

From igneous to hydrothermal stages: Lithium mineralization types in the Central Iberian Zone (Spain & Portugal) and its implications for the European Variscan Belt

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Lithium mineralization is relatively common in the Central Iberian Zone (CIZ) (Spain and Portugal), occurring in a NNW-SSE striking belt, ≈ 500 km long and ≈ 150 km wide. The CIZ represents the westernmost segment of the European Variscan Belt and is characterized by an important granitic magmatism (330-290 Ma) that includes two highly peraluminous, perphosphorous, Ca-poor, S-type granitic series (S1 in the NCIZ and S2 in the SCIZ). Li-mineralization occurring in this region may be classified in five different categories: (i) aplite-pegmatite bodies occurring in pegmatitic fields of up to some hundred dykes, with spodumene, petalite and/or lepidolite as the main Li phases; (ii) marginal and/or apical parts of fractionated leucogranitic cupolas; with lepidolite; (iii) coarse-grained beryl-phosphate pegmatites, commonly intragranitic, with triphylite; (iv) tin+montebrasite-rich quartz hydrothermal veins that usually appear in a stockwork over some leucogranitic cupolas; and, (v) Li $\pm$ B-rich metasomatized metasediments hosting bodies of type iv, with zinnwaldite. Therefore, the processes that generated the Li-mineralization in this region range from igneous/pegmatitic stages (types i, ii and iii), up to hydrothermal stages (types iv and v). Continuous evolution trends have been observed at whole-rock and mineral scales from the less fractionated S1 and S2 granitic units up to the Li-rich pegmatites, for some major and trace elements (e.g. Si, Al, Fe, Ca, Mg, Ti, P, Sr, F, Li, Ta, Cs, Rb and Sn). Consequently, high degrees of fractionation of members of the S1 and S2 granitic series could well explain the origin of the Li-enrichments observed in the CIZ. The initial content of H₂O and fluxes in the melts, as well as their depth of emplacement, could influence the development of the different types of Li-mineralization in the CIZ: The Li-rich hydrothermal deposits would be associated with the exsolution of an aqueous fluid prior to the crystallization of the residual melts, with Li preferentially partitioning into the fluid phase; whereas Li-rich pegmatites would form from the most fractionated granitic melts, without a previous exsolution of a fluid phase. A comparison with other equivalent Li-mineralization suggests the existence of an important Li-metallogenetic province in the European Variscan Belt.