ART. XVI.—*On Herderite from Hebron, Maine*; by H.
L. WELLS and S. L. PENFIELD.

DURING the summer of 1891 we received from Mr. L. K. Stone of Paris, Maine, a small mineral specimen for identification. The unknown mineral consisted of a few yellowish white crystals on albite. They were about 3–5^{mm} in length and their total weight probably did not exceed 2 or 3 grams. Mr. Stone stated that this was the only specimen of the mineral that had been found, and that it was discovered in 1890 at the pollucite locality in Hebron.

A preliminary examination proved that the mineral was a phosphate, very slowly soluble in hydrochloric acid and yield-

* J. H. Kinahan, *Valleys and their Relations to Fissures, Fractures and Faults*. London: Trübner & Co.

† S. F. Emmons, *Notes on the Geology of Butte*, Trans. Inst. Min. Eng., July, 1887, and *Structural Relations of Ore Deposits*, idem. xvi, 804.

ing nearly neutral water in a closed tube. The latter reaction is entirely different from that of the Stoneham herderite, which gives off very acid water and etches the glass decidedly. Before the blowpipe in the platinum forceps it turned white, sprouted and fused at about 3 to a white enamel, coloring the flame very pale green. Only a few fragmentary crystals could be found which were suitable for measurement. The crystals had the habit shown in the accompanying figure. They were attached so that only the faces at one extremity of the macro-axis were developed and were grouped in nearly parallel position but with the basal planes slightly divergent.

The forms which were observed are :

c , 001, O; m , 110, I; n , 331, 3 and q , 332, $\frac{3}{2}$

The basal planes were irregular and yielded no satisfactory reflections of the signal, while m and q were small and frequently wanting. All of the faces except c were usually striated.

The measurements which were made are given below. The calculated values are derived from the axial ratio established by Prof. E. S. Dana* from the Stoneham herderite.

				Calculated.
$n \wedge n$, 331 $\wedge$ 331	=	45° 7'	*45° 10'	45° 26'
$n \wedge n$, 331 $\wedge$ 331	=	*102° 22'	103° 7'	103° 6'
$n \wedge m$, 331 $\wedge$ 110	=	22° 14'	22° 53'	103° 24'
$n \wedge q$, 331 $\wedge$ 332	=	16° 50'	16° 32'	22° 33'
				17° 9'

Herderite was not suggested to us by the preliminary examination, and the measurements showed such a close relation to the angles of childrenite, that we fully expected the mineral to be some new variety of the latter, possibly a beryllium childrenite. It was not till the results of the quantitative analysis were obtained that we became aware of the true character of the mineral.

The similarity in crystalline form between childrenite and herderite is as follows:

Childrenite.	Corresponding forms on herderite.
b , 010, i - $\bar{x}$	c , 001, O
101, 1- $\bar{z}$	m , 110, I
p , 111, 1	n , 331, 3
s , 121, 2- $\bar{z}$	q , 332, $\frac{3}{2}$
Childrenite $a : b : c = .7780 : 1 : .5257$	
Herderite in corresponding position $a : b : c = .7752 : 1 : .4929$	

The axial ratio of the herderite was derived from the angles marked by asterisks in the above table of measurements. The

* This Journal, III, xxvii, 229.

angle $331 \wedge \bar{3}31$ could not be measured with certainty as the crystal, which was selected as best, gave double reflections from one of the faces. The angle $102^\circ 22'$ was selected as fundamental as it was from the brightest reflection, while $103^\circ 7'$ agrees better with the calculated angle of herderite.

The resemblance between the two minerals is remarkable, but since no chemical relation between them apparently exists, except that both are phosphates, the similarity in form may be accidental.

The whole specimen, except two or three small crystals, was sacrificed for a chemical examination. The material was so intimately mixed with albite that the greater part of it had to be separated by Thoulet's solution. The specific gravity of a pure crystal as shown by the heavy solution was 2.975, that of the Stoneham herderite was 3.006. The material used for analysis varied between 2.980 and 2.853.

A careful qualitative analysis showed the presence of beryllium oxide and the absence of all other bases except lime. The phosphoric acid determination was made in a separate portion by the molybdic acid method. The beryllium oxide and water were determined by methods analogous to that described by one of us for the analysis of herderite.* Unfortunately the determination of lime was a failure and there was not enough material for making a new determination. The fluorine was determined by weighing silicon fluoride, using a modification of Fresenius' apparatus.

The results of the analysis are as follows:

	Found.	Deducting Insol.	Calculated for CaBeOHPO_4 .
P_2O_5	40.81	43.08	44.10
BeO	15.32	16.18	15.53
$\text{CaO}^\dagger$	[32.54]	[34.35]	34.78
H_2O	5.83	6.15	5.59
F	.40	.42	----
Insol.....	5.27	----	----
	<hr/> 100.17	<hr/> 100.18	<hr/> 100.00

The analysis shows the mineral to be a new and interesting variety of herderite almost free from fluorine. The result confirms the idea advanced by Penfield and Harper that fluorine and hydroxyl are mutually replaceable in herderite, and the formula deduced by them for the mineral is confirmed.

Sheffield Scientific School, March, 1892.

* Penfield and Harper, this Journal, III, xxxii, 107.

† By difference.