EGU21-11830
https://doi.org/10.5194/egusphere-egu21-11830
EGU General Assembly 2021

Chemical and boron isotopic variations of deformed tourmaline in the Laojunshan metamorphic dome, Southwest China: Implication for magmatic-hydrothermal evolution during exhumation

Wei Li[1], Shuyun Cao[1], Eizo Nakamura[2], Tsutomu Ota[2], Tak Kunihiro[2], and Zhong Liu[1]
[1]State Key Laboratory of Geological Processes and Mineral Resources, School of Earth Sciences, China University of Geosciences, Wuhan 430074, China
[2]Pheasant Memorial Laboratory of Geochemistry and Cosmochemistry, Institute for Planetary Materials, Okayama University, Misasa, Tottori 682-0193, Japan

Multi-stage tourmalines are widely developed in granitic gneisses and hydrothermal veins from the Laojunshan metamorphic dome, Southwest China. These tourmalines exhibit variable petrographic characteristics and microstructures by ductile deformation to brittle deformation, which offers a great opportunity to understand the fluid and structural evolution during exhumation of the Laojunshan metamorphic dome. Three types of tourmalines have been recognized, including disseminated tourmaline distributed in granitic gneisses (Tur-G), elongated and broken tourmalines in quartz veins (Tur-QV), needle-columnar and fine-grained tourmaline with micro-shear zone in tourmaline veins (Tur-TV). All the tourmalines belong to the alkali group representing dravite-schorl solid solution series. The former two types belong to schorl and the latte type contains more Mg-rich components. Models of occurrence and chemical varieties including Al-occupation at the Y-site suggest that the Tur-G type and Tur-QV type tourmalines crystallized from magmatic fluids and the Tur-TV type tourmalines are hydrothermal origin. Hydrothermal tourmalines are characterized by higher Mg/(Mg + Fe) ratios, more pronounced positive Eu anomalies, higher Li, Sr, HREE contents and lower Na/(Na + Ca) ratios, lower Nb, Zr, Hf, LREE contents compared with magmatic tourmalines. The increase of Mg/(Mg+Fe) ratios from the Tur-QV to Tur-TV type tourmalines is associated with the crystallization of Fe-rich mineral during hydrothermal stage. In the Tur-QV types, the decrease of Mg/(Mg+Fe) ratios and increase of Al and LREE contents from core to rim suggest the contamination from surrounding strata. The $\delta^{11}B$ values of Tur-G, Tur-QV, Tur-TV type tourmalines are ranging from -13~-7.9‰, -15.5~-7.5‰, -18.6~-11.6‰ respectively, which suggests that the boron was mainly derived from granitic melt and exsolved hydrothermal fluid. Boron isotopic variations of tourmaline are mainly controlled by temperature and exsolved fluid. All the results of observations from outcrop to thin section scales and chemical analysis indicate the formation of disseminated tourmaline distributed in granitic gneisses (Tur-G) should have been associated with late stage of magma evolution before regional exhumation, while tourmalines in hydrothermal veins (Tur-QV and Tur-TV) have been formed by the magmatic-hydrothermal events during exhumation of Laojunshan metamorphic dome. The primary tourmalines experienced shearing and fracturing, and then were replaced by chlorite, potassium feldspar and epidote. The ductile-brittle deformation of tourmalines was produced by

progressive strain localization accompanied by the alkaline, B-undersaturated fluids, indicating episodes of brittle fracturing, possibly as a consequence of faulting at depths and subsequent fluid flow during exhumation of the dome.