Tourmaline nodule distribution, shape and internal structure: 3D study of granite texture revealed by serial sectioning tomography

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The origin of tourmaline nodules and their peculiar textures, found in the peripheral parts of the Cretaceous Moslavačka Gora (Croatia) peraluminous granite pluton, are associated with the separation of a late-stage boron-rich volatile fluid phase. Based on field, mineralogical and textural observations, it is evident that tourmaline nodules formed during the final stage of granite evolution, when an undersaturated granite magma intruded to shallow crustal horizons, became saturated and exsolved a fluid phase from residual melt in the form of buoyant bubbles or pockets. Tourmaline nodules (usually 1 to 10 cm in diameter) formed from these bubbles have a complex texture comprising two clearly distinct units: tourmaline-bearing core and leucocratic halo. The core, a spherical aggregate of tourmaline crystals, consists of dravite-enriched (Fe# 0.43-0.58) and slightly Na-deficient tourmaline, together with quartz + albite + K-feldspar ± muscovite. The nodule's halo, consisting of quartz + feldspar + muscovite, represents an integral part of the nodule and envelopes the tourmaline-bearing core (Balen & Broska 2008).

In this contribution, a 3D reconstruction and visualization done by BLOB3D software (Ketcham 2005) was used in order to reveal the distribution, shape and internal structure of described nodules. Research is based on the serial cutting and lapping i.e. serial sectioning tomography and included data acquisition using a flatbed scanner. Studied granite samples were cut and/or eroded to obtain a "data brick" consisting of a series of grayscale images with physical resolution of 3.5 mm (cutting) or 0.35 mm (lapping) between individual slices. Figure shows the 3D reconstruction of the tourmaline nodules spatial distribution revealing them as isolated spherical bodies inside the granite host (Fig. 1A), each displaying a complex internal structure with separated volumes pertaining to the nodule's core and halo (Fig. 1B).

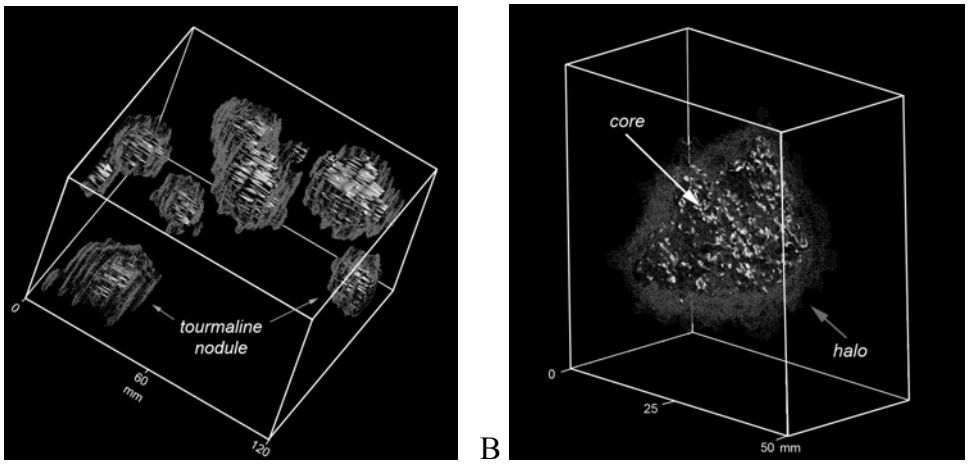

Figure 1. A. Spatial distribution of tourmaline nodules inside investigated granite "data brick" obtained by serial cutting (visible stripes and elongate voxels are due to low interslice resolution), B. details of nodule core and envelope (halo) texture obtained by serial lapping.

Balen D, Broska I (2008). Tourmaline nodules - product of devolatilization during final stage of granite melt evolution? 33rd International Geological Congress, Oslo, Norway.

Ketcham RA (2005). Computational methods for quantitative analysis of three-dimensional features in geological specimens. Geosphere, 1, 32-41.