Trace elements in Tourmaline: markers of incipient W-deposition in Panasqueira mine

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Toumalinization is an ubiquitous process in the wall-rocks of the Panasqueira Wolframite-Quartz vein system and an early quartz (crack-seal)-tourmaline stage (QS) was defined by Polya et al. (2000). Tourmaline occurs as acicular crystals, a few 10 micrometers long, elongated along the former schistosity (Sn). There are 3 stages of tourmaline formation. The first stage (Tur 0) is only preserved as relic cores in the main stage Tur1. The latter was coeval with the first opening of the small QS quartz veinlets. The third stage occurs as overgrowths of Tur 2 in the wall-rock and crack–sealing of Tur1 within the quartz veins. There is a systematic shift from Mg-rich to Fe-rich compositions in the Tur0 > 1> 2 sequence. Small rutile crystals are systematically associated with tourmaline and typically enriched in Nb-Ta, Sn, and W. In the wall-rocks, they often exhibit a core with ≤ 2.5% of rare metals, and a rim with a distinct enrichment in W (up to 10%). W-rich rutiles are typically associated with Tur2. The QS stage just preceded the opening of the quartz vein system (wolframite deposition). Several occurrences demonstrate that the earliest wolframite was in fact coeval with Tur2.

LA-ICP-MS analyses on zoned tourmaline show a strong contrast between Tur1 and Tur2, the latter being distinctly enriched in W (up to 260 ppm) and Li (up to 1100 ppm), whereas the former are richer in Sr (up to 220 ppm), Sn (up to 160 ppm) and Nb+Ta (up to 1.7 ppm). The REE patterns are distinctly fractionated, with a depletion in MREE (La_N/Sm_N 3.3, Gd_N/Yb_N 0.5), and consistently display a strong positive Eu anomaly (Eu_N/Eu_N* 5.1).

Thus, the Tur2/W-Rt assemblage and the distinct W enrichment in Tur2, appear as a marker of the onset of the rare metal influx in the Panasqueira system.