Timing of rare-elements (Li-Be-Ta-Sn-Nb) magmatism in the European Variscan belt

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High-phosphorus peraluminous rare-elements granites and rare-elements LCT (Lithium, Caesium, Tantalum) pegmatites are the most important sources of raw materials for some critical metals like tantalum (1,2)represent important economic storehouses for industrial minerals like feldspar, quartz, mica or kaolin. They principally emplace in orogenic settings (3). Afast overview of three mainEuropean Variscan districts, i.e. the Moldanubian domain of the Bohemian massif, the French Massif Central (FMC) and the NW Iberia provides a basis for questioning the origin of rare-elements magmatism and the actual classification of rare-elements pegmatites, in particular the LCT pegmatites.

Granitic pegmatites are widespread in most of the Bohemian Massifbut LCT pegmatites are most common in the Moldanubian domain. In this area, their emplacements seem mainly controlled by migmatitic domes and shear zones and correspond to two events(4). The older at ~ 333 ± 3 Ma just follow HT-MP event of the end of the Moravo-Moldanubian phase and the younger at ~ 325 ± 4 Ma is contemporaneous with beginning of the Bavarian phase (U-Pb ages on colombite and tantalite).

In the FMC, most of the actually known rare-elements magmatic bodies form a province in the North Limousin area, which represents the northwestern part of the FMC.U-Pb dating of columbite-group minerals from Beauvoir, Montebras and Chèdeville rare-elements magmatic bodies leads to emplacement ages at 317 ± 6 Ma, 314 ± 4 Ma and 309 ± 5 Ma respectively. The contemporaneous Marche fault system (5), which crosscuts in a general E-W trend all the northern part of the Limousin, seems to be a key-structure for the rare-elements magmatism of the area.

Although rare-elements pegmatites are known in the different Variscan massifs of Iberia, the northwest part of the Iberian Variscan belt contains numerous fields that represent the first economic targets in Europe, particularly in the Central Iberian Zone (CIZ) and in Galicia-Trás-os-Montes Zone (GTOMZ)Three events of rare-elements magmatism have been recognized in Northwest Iberia (U-Pb on colombite and tantalite; 6): (i)emplacement of the Argemela rare-element granite, in the CIZ, with an age of 326 ± 3 Ma; (ii) intrusion of rare-element pegmatites from the GTOMZ at an average age of 310 ± 5 Ma; (iii)emplacements of rare-element pegmatites in the CIZ and in the southern GTOMZ at about 301 ± 3 Ma. Moreover, the observed southward propagation of ages of emplacement matches the propagation of deformation, metamorphism and magmatism in the two different geotectonic zones.

The spatial and temporal distributions of rare-element pegmatites in the Variscan beltsuggest that rare-elements magmatism could be related to local specific conditions like particular sources, tectonic and thermal regimes.

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