KERNITE, A NEW SODIUM BORATE

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The new mineral kernite, $Na_2B_4O_7 \cdot 4H_2O$, was received through Hoyt S. Gale of Los Angeles, California, and is reported to occur in quantity in the southeast corner of Kern County, California, in the Kramer boron district. The name kernite is proposed after the county name. The exact locality is about 4 miles north of Rich, a station on the Santa Fe R. R. and about 25 miles directly east of Mojave, being in Sec. 22, T. 11 N., R. 8W. The mineral was discovered in exploratory borings at a depth of several hundred feet. Ulexite and possibly colemanite are associated minerals. The geology of this field has been described by Gale[1] and Noble.[2]

The writer has a cleavage piece of kernite 2 by 2–1/2 by 6 inches. Apparently single crystals are of large size though no terminated crystals have so far been seen. The mineral is colorless to white, transparent, vitreous to pearly in luster, and greatly resembles some specimens of massive cleavable selenite. Orthorhombic. Perfect prismatic cleavage, $m \wedge m = 71°\ 08'$. Readily breaks into long thin fibers and laths. H=about 3. Sp. Gr.=1.953. Optically probably negative, although 2V is nearly 90° and sign uncertain. Elongation (c axis) positive. Axial plane is parallel to elongation. $\alpha = 1.454$, $\beta = 1.472$, $\gamma = 1.488$. Before the blowpipe it swells considerably and finally fuses to a clear glass. Very slowly soluble in cold water, the clear cleavage pieces first becoming opaque white due to abundant etch figures.

Analysis of fragments of clear transparent selected material gave the following results, an analysis of the associated massive fibrous ulexite being added.

	Kernite		Ulexite	
	Analysis	Calculated	Analysis	Calculated
Na_2O	22.63	22.66	7.09	7.65
CaO	0	0	14.06	13.85
B_2O_3	50.76	51.02	42.94	42.95
H_2O	26.50	26.32	35.54	35.55
Insol.	0	0	0.10	0
	99.89	100.00	99.73	100.00

[1] Gale, H. S.; Borate deposits near Kramer, California: *Trans. Amer. Inst. Mining Met. Eng.*, **73**, pp. 449–463 (1926).

[2] Noble, L. F.; Borate deposits in the Kramer district, Kern County, California: *U. S. Geol. Survey Bull.* **785-C**, pp. 45–61 (1926).

The ratios of the analysis of kernite are: $Na_2O:B_2O_3:H_2O$ $= 365 : 729 : 1472$ or $1.00 : 1.99 : 4.02$, the formula for kernite being $Na_2O \cdot 2B_2O_3 \cdot 4H_2O$. Not quite half the water is readily given off at $110°$ and only three-quarters of the total water is lost up to $200°$, there being no swelling of the mineral at this temperature.

The relationships of the water content and physical and optical properties of kernite and the other hydrates of $Na_2O \cdot 2B_2O_3$ (borax and "octahedral" borax, the 5-hydrate) are being studied. Crystallization of a water solution of kernite yields 1.39 times as much borax.

NOTES AND NEWS

THE CRYSTAL STRUCTURE OF SILVER SULFIDE

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X-ray data indicate that at ordinary temperatures the two minerals argentite and acanthite, both with the composition Ag_2S and supposedly dimorphous, have identical structures,[1] which are probably orthorhombic. Ag_2S has an inversion point at about $180°C.$, and a recent experiment[2] indicates that above this temperature the substance gives a cubic diffraction pattern. The described pattern appears to agree with a body-centered cubic structure, and it is assumed, therefore, that the heavier Ag atoms occupy positions at the corners and center of the unit cube. Because of their relatively slight diffraction effects the positions of the lighter S atoms could not be determined. The length of the unit cube is given as 4.84 A. U., and the calculated density is 7.2 (Dana 7.2–7.3)

It is evident from an examination of the data that this structure cannot be correct. The coordinates of the two Ag atoms would be 000 and $\frac{1}{2}\frac{1}{2}\frac{1}{2}$, and the one S atom would be in some other position. But due to the symmetry the only possible points where a single atom could be located in a cube are either 000 or $\frac{1}{2}\frac{1}{2}\frac{1}{2}$. Since these positions are already occupied by Ag atoms, the structure is impossible. In addition to this, if the density is 7.2, a cube of the dimensions stated must contain two molecules of Ag_2S, or four atoms of Ag and two of S, and some arrangement other than a body-centered cube would be necessary to provide the necessary number of positions for the Ag.

The comparatively meagre data (only four lines were measured in the pattern) are hardly sufficient for a satisfactory proof of the structure, but there are indirect means of determining at least a probable structure. Although Cu_2S is orthorhombic at ordinary temperatures, Cu_2Se is cubic, and could reasonably be supposed to be isomorphous with the cubic form of Ag_2S. Davey has shown that Cu_2Se has the CaF_2 type of structure,[3] which requires four molecules in the unit cube.

[1] Ramsdell, L. S.: Crystal structure of metallic sulfides. *Am. Mineral.*, **10**, 286 (1925).

[2] Emmons, R. C., Stockwell, C. H., and Jones, R. H. B.: Argentite and acanthite. *Am. Mineral.*, **11**, 326 (1926).

[3] *Phys. Rev.*, **21**, 380 (1923).