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Evolution and abrupt events of Altay Kujierte Granitic Pegmatite：evidence from major and trace elements of banded tourmaline

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Tourmaline is an important mineral in pegmatite and serve as effective tools for tracing the evolution of ore-forming systems. In this study, EPMA and LA-ICP-MS were used to analyze the major and trace elements of the banded tourmaline in situ from the Altay Kujierte Granitic Pegmatite in Xinjiang province, China. Based on the main and trace elements content in the crystal lattice of tourmaline, the chemical formulas for the four color zones from the center to the edge of the studied tourmaline are calculated. The results show that the tourmaline is a fluor-lithium tourmaline with alkaline components dominant at position X. Both the pink and green zoning in the tourmaline exhibit the O^{2-}, $Al^{3+}(OH^{-}, R^{2+})_{-1}$ substitution pattern, similar to the substitution pattern of hydrothermal environment tourmaline. Trace elements reveals a sharp variation in Fe, Mg, Ti, V and Mn content from the pink core to the green rim of the tourmaline. Fe, Mg, Ti and V contents increase sharply, while Mn content decreases. This suggests that the color change in the banded tourmaline is caused by fluid mixing during its formation. Microscopic observations and energy spectrum analysis reveal the presence of mineral inclusions as potassium feldspar, albite and muscovite in the region of sharp element variation. It suggests that the banded tourmaline initially grew in a stable hydrothermal environment after magmatic stage. Subsequently, there was a short period of growth stagnation , and in the later stage, the addition of hydrothermal fluids rich in elements such as Fe, Mn, Mg, K, Na, Ti, V and other elements altered the original fluid composition, resulting in a significant color change of the banded tourmaline. This confirms that the post-magmatic hydrothermal stage of pegmatites does not always maintain a stable evolution, there may be pulsating injection of hydrothermal fluids from the magma chamber, resulting in abrupt changes in fluid composition.

