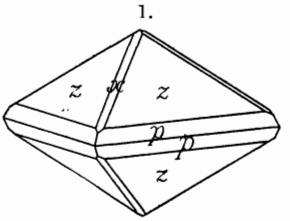
ART. XIV.—*Mineralogical Notes;* by S. L. PENFIELD.

1. *Octahedrite from Magnet Cove, Arkansas.*

UP to the present time octahedrite has been found in the United States at only a few places. It is interesting, therefore, to record its occurrence at a new locality, especially as it is one which is noted for the two other forms of titanic oxide, brookite and rutile. While examining the stock of minerals of Dr. A. E. Foote of Philadelphia, Pa., one specimen was found, among a lot of brookites from Magnet Cove, which attracted the writer's attention from its unusual crystalline form. On measuring the crystals they were found to be tetragonal and to have the angles of octahedrite. The habit is shown in fig. 1, the forms being:



p, 111, 1 z, 113, $\frac{1}{3}$ x, 103, $\frac{1}{3}$-i

The reflections of the signal were fairly good and the angles which were measured agree very well with those calculated from the length of the vertical axis as given by Miller,* $\dot{c} = 1{\cdot}7771$.

	Measured.	Calculated.		Measured.	Calculated.
$p \wedge p'$, $111 \wedge \bar{1}11 =$	82° 6′	82° 9′	$z \wedge z'$, $113 \wedge \bar{1}13 =$	53° 54′	54° 1′
$p' \wedge p''$, $\bar{1}11 \wedge \bar{1}\bar{1}1 =$	82 12	"	$z' \wedge z''$, $\bar{1}13 \wedge \bar{1}\bar{1}3 =$	53 49	"
$p \wedge p^{iv}$, $111 \wedge 11\bar{1} =$	43 22	43 24	$z \wedge z^{iv}$, $113 \wedge 11\bar{3} =$	100 20	100 5½

The crystals are black and have a fine metallic luster. The largest are about 5^{mm} in axial diameter. They are implanted upon a white saccharoidal albite, showing small, distinct crystals of albite in the cavities. When tested with salt of phosphorus before the blowpipe they gave the reaction for titanium.

Although a careful search was made, only this one specimen was found, which is now in the collection of Prof. Geo. J. Brush. There can be no doubt about its having come from Magnet Cove, as it resembles in its character and association other specimens from there and also shows a few brookite crystals.

2. *On the Crystallization of Penfieldite.*

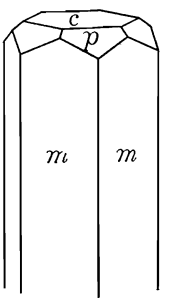
In the September number of this Journal, 1892, page 260, my friend, the late Prof. F. A. Genth, described a new min-

* Mineralogy, 1852, p. 229.

eral from Laurion, Greece, of the composition $PbO \cdot 2PbCl_2$, which he named after the writer. This was one of the last papers published by Prof. Genth and the last new mineral species described by him.

All of the specimens in Prof. Genth's possession were sent to the writer for crystallographic study. As described by him, the crystallization is hexagonal. No indications of hemihedrism were observed. The usual combination is that of prism m with basal plane c. A few of the crystals showed a pyramid of the second order p, $11\bar{2}2$, 1–2, in combination with prism and base, fig. 2. On one small crystal, which gave fair reflections from three of the pyramidal faces, the following measurements of $c \wedge p$ were made, 41° 53′, 41° 52′ and 41° 55′. Taking 41° 53′ as fundamental the axial ratio becomes $a : c = 1 : 0{\cdot}8967$.

2.



Some specimens showed the prismatic faces in combination with steep pyramids of the first order. These were in oscillatory combination, giving rise to horizontal striations and often causing the crystals to taper to a point. The reflections from these pyramids were numerous and so uncertain that no definite symbols could be assigned to them.

The cleavage is distinct parallel to the base and sections show in polarized light a normal interference figure. The double refraction is positive and about as strong as that of calcite.

3. *On the cleavage and parting Planes of Oligoclase and Albite.*

In the November number of this Journal, 1888, page 324, the writer described a very clear glassy feldspar from the Hawk mica mine, near Bakersville, Mitchell Co., N. C., which seemed to show abnormal optical properties. It is found as cleavage masses without crystal faces at a considerable depth in the mine. An analysis by Mr. E. S. Sperry showed that it contained the albite and anorthite molecules in the proportion of $3{\cdot}6 : 1$ and was to be classified therefore as oligoclase. The material that was used for the investigation was a single specimen from the collection of Mr. Norman Spang of Etna, Pa. This was without twinning striations and presented a perfect cleavage parallel to the basal, and an imperfect one, supposed to be parallel to the brachy-pinacoid (010). Plates parallel to this second cleavage showed in convergent polarized light an optical axis almost in the center of the field, while

basal sections gave with the polarizing microscope extinctions inclined about 38°–40° from the edge formed by the meeting of the two cleavages. These optical relations seemed entirely unlike those of oligoclase and the material was therefore described as abnormal. Offret* has since shown that the Bakersville oligoclase has normal optical properties and, therefore, in order to reconcile these differences and to make a further study of the material a new supply was secured from Mr. Geo. F. Kunz of New York and Mr. W. Vance Brown of Plum Tree, N. C., to whom the author's sincere thanks are due. Among the specimens some pieces presented the normal cleavage, polysynthetic twinning and optical properties of oligoclase. Some, however, that were clear and free from twinning, showed the abnormal properties as previously described, but from the examination of a number of fragments it was soon discovered that the second cleavage is not parallel to (010) and that the feldspar thus presents an unusual and unexpected cleavage or parting instead of abnormal optical properties.

In oligoclase the angle γ, between the $\breve{a}$ and $\bar{b}$ axes is practically 90° and the extinction direction on basal sections is +1° or almost parallel to the $\breve{a}$ axis, hence it follows that the angle of 38°–40° which the cleavage makes with the axis of greatest elasticity in a basal section serves to orient the cleavage with reference to the lateral axes. From the measurements of vom Rath† it has been calculated that the pyramid $(\bar{1}\bar{2}1)$ makes angles of 92° 35′ $=(001 \wedge \bar{1}\bar{2}1)$ and 87° 25′ with the base, the measurement of the abnormal cleavage being about 88°, and that the trace of the pyramid on the base intersects the edge between (001) and (010), or the direction of the $\breve{a}$ axis at an angle of 38° 1′, about corresponding to the extinction direction. Exact measurements cannot be made for determining the position of this peculiar cleavage, owing to the poor reflection which it gives and the absence of other planes except the basal cleavage, but it is distinctly parallel to a pyramid and the form $(\bar{1}\bar{2}1)$ has the position to yield all of the abnormal properties that were observed. This abnormal cleavage is well shown on many of the specimens and whether it is a true cleavage or a parting of secondary origin, produced perhaps by pressure, is uncertain but it is probably the latter. The forms that can be broken out, bounded by the basal and abnormal cleavages and an irregular fracture inclined to the base at an angle about equal to β of the feldspars, look like ordinary cleavage blocks of feldspar, and thus caused the

* Bull. Soc. Min. de France, xiii, p. 648, 1890.

† Pogg. Ann., cxxxviii, p. 464, 1869. Also Dana's Mineralogy, Sixth edition, p. 332.

original error in the orientation. Another surprising and unexpected peculiarity of this feldspar is the difficulty of producing the cleavage parallel to (010). Among the specimens that show the unusual pyramidal parting there is not one that shows the (010) cleavage. Some are broken so that the fracture runs nearly parallel to (010) but they present only the curved surfaces of a conchoidal fracture. When the direction of (010) is known, which can be determined by the extinction, it is difficult to produce the cleavage by striking the blocks in a favorable direction with the peen of a hammer, or by striking on a knife blade or chisel whose edge is placed on the crystal in the direction of the desired cleavage. On specimens which show the usual poly-synthetic twinning striæ on the base the (010) cleavage can always be readily obtained. This has given rise to the query, is the good cleavage on plagioclase parallel to (010) only apparent, and is it not possibly the result of a separation along the plane of twinning? Certainly those feldspars which show well developed poly-synthetic twinning readily yield good cleavage surfaces, while those showing no twinning, which the writer has been able to examine, usually yield the (010) cleavage only with difficulty, so that it might well be designated as rather poor and interrupted.

In experimenting upon the cleavages of albite the following peculiarities were also observed. The specimen examined was a large crystal from Amelia, Va., associated with quartz and muscovite. It presented a combination of twinning according to the Carlsbad and albite laws, similar to fig. 7, page 328 of the sixth edition of Dana's Mineralogy, and measured over 70^{mm} in the direction of the $\breve{a}$ and $\dot{c}$ axes. Two of the twinning individuals were fully 6^{mm} broad, measured at right angles to the twinning plane; they were clear and glassy, and free from cracks and poly-synthetic twin lamellæ. The crystal was firmly united by the pinacoid (010) to the quartz and when fragments were detached by striking with a hammer they were always bounded by the basal cleavage and surfaces parallel to the prism $m(110)$ and the pyramid $o(\bar{1}\,\bar{1}1)$. These latter surfaces had the appearance of perfect cleavages, and often their presence was revealed by cracks, running wholly or partly across the detached fragments. The following measurements were obtained on the reflecting goniometer, the reflections, especially those from m, being sharp and well defined:

$c \wedge m$, $001 \wedge 110 = 65° 10'$ mean of five independent measurements, varying from $65° 7'$–$65° 12'$.

$c \wedge o$, $001 \wedge \bar{1}\bar{1}1 = 57° 50'$ and $57° 33\frac{1}{2}'$.

The calculated angles taken from Dana's Mineralogy are $c \wedge m = 65° 17'$ and $c \wedge o = 57° 49'$. The parting parallel to m was moreover observed at a number of places on the specimen where the latter had been broken. Subsequent attempts to produce surfaces parallel to these same planes by breaking up the detached fragments with a hammer, using the customary devices for obtaining cleavage in definite directions, utterly failed. In other words, the partings parallel to m and o do not have the properties of true cleavage. They seem to be partings along definite cracks within the crystal or they were produced by the peculiar strain to which the fragments were subjected in breaking away from the attachment of quartz. The partings parallel to (110) and $(\bar{1}\bar{1}1)$ were readily produced on this material by pressure in the direction of the $\bar{b}$ axis, the blocks of feldspar being held between plates of lead and squeezed in a vice. As shown by Lehmann* a parting parallel to (110) results from the contraction due to sudden cooling, when heated fragments of albite are thrown into water. A similar result was obtained by the writer but no parting parallel to $(\bar{1}\bar{1}1)$ was observed.

Tests made by pressing the Bakersville oligoclase, and by contraction from sudden cooling, did not yield flat surfaces that could be referred to definite crystal directions.

In conclusion, therefore, it should be emphasized that the cohesion relations of the plagioclase feldspars may show considerable variation. The basal cleavage is always perfect. That parallel to the brachy-pinacoid (010) is usually distinct, while it is sometimes imperfect and hard to produce and especially when poly-synthetic twin lamellæ are absent. Under certain conditions of pressure or tension, partings may occur parallel to the prism $m(110)$ or the pyramid $(\bar{1}\bar{1}1)$ which resemble perfect cleavages, while, as in the case of the Bakersville oligoclase the partings may run in other directions resembling imperfect or interrupted cleavages.

Laboratory of Mineralogy and Petrography.
Sheffield Scientific School, February, 1894.

* Zeitschr. Kryst., xi, p. 612, 1886.