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Muscovite composition and the genesis of Li-rich and Be-rich pegmatites: a case study of the Kalu'an rare-metal pegmatite ore-field

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The Altay orogenic belt in Xinjiang is a significant rare-metals resource base in China, hosting a large number of pegmatite-type lithium and beryllium deposits. In this study, we investigated the chemical compositions of muscovite that is a ubiquitous mineral phase in the Li-rich pegmatites and Be-rich pegmatites in the Kalu'an-Azubai ore field. The purpose is to explore the compositional evolution of muscovite in different mineralized pegmatites and its implications for the genetic relationship between the granite and pegmatites. Field and petrographic observations show that there are a variety of phosphate minerals in Be-rich pegmatites, whereas the Li-rich pegmatites contain abundant orange spessartine and lepidolite but lack typical Fe-Mn phosphates. The Nb contents and Nb/Ta values of muscovite decrease from the muscovite granite to Be-rich pegmatite to Li-rich pegmatite, likely indicating an increasing differentiation degree of the granite/pegmatite-forming melts. The magmatic evolution of the granite-pegmatite system was modeled using the mica chemistry (particularly LILE including K, Rb, and Cs). According to the modelling, the evolutionary trend of mica compositions is consistent with the assumption that the muscovite granites, Be-rich and Li-rich pegmatites successively formed via Rayleigh fractionation of a parental magma (Fig.1). Nevertheless, the chronological, mineralogical, and isotopic evidence suggest that the melts forming the Li and Be pegmatites might have different geochemical characteristic and that the studied Li and Be pegmatites exhibit distinct age difference. Therefore, using the evolutionary trend of mica compositions to address the genetic relationships of different rare-element mineralized pegmatites in the same regions should be under the precondition that the granite-pegmatite system has a reasonable spatio-temporal distribution and other evidence supporting the successive evolution of a common parental magma is also needed.

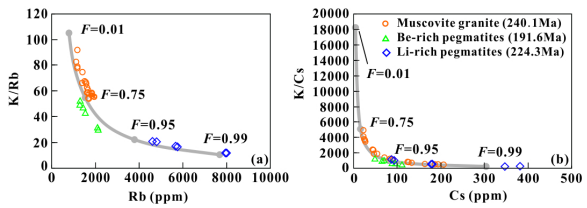

Fig.1 Modelled Rayleigh fractionation trajectories for LILE trends in muscovites (a,b) from muscovite granite, Be-rich pegmatites, and Li-rich pegmatites in the Kalu'an-Azubai field.