Contrasting REE patterns of tourmaline and their implications for the melt evolution; example from LCT and NYF pegmatites

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Tourmaline (Trm) is widely used as geochemical indicator of geological processes chiefly due to its ability to incorporate a high number of elements, large PTX stability field, and refractory behavior. REE patterns of Trm were studied in granitic pegmatites of the LCT and NYF families. The relation of the REE patterns of Trm to the signature (LCT/NYF) of the host granitic pegmatites, degree of fractionation, magmatic / hydrothermal origin, and mineral assemblages is evident.

Magmatic Trm from NYF and mixed pegmatites is characterized by variable and relatively high concentrations of REE with steep LREE enriched REE patterns. The Eu anomalies in Trm vary from positive to negative ones related to the Eu contents in the melt and degree of its fractionation. Similarities between the REE contents and patterns of magmatic tourmaline and the whole-rock were observed, the calculated partition coefficients close to unity (0.42–1.24) suggesting that Trm does not selectively incorporate specific REE into its structure.

On the other hand, very low REE contents with steep LREE enrichment and deep negative Eu anomalies are typical for magmatic Trm from LCT pegmatites. It reflects an uptake of REE by early precipitation of REE phosphates in these pegmatites and a high degree of melt fractionation.

Generally, low REE contents were confirmed in Trm crystallizing from pegmatite-derived hydrothermal fluids relative to the associated magmatic Trm. Positive Eu anomalies in hydrothermal Trm agree with presence of Eu^{2+} in fluids under most conditions.