

Syn-metamorphic boron-bearing fluid infiltrations deduced from tourmaline in the Main Central Thrust zone, eastern Nepal Himalayas

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Mode of occurrence and chemical composition of tourmaline in pelitic schists from the Main Central Thrust (MCT) zone of the Lesser Himalayan Sequences (LHS) are described in detail to deduce the chemical characteristics of tourmaline formed through boron-bearing fluid infiltration, and to estimate the syn-metamorphic fluid compositions.

Metasomatic tourmaline from the tourmalinized wall rocks of tourmaline-quartz veins and a plagioclase-quartz vein shows significant increase in X_{Ca} [=Ca/(Ca+Na)] at almost constant X_{Mg} [=Mg/(Mg+Fe_{total})]. Plagioclase present in such veins are anorthite-rich, and is not in equilibrium with tourmaline. These chemical characteristics of tourmaline are also confirmed in some of the tourmaline-rich pelitic schists that contain more than 1.0 vol% tourmaline. The tourmaline-rich pelitic schists, therefore, are considered to have formed through boron-bearing fluid infiltration. Ca-metasomatism observed in the pelitic schists adjacent to the metadolostone layers points to Ca-enrichment of the fluid composition when passing through the metadolostone layers. Episodic infiltration of such fluids into pelitic schists resulted in production of abundant tourmaline with increasing X_{Ca} trend at almost constant X_{Mg} . Most of the tourmaline in tourmaline-rich pelitic schists are in equilibrium with plagioclase, suggesting rock-buffered environment during the fluid infiltration. The pelitic schists without tourmaline enrichment mostly show increase in X_{Ca} at broad X_{Mg} values, reflecting its growth during longer range of metamorphism.

The fluid compositions that coexisted with tourmaline were estimated by applying experimentally-determined fluid/tourmaline chemical relationships to the vein, tourmaline-rich pelitic schist and tourmaline-poor pelitic schist samples. Assuming coexisting anion to be Cl, they all gave salinity similar to the sea water (~0.6 mol/l NaCl) and slightly above it (~0.4-0.9 mol/l NaCl+CaCl₂). The tourmaline-bearing veins and tourmaline-rich pelitic schists indicative of syn-metamorphic boron-bearing fluid infiltrations are widely distributed in the MCT zone of the LHS.

This observation supports that such fluid infiltrations into the High Himalayan Crystallines (HHC), contemporaneous with the inverted metamorphism of the MCT zone, caused vapor-saturated partial melting of the HHC and formed tourmaline leucogranite melts.

Keywords: metamorphic fluid , boron, tourmaline, inverted metamorphism