according to Cerny & Burt (1984).

Fig. 4. Plot of Cs versus Ta in muscovite with best tit line. For turther explanation see text.





CONCLUSION

Geochemical and field data demonstrate that the granite-pegmatite system of the APD corresponds in its derivation, evolution and mineralisation very closely to the LCT pegmatite family with its typical enrichment in Li, Rb, Cs, Be, Sn, Nb<Ta, B, P, and F as defined by Cerny (1991) (Preinfalk et al. in prep.).

Fractionation diagrams, such as Cs vs. K/Rb for muscovite and K-feldspar can be used to select the most differentiated pegmatites of a huge pegmatite population as present in the APD. Looking in detail at these diagrams individual pegmatites display an internal differentiation which is almost as extensive as that displayed by the whole pegmatite district. The Ta contents in muscovite give a hint for an economic Ta and Nb mineralisation of the APD.

A comparison with the geochemical data from the other pegmatite districts of the eastern Brazilian pegmatite province shows that the pegmatites of the Araçuaí pegmatite district have the widest range in differentiation up to Li-Be-Cs-Ta rare-element class pegmatites (Morteani et al. in press). This correlates well with the fact that the APD district is not only the leader in Nb and Ta mineralisation, but also the only source of lithium (spodumene) and cesium (pollucite) in the Eastern Brazilian Pegmatite Province.

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