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Mn-tourmaline crystals from island of Elba (Italy): Growth history and growth marks

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ABSTRACT

The growth history reconstruction of tourmaline macro-crystals from pegmatite pockets in the aplite veins of Grotta d'Oggi (island of Elba, Italy) was carried out using a multi-disciplinary and multi-analytical approach [X-ray diffraction topography (XRDT) and electron microprobe analysis (EMPA)]. The work covered in this paper is closely related to the previous crystal-chemical characterization of the same macro-crystals (Bosi et al. 2005).

The tourmalines examined here are bi-colored crystals exhibiting greenish-yellow to colorless zoning perpendicular to and parallel to the **c** axis: the transition from the inner yellow regions to the colorless ones occurs suddenly. XRDT and EMPA studies show relationships between color and chemical zoning and crystal growth evolution, thus identifying two main growth stages, which developed under different conditions. The first stage corresponds to greenish-yellow Mn-tourmaline grown as a result of a 2D-growth mechanism in a F-rich pegmatitic environment; the second one corresponds to colorless elbaitic tourmaline, which developed chiefly by a spiral growth mechanism in an OH-rich hydrothermal environment. The structural defects found in greenish-yellow Mn-tourmaline (growth bands, absence of dislocations, near-uniform chemical element concentrations) are the same as those observed in beryl crystals from pegmatite pockets of the island of Elba. Therefore these features are growth marks that characterize the pegmatitic crystallization stage and differentiate it from the hydrothermal stage, in which the dislocations normal to the growing faces occurred. Hence, the role of tourmaline as a petrogenetic indicator can be extended from chemical composition to crystal growth, reflecting both chemical environment and growth mechanism, and contributing to a better understanding of mineral genesis in pegmatitic crystallization.

Keywords: Analysis, chemical (mineral), Mn-tourmaline and elbaite, crystal growth, structural defects, pegmatites, X-ray diffraction topography