THE STUDY OF FLUID INCLUSIONS IN PETALITE-BEARING PEGMATITE-APLITE VEINS OF THE BARROSO-ALVÃO FIELD (NORTHERN PORTUGAL)

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Introduction

The Barroso-Alvão field (Northern Portugal) contains a large number, more than a hundred, of pegmatite-aplite veins. These pegmatite-aplite bodies are hosted by metasediments Silurian in age, in andaluzite isograde, of the southern part of the Middle Galicia-Trás-os-Montes geotectonic zone.

Some of these pegmatite-aplite bodies are mineralized either with spodumene (Charoy et al.1992, 2001) or with petalite as the main lithium phases. Microthermometric and Raman studies have been carried out on fluid inclusions (FI) from spodumene and quartz of spodumene-bearing veins, and the results were published by Dória et al. (1989), Charoy et al. (1992), Lima et al. (1999, 2001) and Lima (2000).

In this study we present the preliminary results on petalite-hosted FI from petalite-bearing veins recently discovered in the referred pegmatite-aplite field. These FI are smaller, bear less and smaller solids and also posses less CO_2 than the spodumene-hosted FI. The majority of the solids are carbonates (mainly zabuyelite), that are regarded as daughter minerals resulting of the reaction between the carbonic fluid and the host mineral, as described by Anderson et al. (2001) as in his spodumene case.

Mineralogy

The fundamental rock-forming assemblage of these petalite-bearing pegmatite-aplites veins is fairly simple and mostly granitic in bulk composition.

Currently we can find three types of petalite occurrences. The first is represented by small millimetric crystals presented in spodumene-bearing veins. The second type is represented by isolated crystals presented in small veins that crosscut the spodumene-bearing veins. The third type is represented by larger centimetric crystals presented in petalite-bearing veins. This petalite rarely presents the isochemical breakdown to spodumene-plus-quartz intergrowths (squi) as the consequence of decreasing temperature on nearly isobaric conditions (London, 1984).

Montebrasite is also present in a small amount. A subsolidus mineral alteration is marked by incipient corrosion of petalite by K-feldspar and/or eucryptite.

Fluid Inclusion studies

The present study is about the third type of petalite. Petalite, like spodumene, has complex multiphase fluid inclusions that show some prismatic elongated morphology and are mainly, but not exclusively, arranged parallel to the longest axis of the host mineral, ranging in size from 5 up to 40 μm in length. The volume of solids or vapour vs. global volume is highly variable. Very few inclusions are three phase CO_2-bearing, at room temperature, with apparently variable ratios of CO_2/H_2O.

Such petalite-hosted FI that in 2D are interpreted as primary or pseudosecondary, are opposed to much smaller clearly secondary inclusions in irregular trails which transect the host mineral (not studied in this work). Compared with the spodumene-hosted FI, they are smaller, with less and smaller solids. Anderson et al. (2001) with 3D studies consider that the majority of inclusions in spodumene are secondary, or possibly pseudo-secondary, in origin.

A microthermometry program is currently in progress, and the preliminary results are presented in table I, together with the results of FI in the spodumene obtained in the same pegmatite-aplite field.

Table I - Microthermometric results of FI in spodumene and petalite of the Barroso-Alvão field (spodumene FI values are a compilation of results presented in Dória et al. 1989, Charoy et al. 1992, Lima 2000 and Lima et al. 1999, 2001).

Min-Eral	Vein	FI.Type	Flw min/ max	Te	$TmCO_2$ min/max	TmIce min/max	TmC min/ max	$ThCO_2$ min/ max	Th min/ max
Spodumene	ALJ	Lc-w-s / Lc-w	30/	-50	-60,6/	-6/	-4,3/ 5,3	17/19,1L	292/380L
		Vc-w-s / Vc-w	70		-57,6	-4		11,2/27,7V	317/380V
	VR	Lc-w-s / Lc-w	50/	-50	-60,5/	-5,3/	-0,7/ 3,6	7,2/19,6V	300/344L
		Vc-w-s / Vc-w	60		-59,1	-0,8			315/380V
	ADG	Lc-w-s / Lc-w	50/	-50/	-60/	-6,8/	--	20,8/24,4V	290/360L
		Vc-w-s / Vc-w	60	-45	-56,6	-2			320/405V
Petalite	AL91	Lc-w-s/Lc-w	25/	-57/	-60,6/	--	-9/9,6	8/20 L	217/366 L
		Vc-w-s/Vc-w	90	-45	-56,9			18,4/19,3 V	308 V

Optical examination and laser Raman spectroscopic analyses (Fig. 1) of the high-birefringence solids in the petalite-hosted FI, indicate that they are zabuyelite (Li_2CO_3) just like the carbonates in spodumene-hosted FI described in Lima et al. (2001) and Anderson et al. (2001).

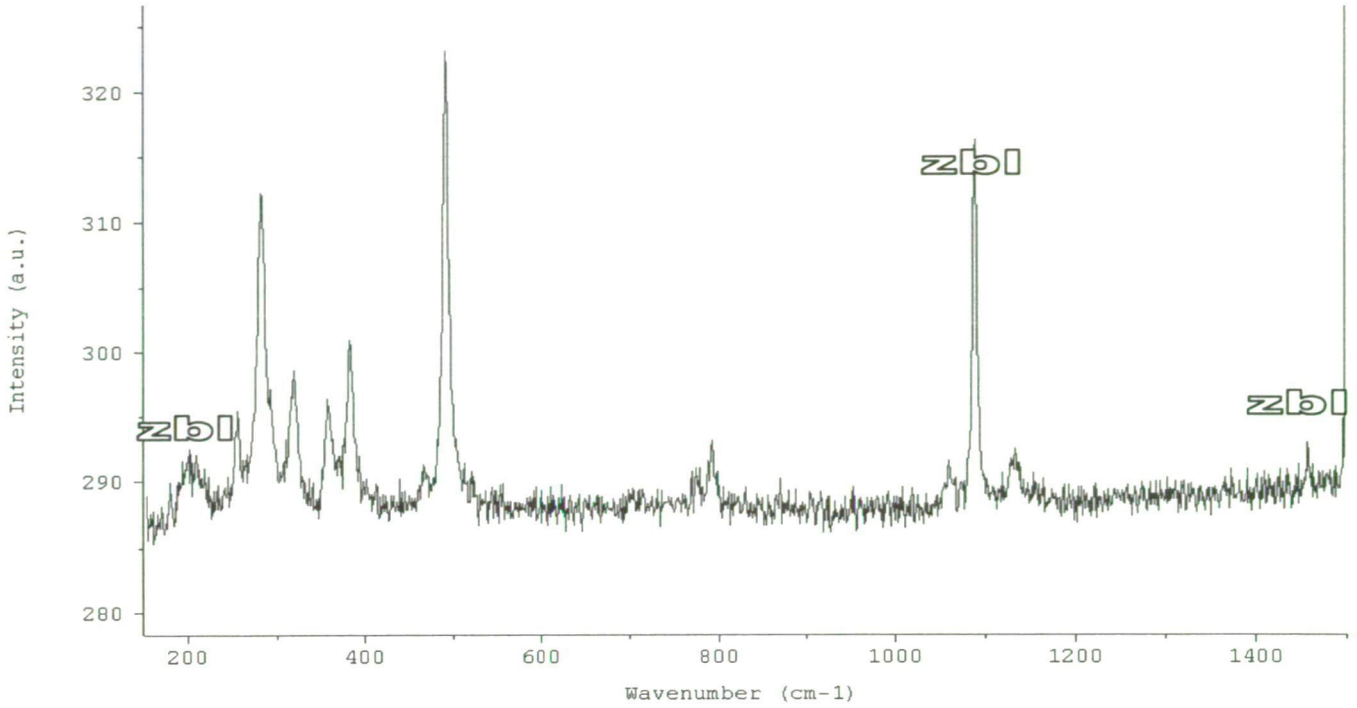

Figure 1 – Laser Raman spectrum of a zabuyelite crystal in a petalite-hosted FI. Vibrational frequencies attributed to zabuyelite are designated by zbl.

Conclusions

As already mentioned by Dória et al. (1989) and Lima et al. (1999) regarding the fluids associated with spodumene-bearing veins of the same pegmatite field, we must emphasise the presence of CO_2-rich fluids associated with petalite crystallisation.

The majority of the solids both in spodumene-hosted FI and petalite-hosted FI were identified as carbonates (mainly zabuyelite), that are regarded as daughter minerals resulting from the reaction between the carbonic fluid and the host mineral, as described by Anderson et al. (2001).

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