Trace element partitioning between Mg-hastingsite and alkali basaltic melt in volcanic environment

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The occurrence of amphibole with no evidence of re-equilibration under low pressure conditions is rather rare in volcanic environment. The occurrence of a Mg-hastingsitic amphibole in trachybasaltic volcanic rocks of the 2001 eruption at Mt. Etna (Italy) has drawn the attention of many authors. However, the most intriguing character was found in tephra related to the most violent explosive phases of the event, whose textures show the original equilibrium at high-P_{fluid} between the amphibole and the surrounding glassy groundmass. This has allowed to calculate new accurate trace element partition coefficients (from LA-ICP-MS data) between Mg-hastingsite and basaltic-trachyandesite melt, well represented by the coexisting glass. Pressure and temperature conditions have been constrained on the grounds of geophysical and petrological data at 250 MPa and 980°C respectively.

Element	$^{Amph/melt}D$	Element	$^{Amph/melt}D$
La	0.366	Rb	0.063
Ce	0.671	Ba	0.564
Pr	0.959	Th	0.025
Nd	1.230	U	0.020
Sm	1.539	Nb	1.223
Eu	1.646	Ta	0.686
Gd	1.337	Sr	0.521
Tb	1.601	Zr	0.584
Dy	1.492	Hf	0.863
Ho	1.676	Sc	2.233
Y	1.498	V	2.065
Er	1.280	Cr	0.366
Yb	1.248	Co	2.094
Lu	1.267		

In detail, commonly incompatible trace elements such as Nb and Ta can be more easily incorporated in the amphibole than Th, U and LREE. This means that, if Mg-hastingsite fractionation occurs in magma reservoirs, the trace element signature of the residual melt can be strongly affected, with a significant increase in the melt of trace element ratios such as U/Nb, Th/Ta, La/Nb, La/Ta. This can have a great importance especially for those systems where amphibole is unusual, so that its role as a phase fractionated from the magma can be recognised from uncommon trace element ratios.

Lithium-bearing pegmatite resources at Fregeneda-Almendra pegmatitic field (Spain & Portugal)

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Introduction

A geological exploration is being carried out in the Fregeneda-Almendra region. This field has different types of pegmatite veins, defined according to their mineralogy, morphology and internal structure. The veins intrude a pre-Ordovician E-W metasediments belt and are located to the north of the syn-Hercynian Mêda-Penedono-Lumbrales complex. This complex is mainly composed of a two-mica, peraluminous leucogranite. The veins have a zoned spatial distribution: the barren pegmatites are located near to the granitic complex and the rare-element enriched bodies occur further to the north. The Li-rich pegmatites are discordant, emplaced along the regional fracture system N-S to N030º E. Metamorphism isograd decreases with the distance from the granite and parallel to its contact: from sillimanite to chlorite isograd.

Methodology

Based on a stream sediment survey, the Li content of 2529 samples was analysed. Data was statistically studied and overlapped on region geological maps. This approach lead to the recognition of petalite- and spodumene-bearing pegmatites non identified until that moment.

Petalite- and Spodumene-bearing veins

Petalite-bearing veins only occur in the Portuguese part of the field. They are emplaced in the andalusite-sillimanite zone. Pombal and Vales outcrops exhibit a maximum extension of 500m and 10m width. The bodies do not show an evident internal zonation. Mineralogy assemblage is feldspars, quartz, and petalite as major constituents; minor muscovite, montebrasite and cassiterite. Fe-Mn phosphates and apatite appear as accessory minerals. Geochemical bulk analyses allow us to say that these veins are peraluminous (A/CNK>1), have low SiO_2 content and $Na_2O>K_2O$. They are also impoverished in Fe(t), MgO and CaO.

Spodumene-bearing veins outcrop close to the limit of the biotite/chlorite isograd. Vau and Alberto mine have variable thicknesses of 4m to 15m. Internal zonation is not observed. Mineralogy is simple: feldspars, quartz and spodumene as major constituents; minor muscovite, montebrasite and petalite; beryl, Fe-Mn phosphates and cassiterite as accessory minerals. Further studies are required.

Final Remarks

Stream-sediment geochemistry is a powerful tool on Li-pegmatite exploration and allowed an improvement on the pegmatitic field petrogenetic understanding. It also provided the increase of mineral resources for ceramics and glass industry, which already consume material from this region.