

## **Benneshерite, Ba<sub>2</sub>Fe<sup>2+</sup>Si<sub>2</sub>O<sub>7</sub>: A new melilite group mineral from the Hatrurim Basin, Negev Desert, Israel**

**ARKADIUSZ KRZĄTAŁA<sup>1,\*</sup>, BILJANA KRÜGER<sup>2</sup>, IRINA GALUSKINA<sup>1</sup>, YEVGENY VAPNIK<sup>3</sup>, AND  
EVGENY GALUSKIN<sup>1</sup>**

<sup>1</sup>Institute of Earth Sciences, Faculty of Natural Sciences, University of Silesia, Będzińska 60, 41-200 Sosnowiec, Poland

<sup>2</sup>Institute of Mineralogy and Petrography, University of Innsbruck, Innrain 52, 6020 Innsbruck, Austria

<sup>3</sup>Department of Geological and Environmental Sciences, Ben-Gurion University of the Negev, POB 653, Beer-Sheva 84105, Israel

### **ABSTRACT**

The first barium member of the melilite group, benneshерite Ba<sub>2</sub>Fe<sup>2+</sup>Si<sub>2</sub>O<sub>7</sub> [*P* $\bar{4}$ 2<sub>1</sub>*m*, *Z* = 2, *a* = 8.2334(14) Å, *c* = 5.2854(8) Å, *V* = 359.29(13) Å<sup>3</sup>], was discovered in thin veins of rankinite paralava within pyrometamorphic gehlenite hornfels at Gurim Anticline, Hatrurim Basin, Negev Desert, Israel. Benneshерite occurs in small intergranular spaces between large crystals of rankinite, gehlenite, and garnet together with other Ba-minerals such as fresnoite, walstromite, zadovite, gurimite, hexacelsian, and celsian. It forms transparent, light yellow to lemon-colored crystals with a white streak and a vitreous luster. They exhibit good cleavage on (001), a brittle tenacity, and a conchoidal fracture. The estimated Mohs hardness is 5. Benneshерite has a melilite-type structure with the layers composed of disilicate (Si<sub>2</sub>O<sub>7</sub>)<sup>6-</sup> groups and (Fe<sup>2+</sup>O<sub>4</sub>)<sup>6-</sup> tetrahedra, connected by large eightfold-coordinated Ba atoms. In some grains, epitaxial intergrowths of benneshерite and fresnoite are observed. The structure of the fresnoite, Ba<sub>2</sub>TiO(Si<sub>2</sub>O<sub>7</sub>) with a *P4bm* space group and unit-cell parameters *a* = 8.5262(5) Å, *c* = 5.2199(4) Å, is closely related to the structure of benneshерite. Among all the known minerals of the melilite group, benneshерite has a structure characterized by the lowest misfit degree between the tetrahedral (*T1* and *T2* sites) and polyhedral (*X*-site) layers, as it was shown in both natural and synthetic melilite-type phases.

**Keywords:** Benneshерite, new mineral, melilite group, crystal structure, Raman, fresnoite, paralava, Hatrurim, Israel