Associating Borate and Silicate Chemistry by Extreme Conditions: High–Pressure Synthesis and Crystal Structure of the Novel Borates $RE_3B_5O_{12}$ (RE = Er – Lu)

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The diagonal relationship B↔Si enables the partial substitution of silicon for boron, leading to the substance class of borosilicates, which are widespread accessory minerals. Unfortunately, a complete substitution of silicon against boron in the tetrahedral position, keeping up the silicate structure, is hardly so simple.

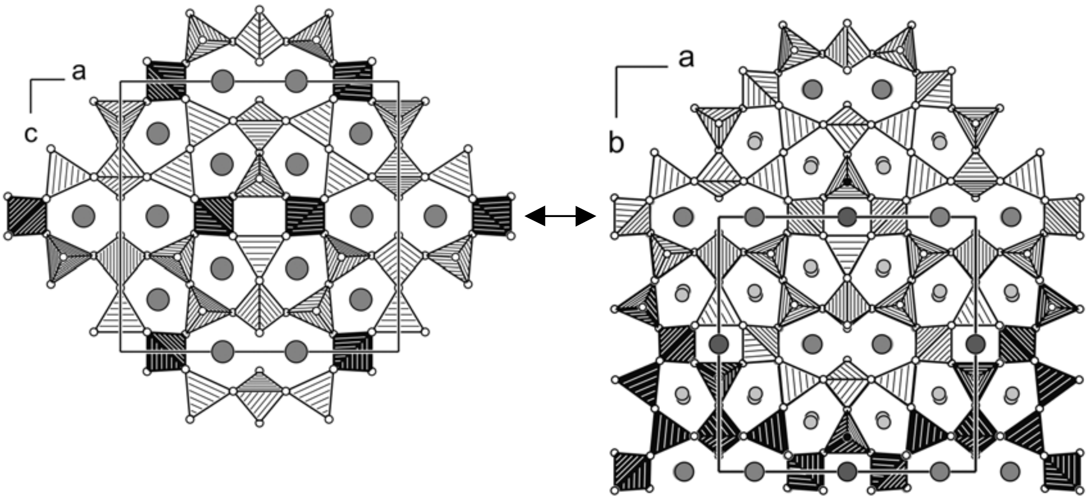

Fig. 1. Comparison of the crystal structures of $RE_3B_5O_{12}$ (RE = Er – Lu) (left; light polyhedra Q^3, dark polyhedra Q^4) and semenovite (right). The light polyhedra in the structure of semenovite visualize the identity of the tetrahedral layers in $RE_3B_5O_{12}$ (RE = Er – Lu) and semenovite.

By the use of high–pressure [1] (10 GPa, 1100 °C, Multianvil–technique) we were able to synthesize oxoborates with the new composition $RE_3B_5O_{12}$ (RE = Er – Lu) (S. G. *Pmna*), which are homeotype to the beryllo–silicate mineral semenovite ($(\mathrm{Fe}^{2+}, \mathrm{Mn}, \mathrm{Zn}, \mathrm{Ti})RE_2\mathrm{Na}_{0\text{-}2}(\mathrm{Ca}, \mathrm{Na})_8(\mathrm{Si}, \mathrm{Be})_{20}(\mathrm{O}, \mathrm{OH}, \mathrm{F})_{48}$) (Fig. 1). These results have important implications for the geochemistry of the Earth´s mantle. This work is supported by the Deutsche Forschungsgemeinschaft and the European Science Foundation (COST D30/003/03).

[1] H. Huppertz, *Z. Kristallogr.* **2004**, *219*, 330-338.