Cassiterite from petalite-bearing veins of the Barroso-Alvão pegmatitic field: preliminary study

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ABSTRACT

Barroso-Alvão pegmatitic field is known for having a very large number of aplite-pegmatite bodies either crosscutting metasediments or intruded in granite (sparsely in the biotite granite and more frequently in the two-mica syntectonic granite). Not all vein types were studied yet and previous studies gave more importance to the Li enriched bodies. In order to understand the field as a whole, more studies are being carried out in the other types of veins. Meanwhile, cassiterite from petalite-bearing veins was studied and characterised and some preliminary data is given.

Keywords: *Cassiterite, granitic pegmatites, Barroso-Alvão pegmatitic field, fluid inclusions.*

INTRODUCTION

Barroso-Alvão pegmatitic field is well known for a large number of pegmatitic bodies. While working on a programme of regional mapping and granite petrology, one of the authors (F N) identified lithium-bearing veins (with spodumene and lepidolite). Since then, several geochemistry and fluid inclusion studies were carried out, having spodumene-bearing aplite-pegmatite veins as the main object of study. Presently the other vein types are also being studied in order to have a full understanding of the entire pegmatitic field. In this study some preliminary data on cassiterite from petalite-bearing aplite-pegmatite veins is given.

GEOLOGICAL SETTING

The Barroso-Alvão pegmatitic field is located in the western part of the Iberian Peninsula, "Galicia-Tras-os-Montes" geotectonic zone defined by Farias *et al*., 1987. The dominant rock types encountered in the most part of the field are Silurian in age and of metamorphic low-grade to medium-grade: quartziferous schists and micaceous schists with minor interbedded black schists. These rocks were affected by at least three episodes of Hercynian deformation and maximum conditions of metamorphism correspond to the andalusite isograd (Noronha *et al*., 1981). Surrounding the field, there are three different types of synorogenic granites. They all are of Hercynian age and classified according to Ferreira *et al*. (1987): biotite granites (syn-F_3), two mica granites (syn-to late-F_3) and post-tectonic biotite granites (post-F_3). The lithium pegmatitic bodies were genetically related with the adjacent syn- to late tectonic two-mica granites (Lima, 2000).

DIFFERENT TYPES OF VEINS

The field contains numerous pegmatitic granitic bodies that sharply crosscut the Silurian metasediments. In general, these bodies can be grouped into barren pegmatitic veins, pegmatitic veins with beryl, pegmatite veins with cassiterite and pegmatitic veins with lithium minerals: spodumene, petalite and lepidolite. According to Černý & Ercit (2005), the Li-bearing veins were classified as belonging to the LCT family, Rare element (REL) class, REL-Li subclass, complex type, spodumene subtype, petalite subtype or lepidolite subtype.

Besides the veins intruded in the metasedimentary rocks described above, it is also possible to identify some pegmatitic bodies throughout the synorogenic two-mica granite and very sparsely in the biotite granite. In these veins muscovite appears as dominant mica; biotite occurs together with tourmaline (schorl) and spessartine-rich garnet is present as a minor phase and may outline a crude layering; beryl is a rare accessory mineral (Charoy *et al*., 1992).

PEGMATITIC BODIES WITH CASSITERITE

Charoy *et al*. (1992) describes lepidolite aplite-pegmatite veins exhibiting low-grade tin mineralisation (0.1 to 0.3 vol. %). Those veins were mined on a small scale after the Second World War, wherever argilitic alteration made digging by hand possible.

After some work developed during a research project, cassiterite was also recognized as a minor mineral phase in petalite-bearing veins (Lima *et al*., 2003). Comparative bulk analyses from Li-bearing veins are shown in Table 1. Sn contents are higher in the lepidolite and petalite subtype veins.

TABLE 1. Bulk analyses of the three Li-bearing veins. (AL 91 data from Lima *et al*. 2003. CHN 5 and CHN 26 from Charoy *et al*., 1992). *tr.: below detection value. nd.: non determined.*

Wt %	Petalite subtype (AL 91)	Spodumene subtype (CHN 5)	Lepidolite subtype (CHN 26)
SiO_2	71.05	73.15	70.13
Al_2O_3	17.74	16.14	17.38
Fe (total)	0.18	0.81	0.26
MnO	<0.02	0.04	0.08
MgO	0.02	0.15	tr.
CaO	0.04	0.19	0.17
Na_2O	2.58	2.45	4.89
K_2O	3.58	3.54	2.85
TiO_2	<0.04	tr.	tr.
P_2O_5	0.71	0.40	0.70
F	nd.	0.03	0.99
LOI	1.99	2.12	2.15
Total	97.89	99.01	99.18
A/CNK	2.16	1.95	1.56
Li (ppm)	8200	6270	3565
Rb (ppm)	1134	770	2393
Sn (ppm)	667	45	728

In petalite-bearing veins, cassiterite appears randomly distributed and based on textural relation with the other mineral phases, it is considered primary. The studied mineral is deformed, as described by Borges *et al*. (1979), and fractured (in some cases fractures are filled by aplitic material from the matrix). It exhibits typical idiomorphic crystals < 1 cm in length and the familiar "knee" twin.
Under the microscope it is possible to identify an internal chromatic oscillatory zoning with strong pleocroism from pale yellow to dark reddish brown (Figure 1) and a less coloured area with mineral inclusions from the ferrocolumbite-ferrotantalite series and feldspars (Figure 2).

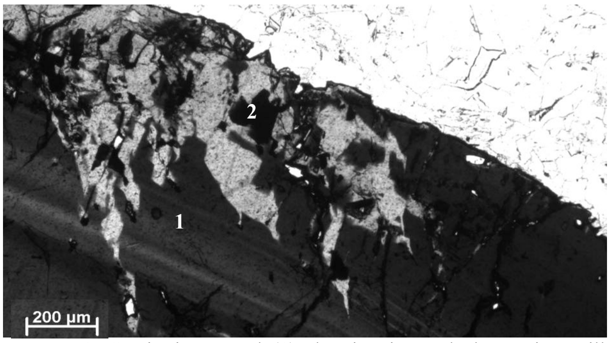

FIGURE 1. Cassiterite crystal (1) showing internal chromatic oscillatory zoning and a less coloured zone with ferrocolumbite inclusions (2). Transmitted light.

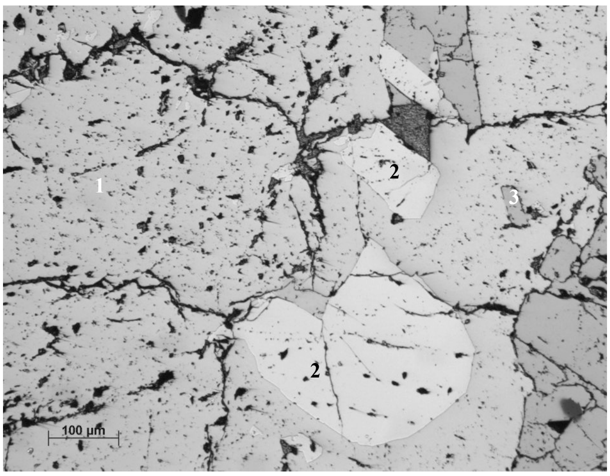

FIGURE 2. Cassiterite crystal (1) with mineral inclusions: ferrocolumbite-ferrotantalite (2) and feldspar (3). Reflected light.

Preliminary fluid inclusions (FI) studies in cassiterite allow us to recognise primary aqueous–carbonic fluid inclusions. Microthermometry and micro-Raman spectroscopy analysis performed in these fluid

inclusions reveal that they belong to the H_2O–CO_2–(N_2–CH_4–NaCl) system. The micro-Raman spectroscopy allowed also the distinction of two different characteristics in these FI. Those located in the oscillatory growing zones have less CO_2 and more N_2 than the FI located near the ferrocolumbite inclusions. The CH_4 content is constant for both cases.
When comparing with results obtained from fluid inclusions hosted in quartz, it is possible to say that although they belong to the same H_2O–CO_2–N_2–CH_4–NaCl system, there is a significant variation in the water phase proportions among the fluid inclusions and there volatile phase is more enriched in CO_2.

DISCUSSION

Cassiterite mineralisation from petalite-bearing veins is considered of primary crystallisation and exhibits deformation. By optical observation and micro-Raman spectroscopy analysis, minerals from the ferrocolumbite-ferrotantalite series and feldspars were identified. Further studies based on microprobe analyses are required in order to study chemical variation in the oscillatory growth zones and at the less coloured zones where ferrocolumbite-ferrotantalite was identified.
Preliminary studies in fluid inclusion hosted in cassiterite belong to the H_2O–CO_2–(N_2–CH_4–NaCl) system as well as those hosted in quartz. Thus the last ones have a CO_2 enrichment, N_2 and CH_4 ratios are similar. Further microthermometric and micro-Raman data are required to establish a relation between these minerals.

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