

## STRUCTURAL AND CHEMICAL INVESTIGATION OF A ZONED SYNTHETIC CU-RICH TOURMALINE

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The studied blue Cu-rich tourmaline was synthesized (at 650 °C/1.5 kbar) at the Institute of Mineralogy and Petrography, Novosibirsk (LEBEDEV et al., 1988). It was grown on natural elbaite as seed crystal and it was shown that this overgrowth consists of three different zones. The first tourmaline zone has the formula (EMPA, SIMS)  $\sim^X(\text{Na}_{0.8}\square_{0.2})^Y(\text{Al}_{2.0}\text{Cu}_{0.9}\square_{0.1})^Z\text{Al}_6^T(\text{Si}_{5.1}\text{Al}_{0.9})\text{O}_{18}(\text{BO}_3)_3^V(\text{OH})_3^W[\text{O}_{0.7}\text{F}_{0.2}(\text{OH})_0.1]$  with lattice parameters  $a = 15.835(1)$  Å,  $c = 7.093(1)$  Å ( $R = 2.4\%$ ). The enlarged  $\langle T\text{-O} \rangle$  distance of 1.625(1) Å is in agreement with the  $T$ -site occupancy. The second zone has the formula (EMPA, SIMS)  $\sim^X(\text{Na}_{0.8}\square_{0.2})^Y(\text{Al}_{1.8}\text{Cu}_{1.1}\square_{0.1})^Z\text{Al}_6^T(\text{Si}_{5.1}\text{Al}_{0.7}\text{B}_{0.2})\text{O}_{18}(\text{BO}_3)_3^V(\text{OH})_3^W[(\text{OH})_{0.4}\text{F}_{0.3}\text{O}_{0.3}]$  with  $a = 15.824(1)$ ,  $c = 7.087(1)$  Å ( $R = 2.3\%$ ). The third zone (highest Cu content with ~14 wt% CuO) has the formula (EMPA, SIMS)  $\sim^X(\text{Na}_{0.8}\square_{0.2})^Y(\text{Al}_{1.2}\text{Cu}_{1.8}\square_{0.1})^Z\text{Al}_6^T(\text{Si}_{5.2}\text{Al}_{0.4}\text{B}_{0.4})\text{O}_{18}(\text{BO}_3)_3^V(\text{OH})_3^W[(\text{OH})_{0.6}\text{F}_{0.4}]$ . The formula for the third zone, as determined by refinement, is  $\sim^X(\text{Na}_{0.8}\square_{0.2})^Y(\text{Al}_{1.6}\text{Cu}_{1.4})^Z\text{Al}_6^T[(\text{Si},\text{Al})_{5.4}\text{B}_{0.6}]\text{O}_{18}(\text{BO}_3)_3^V(\text{OH})_3^W[(\text{OH})_{0.7}\text{F}_{0.3}]$  with  $a = 15.849(1)$  Å,  $c = 7.087(1)$  Å ( $R = 2.5\%$ ). The reduced  $\langle T\text{-O} \rangle$  distance of 1.616(1) Å is in agreement with some B at the  $T$  site. Although the  $\langle Z\text{-O} \rangle$  distance with 1.906(1) Å is within errors similar to the  $\langle Z\text{-O} \rangle$  distances of the other zones, the refinement  $\text{Al} \leftrightarrow \text{Cu}$  gives (only for this zone) some evidence for a small amount of Cu (~1%) at the  $Z$  site of this very Cu-rich tourmaline. The occurrence of Cu at the  $Z$  site was already proposed by VERESHCHAGIN et al. (2013). Although the refined value is higher than the  $3\sigma$  error, another evidence (e.g., spectroscopic investigation) would be necessary for a final prove of the occurrence of Cu at the  $Z$  site. However, the occupancy of significant amounts of B and/or Al at the  $T$  site of this synthetic Cu-rich tourmaline seems to be well established.

LEBEDEV, A.S., KARGALCEV, S.V., PAVLYCHENKO, V.S. (1988): In: Proc. Gen. & Exper. Mineral. Growth and properties of crystals. Novosibirsk, Nauka. (in Russian)

VERESHCHAGIN, O.S., ROZHDESTVENSKAYA, I.V., FRANK-KAMENETSKAYA, O.V., ZOLOTAREV, A.A., MASHKOVTSSEV, R. I. (2013): Am. Mineral. 98, (in press).