

# Quantitative evaluation on metamictization of columbite-group minerals from pegmatites based on Raman spectroscopy.

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In this study, systematic Raman spectroscopic analysis of columbites from a variety of granitic pegmatites (including the Jingerquan No. 1 pegmatite in East Tianshan Mountains, Dakalasu No. 1 pegmatite and Kalu'an K802 and K803 pegmatites in the Chinese Altay orogen) were carried out. The chemical compositions and U-Pb isotopic ratios of columbites were used to calculate the degrees of metamictization. Alpha decay dose (D) and displacements per atom (dpa) are two common parameters for quantifying metamictization degree of U-Th-bearing minerals such as columbite<sup>[1,2]</sup>. Furthermore, we discussed the correlation between the degrees of metamictization and the key Raman spectral parameters of columbite samples. According to the LA-ICP-MS data and electron probe data obtained in this study and previous studies<sup>[3,4]</sup>, the alpha decay dose (D) of columbite in Kalu'an 802 pegmatite (corrected based on a mean life of 200 Ma for the alpha-recoil tracks) is  $0.169 \times 10^{15} \alpha\text{-events} \times \text{mg}^{-1}$ , which indicates that the columbite is well crystalline; the alpha decay doses (D) of the columbites from Jingerquan No. 1 pegmatite, Kalu'an 803 pegmatite, DKLS 107 and DKLS 108 are  $0.638 \times 10^{15}$ ,  $0.268 \times 10^{15}$ ,  $3.119 \times 10^{15}$  and  $2.748 \times 10^{15} \alpha\text{-events} \times \text{mg}^{-1}$  respectively, indicating all the columbites are in a transitional stage from being crystalline to metamict state. Correlation analysis of the alpha decay dose (D) with the peak position and full width at half maximum of the strongest Raman peak leads to the following conclusions:

1. The peak position of the strongest Raman peak shifts to a lower wavenumber region with increasing degree of metamictization;
2. The value of FWHM at the strongest peak increases systematically with the increase in the metamictization degree.

## References:

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