

**WILUITE, $\text{Ca}_{19}(\text{Al}, \text{Mg}, \text{Fe}, \text{Ti})_{13}(\text{B}, \text{Al}, \square)_5\text{Si}_{18}\text{O}_{68}(\text{O}, \text{OH})_{10}$,
A NEW MINERAL SPECIES ISOSTRUCTURAL WITH VESUVIANITE,
FROM THE SAKHA REPUBLIC, RUSSIAN FEDERATION: DISCUSSION**

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Groat *et al.* (1998) proposed recently that wiluite, a boron-bearing variety of vesuvianite, is a new mineral species. Unfortunately, the authors did not refer to the results of numerous previous investigators of wiluite, which resulted in the inaccurate description of both the internal structure and optical properties of wiluite crystals. Here, we critically discuss some of their results. The group "vesuvianite" is absent in Mandarino (1999), although Semenov *et al.* (1981) did discuss the vesuvianite group in their *Mineralogical Tables*.

Wiluite has been known more than 200 years (Lyachovich 1954). That it is the boron-bearing variety of vesuvianite was determined by Jannasch (1884). Kurbatov (1946) suggested that the name *wiluite* was given by Hatiy. According to Lyachovich (1954), however, the name originated in Russia. The name *wiluite* appeared earlier than vesuvianite (Betehtin 1951). One can find in Lyachovich's work (1954) a complete historical review of investigations of wiluite, which was brought from the shores of Wiluy River by Laksman in 1790 and was described for the first time by Pallas (1793).

Prendel (1887), Lyachovich (1954, 1955) and others observed a zonal-sectoral structure in wiluite crystals. The outer rims of the crystals they studied show oscillatory zoning, with values of the $2V$ angle attaining $30\text{--}35^\circ$ *independently of the growth sector*. Thin oscillatory zoning is visible owing to the different optical orientation of the compositional zones (Lyachovich 1954).

Groat *et al.* (1998) investigated the optical properties of a wiluite crystal with simple forms {100} and {101} and subordinate forms {110} and {001} (structural orientation) in a section perpendicular to Z (?); they attributed the internal slightly biaxial part to sector {001} and the external part, having a stronger birefrin-

gence, to sectors {100} and {110}. However, there are at least five morphological varieties of wiluite crystals (Lyachovich 1955). Pinacoidal crystals, for example, do not display anomalous birefringence in the various growth-sectors.

According to Groat *et al.* (1998), wiluite in thin section is colorless and does not show pleochroism. Our observations are the opposite. All wiluite crystals from Yakutia that we have observed in thin sections are colored, with light greenish to brownish shades, and display weak but easily recognizable pleochroism. Pleochroism is observed especially in the section parallel to Z in the relatively darker sectors of the {001} growth face.

Groat *et al.* (1998) described a 5-cm-long sectorized crystal of wiluite as chemically homogeneous. This observation is surprising, if one considers the complex crystal-growth history of wiluite, which was a part of the multistage origin of the Wiluy Formation (Galuskina 1998, Galuskina *et al.* 1998, Galuskin *et al.* 2000).

Results of chemical analyses by Zhabin & Lyachovich (1994) and Popova (1995) clearly indicate the chemical heterogeneity of wiluite crystals. We have performed electron-microprobe analyses (CAMECA SX-50, accelerating voltage 10 kV, beam current 50 nA, counting time 100 s per point) on a single crystal of wiluite to determine the boron concentration. We have observed a heterogeneous distribution of boron, as well as Fe, Ti, Mg and Al, in a zoned crystal with a morphology identical to the crystal investigated by Groat *et al.* (1998). Most of the analyses gave a boron concentration lower than 2.5 atoms per formula unit [*i.e.*, less than half of the $T(\text{boron})$ position and less than ~ 2.8 wt.% B_2O_3], which is typical for boron-bearing vesuvianite and lower than expected in wiluite (Groat *et al.* 1998). Yet, the crystals have all the properties typical of wiluite.

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The heterogeneous distribution of boron in a sector-zoned crystal of wiluite has already been observed by Groat *et al.* (1992); therefore, the notion of the chemical homogeneity of a wiluite crystal described by Groat *et al.* (1998) requires further explanation.

It is necessary to emphasize that Yakutian wiluite has a higher concentration of boron than wiluite from other localities. Wherry & Chapin (1908) and Lyachovich (1955) reported 4.14% and 4.66% B₂O₃, respectively. Groat *et al.* (1992) disregarded these determinations without explanation, and concluded that the highest concentration of boron (~3.18% B₂O₃) occurs in vesuvianite (wiluite) from Templeton Township, Quebec and Tulare County, California. However, our recent determination of boron in the same sector-zoned crystal of wiluite by photometric method and by electron-microprobe analysis gave 4 wt.% B₂O₃ (analyst L. Pautov, Fersman Mineralogical Museum, Moscow) and

4.86 wt.% B₂O₃, respectively, thus confirming the high concentrations of boron in wiluite determined by Wherry & Chapin (1908) & Lyachovich (1955).

Groat *et al.* (1998) did not provide new data on infrared spectroscopy of wiluite. They referred to Groat *et al.* (1995), in which only the OH region of the infrared spectrum of wiluite was investigated. However, the absorption band at 1300 cm⁻¹, ignored by Groat *et al.* (1998), is a prominent feature of the infrared absorption spectrum of wiluite, and it distinguishes wiluite from vesuvianite (Minerals 1972, Galuskina 1998).

The investigation of wiluite carried out by Groat *et al.* (1998) showed that wiluite as a new mineral species needs further investigations focused on its growth-induced heterogeneity, which reflects its history of crystallization. A Russian version of this paper was published in the Proceedings of the Russian Mineralogical Society (Galuskin & Galuskina 2000).