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Li-B-metasomatism in metasedimentary host rocks prompted by aplite-pegmatite in Belvís de Monroy Pegmatite Field (Spain)

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The movement of fluids plays a crucial role in driving mass transfer processes during metasomatism associated with igneous intrusions. In these dynamic environments, the addition or depletion of chemical components give rise to metasomatic halos, which are distinguished by geochemical imprints. This study focuses on the geochemical halos generated by a granitic aplite-pegmatite dyke from the Belvís de Monroy granite-pegmatite system in the Central Iberian Zone (Spain). The investigated dyke is an internally zoned (across and along), subvertical body, up to 3 meters thick and >500m long, characterized by a relatively poorly evolved mineralogical assemblage dominated by quartz, albite, muscovite, K-feldspar, and schorl. However, locally the inner zone of the dyke may present a more evolved paragenesis, with minerals such as lepidolite, topaz, beryl, and columbite group minerals. To assess the metasomatic processes triggered by this intrusion, whole-rock samples of the hosting metasediments were taken at increasing distances from the contact in different sections along the dyke, and analyzed to evaluate elemental gains and losses. The results indicate that the expelled aqueous fluids transported elements such as B, Li, Rb, Cs, Sn, and Tl, with minor enrichment in P, As, W, and F. The metasomatic effect is clearly influenced by the nature of the host metasediments, with a significantly higher degree of alteration observed in pelitic samples compared to more psammitic ones; however, the metasomatic effect is restricted to the first centimeters from the pegmatite-host rock contact. Additionally, the longitudinal heterogeneity of the dyke influences its geochemical interaction with the host rock, as reflected in the higher enrichment of B and Li in the metasediments near the lepidolite-bearing zones (up to 1480 ppm and 670 ppm, respectively). On the contrary, in areas with no lepidolite these values are significantly lower, being below 743 ppm and 310 ppm in B and Li respectively. These results highlight the complex nature of fluid-rock interactions in pegmatitic systems, where multiple factors ranging from the evolving characteristics of the intrusion to the lithological variability of the host rocks, converge to shape the geochemical signature induced by metasomatic processes.