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Magmatic to aqueous phase transition in layered Li-pegmatite: microtextural and geochemical study of muscovite-lepidolite from Boam mine area, Uljin, South Korea

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Boam mine area is one of the Li-pegmatite deposits in South Korea (4.7 wt% Li_2O), composed of three major ore bodies. We applied microtextural and geochemical analysis for Li-bearing micas to figure out evolution of Li-mineralization fluid of pegmatite. Muscovite and lepidolite of the layered pegmatite show distinct zonation, and distinguished as six stages. First stage (Primary muscovite; PM) is large euhedral to subhedral muscovite associated with pegmatitic quartz and K-feldspars. High Mg (~12000ppm) and Fe (~25000ppm) also show magmatic origins. Second stage (Primary lepidolite; PL) is subhedral lepidolite consisting core zones of zoned micas, and show gradual diffusive replacement into third stage (First replacement lepidolite; RL1). Lepidolite of second and third stage generally show similar composition, but high Cs (~12000ppm) distinguishes third stage from second stage. Incompatibility of Cs is the reason for enrichment in later magmatic stage. At fourth stage (Replacement muscovite; RM), muscovite reappears but with specific abundance of B (~1700ppm). Accumulation of B and sharp boundaries with former stage insists this stage originates from aqueous melt, rather than magmatic melt. Fifth stage (Second replacement lepidolite; RL2) have erratic boundaries, evidence of dissolution-reprecipitation. Also, high Ta/Nb ratio (~1.6) and low B (~430 ppm) relative to fourth stage show mineralization from magmatic melt. Thus, during fourth and fifth stages, magmatic and aqueous melt coexists with immiscibility, and crystallize them with oscillation. The last sixth stage (Secondary muscovite; SM) is fine grained epitactic micas coexisting with microcrystalline quartz, clevelandite, and apatite. Lowest Na (~0.3 wt%) content is evidence of its mineralization from aqueous fluid after the formation of albitite, and highest Ta/Nb ratio (~2.1) might resulted from enrichment of F in the hydrothermal fluid. According to these microtextural and geochemical analysis of muscovite-lepidolite in layered pegmatite from the Boam mine, we could figure out transition of magmatic and aqueous phase played significant roles during Li-mineralization. Also, we could figure out albitization migrates Li from them, since only muscovite forms after the formation of albitite. This can be useful implication for the exploration of Li-pegmatite deposits.