Chemical variation and significance of micas from the Fregeneda-Almendra pegmatitic field (Central-Iberian Zone, Spain and Portugal)

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ABSTRACT

Field, textural, paragenetic, and chemical data for micas from pegmatites of the Fregeneda-Almendra pegmatitic field (Central-Iberian Zone) are used to characterize and evaluate their petrogenesis. These pegmatites show a zonal distribution from barren to evolved, with an increase in degree of evolution with increasing distance from the Méda-Penedono-Lumbrales leucogranite. Five types of evolved pegmatites have been recognized: (1) petalite-rich, (2) spodumene-rich, (3) Li-mica + spodumene-rich, (4) Li-mica-rich, and (5) cassiterite-rich pegmatites, plus six types of barren and intermediate pegmatites. Representative micas from the different pegmatite types and from the leucogranite were analyzed for major and trace elements. All micas belong to the muscovite-lepidolite series. Lithium is incorporated into Li-micas via the LiAl 3−1o−2 and Si2LiAl−3 substitutions, where o represents vacancies. The Al4Si3o−1 and Al2o1R2+−3 substitutions, where R2+ = (Fe + Mg + Mn), account for the compositional variability of micas from the Li-mica-free pegmatites. The Li, Rb, Cs, Be, Ta, and Nb contents of micas increase in the order: leucogranites and barren pegmatites < intermediate pegmatites < spodumene-bearing and petalite-bearing dikes < Li-mica-bearing pegmatites. The Ba content decreases in the same order, and Sn and Zn are relatively abundant in the intermediate pegmatites. These variations are consistent with rare-element enrichment via fractionation processes combined with partitioning of rare elements from the pegmatite melt into the minerals and volatile phases. However, some pegmatite types occurring in this area, such as the cassiterite-rich dikes, do not seem to form part of the same evolutionary trend.

Keywords: Micas, pegmatites, compositional variations, petrologic implications, degree of evolution, Fregeneda-Almendra area

INTRODUCTION

In the Fregeneda-Almendra area (FA) (Salamanca, Spain, and Guarda, Portugal), 11 pegmatite types have been recognized. They show a zonal distribution northward from the Méda-Penedono-Lumbrales granitic complex (MPL). Less evolved dikes occur inside or close to the contact of the granite, and the content in lithophile elements increases northward with increased distance from the granite. In the northernmost part of the field, Li- and/or Sn-rich pegmatites are common (petalite-rich, spodumene-rich, Li-mica + spodumene-rich, Li-mica-rich, and cassiterite-rich) (Roda 1993; Roda et al. 1999; Vieira 2010). The evolution observed in the FA field with increased distance from the MPL granite is mineralogical, textural, and compositional. All rock-forming minerals of these pegmatites reflect clearly this evolution, which is especially apparent in mica, ubiquitous minerals in all the pegmatites from the FA field. Physical properties, chemical composition, and paragenetic relations of micas have been frequently used to establish the degree of evolution and crystallization conditions of pegmatites (e.g., Černý and Burt 1984; Foord et al. 1995; Wise 1995; Jolliff et al. 1987, 1992; Henderson et al. 1989; Roda et al. 1995, 2006, 2007a; Kile and Foord 1998; Brigatti et al. 2000).

This paper is concerned with micas from the different pegmatite types in the FA field. This field is a good example to better understand the chemical, paragenetic, and textural evolution of micas during pegmatitic crystallization in zoned pegmatitic fields. We focus on the paragenetic and textural relations, and chemical composition in relation to pegmatite petrogenesis. We also propose an order of crystallization for the different pegmatite types in the area.

GEOLOGICAL SETTING AND GENERAL GEOLoGY OF THE PEGMATITIES

The FA area represents a typical section of the metamorphic Variscan basement in the Central-Iberian Zone, which is located in the western part of a narrow EW trending belt (Fig. 1). It consists largely of psammopelites, with abundant intercalations of quartzites, conglomerates and, less frequently, amphibolites and calc-silicate rocks from the pre-Ordovician Schist-Greywacke Complex.