Fluid source for Balda and Motiya tungsten mineralization, W India: a boron isotope study of tourmaline

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Tungsten mineralization is commonly related to highly fractionated granitses and pegmatites. Despite several studies [1-2], the petrological constraints on tungsten mineralization are not completely understood. This study targets the Balda and Motiya Proterozoic tungsten belts in Rajasthan, western India, where tungsten mineralization is hosted in quartz veins associated with pelitic schists, granites and pegmatites. Tourmaline is a ubiquotous phase in all the rock units. The tourmalines from both the belts are of schorl composition and have B-isotopic composition similar to those of S-type granite with no intra-grain variation from core to rim. At Balda, tourmalines in the Balda leucogranite have $\delta^{11}B$ of −11.5±0.7‰ whereas those in topaz-bearing granites and pegmatites have lighter $\delta^{11}B$ of −14±0.8 ‰.which may be attributed to the exsolution of ^{11}B-rich fluids during fractional crystallization. Tourmalines growing as orbicules in granites and pegmatites from Motiya have $\delta^{11}B$ of −13.2±1.2 ‰ and −11.3±0.9 ‰ respectively, the variation possibly reflecting fractional crystallization of muscovite. Tourmalines in pegmatites adjacent to the mineralized vein in Motiya have $\delta^{11}B$ of –9.2±1.1‰, i.e., heavier than the granites. They may have crystallized from isotopically heavier exsolved fluids or retain the signature of extensive muscovite crystallization. The mineralized veins of Balda and Motiya have $\delta^{11}B$ of -10.9±0.7‰ and -10.3±0.8 ‰ respectively suggestive of granite-derived mineralizing fluids, consistent with extensive tourmalinization and muscovitization of the adjacent wall rocks (schist, tourmalinite). Lack of any significant variation in $\delta^{11}B$ of the vein tourmalines indicates a uniform fluid source. The mineralizing fluid is estimated to have $\delta^{11}B$ ca. −8‰ [3] at 450 °C (Ti-in-biotite thermometry in tourmalinites and fluid inclusion thermometry [4]).

[1] Wood & Samson, 2000. *Econ*. *Geol*. **95(1),** 143–182. [2] Lecumberri-Sanchez, et. al., 2017. *Geology*, **45(7),** 579–582. [3] Meyer et. al., 2008. *Contrib*. *Mineral*. *Petrol*. **156,** 259–267. [4] Sharma et. al., 2003. *J*. *Geol*. *Soc*. *India*. **61(1),** 37-50.