

## PROBERTITE, A NEW BORATE

ARTHUR S. EAKLE, *University of California.*

The new borate described in this paper occurs as one of the minerals of the kernite deposit<sup>1</sup> in the Kramer District, Kern County, California, and the name "probertite" is proposed for the mineral, in honor of Frank H. Probert, Dean of the Mining College, University of California, to whom the writer is indebted for specimens, photos and notes of its occurrence.

The mineral is prismatic columnar, radiating from sharp centers and appearing as rosettes up to three centimeters in diameter. It occurs as inclusions in the kernite (Fig. 1), in secondary borax (Fig. 2), and in the greenish gray shales which the kernite deposit has apparently replaced, (Figs. 3 and 4). It is of fairly common occurrence in the deposit.

Probertite is colorless, glassy and brittle, crushing into long splinters some of which show prismatic cleavage. No crystal faces are present.  $H=3-4$ .  $Sp. G.=1.91$ . It is a double borate of sodium and calcium but is distinctively different from ulexite in having less water and more sodium.

ANALYSIS		RATIOS
Na <sub>2</sub> O	14.03%	.226
CaO	12.76	.228
B <sub>2</sub> O <sub>3</sub>	47.80	.675
H <sub>2</sub> O	24.83	1.378

From the ratios it is evident that the formula for probertite is  $Na_2CaB_6O_{11} \cdot 6H_2O$ . This is analogous to the formula for hydroboracite  $CaMgB_6O_{11} \cdot 6H_2O$ . No magnesium minerals have been so far observed in the kernite deposit. In a low Bunsen flame probertite first whitens and then fuses easily and quietly to a clear glassy bead with no intumescence or decrepitation. It is little affected by cold water and very difficultly soluble in hot water. Its solubility is less than for ulexite. Easily soluble in acid solutions.

It crystallizes in the monoclinic system. Biaxial, positive with large  $2V$  angle.

<sup>1</sup> Schaller, W. T., Kernite, a new sodium borate. *Amer. Mineral.*, 1927, vol. 12, p. 24.

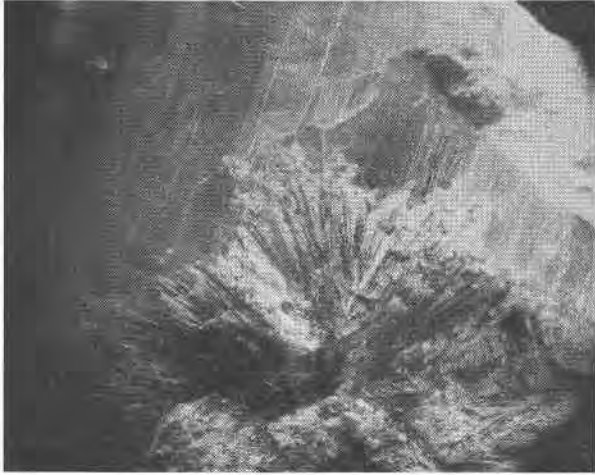


FIG. 1. Probertite in kernite. Magnified 2 diameters.



FIG. 2. Probertite in massive borax. Magnified  $1\frac{1}{2}$  diameters.

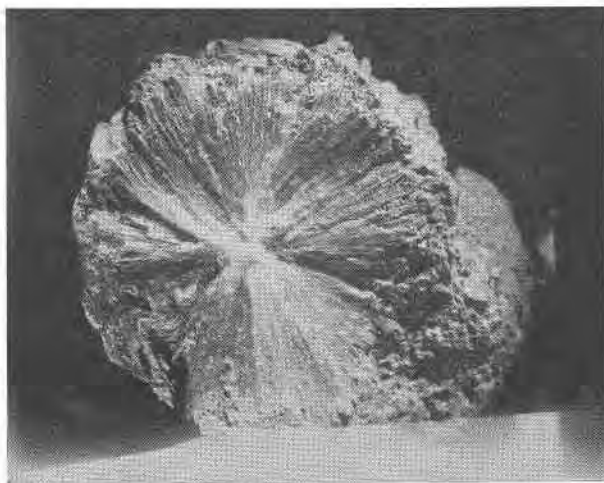


FIG. 3. Probertite hemisphere enclosed in shale. Magnified  $1\frac{1}{2}$  diameters.

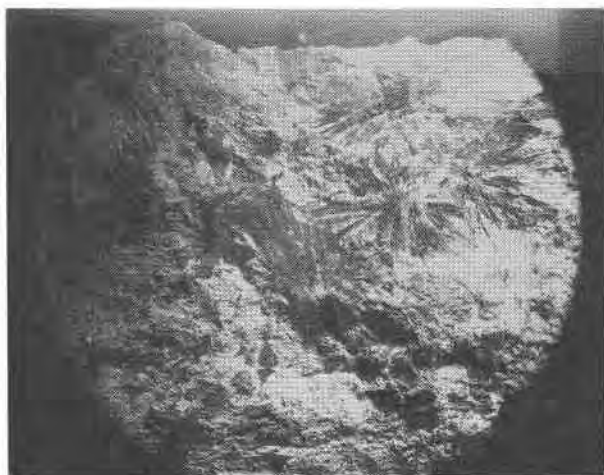


FIG. 4. Probertite rosettes in shale.  $\frac{2}{3}$  Natural size.

Indices—  $\alpha=1.515$ ;  $\beta=1.520$ ;  $\gamma=1.538$ .  $Z$  to  $c=12^\circ$ .

These indices lie between those of ulexite and hydroboracite:

Ulexite  $\alpha=1.491$ ;  $\beta=1.504$ ;  $\gamma=1.520$ .

Hydroboracite  $\alpha=1.517$ ;  $\beta=1.534$ ;  $\gamma=1.565$ .

Kernite and probertite are the primary borates of the deposit and the crystallization of the probertite has preceded or has been simultaneous with the crystallization of the kernite. The deposit is a lode-like replacement deposit in Upper or Middle Miocene-Tertiary beds. These two exceptional borates are evidently products of fumarolic or hot-spring conditions in which the temperature was the important factor influencing the crystallization of these two lower hydrates, as the primary minerals of the deposit, instead of the usual and common borax and ulexite. The presence of realgar, orpiment and stibnite as associates of the kernite confirm this view of fumarolic action.

Borax is very common in fresh glassy masses and in white altered veins, but is wholly secondary and a result of the alteration of the kernite. Ulexite is also common in divergent masses, and in veins like satin-spar, but its origin represents a later crystallization from borate solutions at ordinary temperatures.