ART. XIX.—*On Herderite (?)*, a glucinum calcium phosphate and fluoride, from Oxford County, Maine; by WILLIAM EARL HIDDEN and JAMES B. MACKINTOSH.

IN the January number of this Journal, page 73, attention was called to the mineral here described. Our specimens were obtained in October, 1883, from Mr. Nathan H. Perry, of South Paris, Me. They were then thought to be topaz, so much did they resemble that mineral in form and color, and also from the fact of their being from the same ledge, though not from the same pockets, that yielded the fine crystals of topaz noticed in this Journal, III, xxv, p. 161.

Mr. Perry has since informed us that these specimens were found in October, 1882, on a bleak ledge near Stoneham, in Oxford county, Maine, at a point about 14 miles, a little west of south, from West Bethel station on the Grand Trunk R. R.

Some weeks after they were received, we noticed that the basal cleavage, characteristic of topaz, was absent, and that the hardness of the mineral was 5, instead of 8, as in topaz.

The crystals are implanted in small clusters, and separately, on quartz crystals, and are often partly embedded in them; they also occur on muscovite: some little albite (var. cleavelandite) is often associated with them. The average size of the crystals is about 3^{mm} diameter, though one of 1^{cm} and another of nearly 2^{cm}, length and thickness was noticed. This last crystal was the only one which gave a hint of cleavage possibly existing in the mineral; a distinct pearly luster was observed while looking into it on the basal pinacoid.

All the crystals, and we have not yet found the mineral massive, are bright, well formed and rich in planes. which, however, are not usually suited for exact measurement from the presence of minute prominences over their surfaces. No regular striations seem to be present on any of the planes. The faces of one of the octahedrons are invariably dull and waxy-looking and in this respect differ from the other planes observed.

Apparently the crystals are orthorhombic, with $I \wedge I$ 116°. A macrodome measured over edge, $I \wedge I$ gave 91° 30', which would require 134° 15' for the angle of this plane on O , and a brachydome measured over O gave 113°. The observed planes are O , I , $i\tilde{2}$ (?), three brachydomes, two macrodomes, three octahedrons and two other octahedral planes beveling the edges between the regular octahedrons and the brachydomes.*

*The best crystals which we have received have been placed in the hands of Mr. E. S. Dana for crystallographic determination, and his results will be published in the next number of this Journal. He has given us the following data for publication here: The fundamental angles obtained are $1\tilde{2} \wedge 1\tilde{2}$, over O ,

The mineral is colorless to faintly yellowish, and is transparent to sub-transparent. Streak white. Crystals very brittle, with fracture small conchoidal. As the form, hardness, streak, color, associations and mode of occurrence were nearly if not quite the same as those recorded for the rare species herderite,* it was concluded that these crystals must belong to that species and accordingly tests were made to positively identify it. A specific gravity determination on a small quantity gave the result of 3, and on testing for phosphoric acid it was found to be present in large quantity.

These results, together with previously obtained crystallographic data, seemed to point conclusively to the fact that it was herderite, or a new mineral species. As no quantitative analysis of herderite has ever been published and as the qualitative analysis accorded to it was uncertain, we commenced a quantitative analysis of it in order to determine its formula. The methods pursued in its analysis were as follows: For the determination of phosphoric acid, 300^{mg} were fused with sodium carbonate. The fused mass when treated with water and nitric acid left an insoluble residue which was decomposed by heating with sulphuric acid; the solution of the residue contained only a trace of phosphoric acid. The two solutions were mixed and used for the determination. 500^{mg} were treated with silica and sulphuric acid to eliminate fluorine and, after driving off the excess of acid, dissolved in dilute hydrochloric acid. The residue was fused with sodium carbonate, the silica separated

(011 $\wedge$ 0 $\bar{1}$ 1) = 45° 54', and 1- $\bar{x}$ $\wedge$ 3 (011 $\wedge$ 331) = 57° 7'. From these the axial ratio has been calculated $\bar{a} : b : c = 1 : 0.6823 : 1.6114$. The axial ratio obtained by Haidinger for herderite is 1 : 0.6783 : 1.5971. Some of the more important angles (supplement angles) of the Maine phosphate, compared with the corresponding angles of the original herderite, are as follows:

	Maine phosphate.	Herderite.
$I \wedge I$ (110 $\wedge$ 1 $\bar{1}$ 0)	= 63° 39'	64° 7'
1- $\bar{1}$ $\wedge$ 1- $\bar{x}$ (101 $\wedge$ 1 $\bar{0}$ 1)	= 68° 37'	68° 18'
1- $\bar{x}$ $\wedge$ 1- $\bar{x}$ (011 $\wedge$ 0 $\bar{1}$ 1)	= 45° 54'	46° 2'
6- $\bar{x}$ $\wedge$ 6- $\bar{x}$ (061 $\wedge$ 0 $\bar{6}$ 1)	= 137° 2'	137° 8'
$O \wedge 1$ (001 $\wedge$ 111)	= 38° 46'	38° 41'
$O \wedge 3$ (001 $\wedge$ 331)	= 67° 27'	67° 25'

These angles show that the form of the Maine phosphate approaches closely to that of the original herderite.

* "Herderite, as originally described, is orthorhombic, $I \wedge I = 115^\circ 53'$, $O \wedge 1-\bar{1} = 145^\circ 57'$, observed planes O , I , 1, 3, 4, $\frac{2}{3}-\bar{x}$ and 6- $\bar{x}$. Cleavage: I interrupted. $H. = 5$. $G. = 2.985$. Luster vitreous, inclining to sub-resinous. Color various shades of yellowish and greenish white. Translucent. Fracture small conchoidal. Very brittle. Composition, probably, after trials by Turner and Plattner: an anhydrous phosphate of *alumina* and lime with fluorine. B.B. fuses to a white enamel with difficulty; becomes blue with cobalt solution. Dissolves when finely powdered in muriatic acid. Found very rarely at the tin mines of Ehrenfriedersdorf, Saxony ('also a good topaz locality'). Resembles the asparagus variety of apatite. (Dana's Syst. Min., 5th ed., p. 546).

and the solution added to the main one. The solution was diluted to 500^{cc} and used to determine the other constituents. 200^{cc} were taken and the lime precipitated as oxalate in an acetic acid solution. 100^{cc} were taken and precipitated with ammonia. The precipitate contained all the phosphoric acid combined with part of the lime and all the other bases present. In the filtrate the excess of lime was determined as oxalate.

The fluorine was calculated from the excess of lime. The glucina was determined by subtracting the lime and phosphoric acid known to be present from the ammonia precipitate and proved to be glucina both by its equivalent weight and by its reactions when afterwards separated.

The results obtained are:—

Found.		Calculated.	
CaO	33.21	CaO	34.33
GlO (or Gl ₂ O ₃)	15.76	GlO	15.39
P ₂ O ₅	44.31	P ₂ O ₅	43.53
F	11.32	F	11.64
	<hr/>		<hr/>
	104.60		104.89
less O	4.76	less O	4.89
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	99.84		100.00

Corresponding to the formula

or as it might be written,

The differences between the obtained and the calculated values are to be expected when the quantities used are considered. The methods employed also would tend to make the lime low and the glucina high. There is no doubt, however, that the above formula represents the true composition of the mineral. When heated on charcoal before the blowpipe, this mineral phosphoresces brightly and becomes white and opaque. When moistened with cobalt solution and reheated it becomes dark externally, but when fractured the interior surfaces show in part an amethystine color.

The results of the analysis are of great interest, since it is the first time that glucina has been recognized in any mineral in any other form of combination except as a silicate or aluminate.

In case the original determination of herderite, by Turner and Plattner, was correct, namely, an *alumina* lime phosphate fluoride, then this mineral from Maine is not herderite but a

new species. However, the probability is, from the imperfect nature of the work previously done, that this mineral from Maine is identical with the herderite of Haidinger (Phil. Mag., iv, 1, 1828, Dana's Syst. Min., p. 546). Should it prove to be otherwise, we suggest the name of *Glucinitz* as appropriate.

Feeling under obligation to Mr. Perry for furnishing us with a supply of specimens for the purposes of this article, we take pleasure in here thanking him for his kindness.

New York, January 3, 1884.