

THE OPTICAL PROPERTIES AND MORPHOLOGY
OF BISBEEITEAUSTIN F. ROGERS, *Stanford University*

The object of this article is to place on record a second occurrence of bisbeeite, a hydrous copper silicate, ($\text{CuSiO}_3 \cdot \text{H}_2\text{O}$), described not long since by Schaller¹ and also to define more accurately the optical properties of this rare mineral. In addition it has been possible to determine the crystal system as orthorhombic.

The locality for the new occurrence of bisbeeite is the Grandview Mine in the Grand Canyon, Arizona. A specimen collected by Mr. E. A. Melczer, a former student of the writer, furnishes the material on which this note is based. It occurs in minute (1–2 mm.) imperfect spherulites disseminated through the outer portion of a reddish-brown oxidized copper ore. The specimen contains a small amount of an unidentified green copper mineral and also residual specks of chalcocite.

The color of the bisbeeite is Ridgway's² 47a (between methyl blue and light methyl blue). It was provisionally labelled "azurite pseudomorph after malachite," but is soluble in nitric acid without effervescence. In the closed tube it turns black and yields water when heated. Qualitative tests for copper were obtained and optical tests prove its identity with bisbeeite. Altho a silicate, it is noteworthy that fragments of the mineral are soluble in a molten sodium metaphosphate bead. As Moses and Parsons³ have suggested, a satisfactory blowpipe test for silica is needed.

OPTICAL PROPERTIES: The spherulites are readily separable into fibers which have parallel extinction and as a rule are pleochroic from pale blue to deeper blue. The elongation is parallel to the slower ray in all cases. The indices of refraction, which were determined by the indirect or immersion method in sodium light, are as follows: $n_\gamma = 1.649$, $n_\beta = 1.620$, $n_\alpha = 1.589$, all ± 0.001 ; $n_\gamma - n_\alpha = 0.060 \pm 0.002$. The values given by Schaller are $\gamma = 1.65$ and α or $\beta = 1.59$, which together with the chemical tests,

¹ *Jour. Wash. Acad. Sci.*, 5, 7, 1915.

² Color Standards and Nomenclature, Washington, 1912.

³ Mineralogy, Crystallography and Blowpipe Analysis, 5th edition, p. 192.

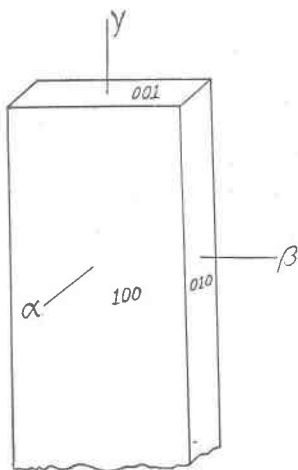


FIGURE 1.
EUBHEDRAL CRYSTAL OF BIS-
BEEITE, SHOWING OPTICAL
ORIENTATION

prove the identity of the mineral in question with the original bisbeeite.⁴ The axial colors of the bisbeeite are as follows:⁵ γ = rather deep blue, β = pale bluish green, α = neutral. The absorption scheme is $\gamma > \beta > \alpha$. The bisbeeite is probably optically positive.

MORPHOLOGY: The ends of some of the minute acicular crystals project into cavities; they for the most part have indefinite terminations, but a few have a form similar to that shown in Figure 1. The forms present are the three pinacoids: (100), (010), and (001). The optical orientation is: $a = \alpha$, $b = \beta$, and $c = \gamma$. If the observations are correct bisbeeite is orthorhombic in crystallization.

THE BELLEVILLE COPPER-MINE

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The Schuyler Copper-mine at North Arlington, New Jersey, is believed to be the oldest in the United States. It is situated on property secured by Captain William Sanford of the British Army by a patent, issued on July 4th, 1668, conveying to him about ten thousand acres of meadow-land and five thousand three hundred acres of the higher ground lying between the Hackensack and the Passaic Rivers. Nathaniel Kingsland, sergeant-major of the island of Barbados, later became interested in this grant, and from him the eastern half of the town of Lyndhurst takes its name. Sometime about the year 1712 or 1713 the discovery that copper existed in the rock appears to have been made by Arent Schuyler (1662-

⁴ Larsen's (*U. S. Geol. Surv., Bull.* 679, 48, 1921) values for the indices of refraction of bisbeeite are: $\alpha = 1.615$, $\beta = 1.625$, $\gamma = 1.71$, all ± 0.01 . It is doubtful whether he worked with the original mineral.

⁵ γ , β , and α are axial directions of the index ellipsoid and n_γ , n_β , and n_α , the values of the indices of refraction for these directions.