

Optically —. Ax. pl. nearly perpendicular (82° – 83°) to b . Bx_c inclined $15^{\circ} 26'$ to a normal to b . Dispersion $\rho < v$ about Bx_c . Extinction-angle on c , $+ 15^{\circ} 30'$; on b , $+ 5^{\circ}$ to 6° (Fig. 739, p. 375). $2H_{ax} = 88^{\circ}$ to 89° , Dx .

The essential identity of orthoclase and microcline has been urged by Mallard and Michel-Lévy on the ground that the properties of the former would belong to an aggregate of submicroscopic twinning lamellæ of the latter, according to the albite and pericline laws.

Comp., Var.—Like orthoclase, $KAlSi_3O_8$ or $K_2O \cdot Al_2O_3 \cdot 6SiO_2 =$ Silica 64.7, alumina 18.4, potash 16.9 = 100. Sodium is usually present in small amount: sometimes prominent, as in soda-microcline.

Pyr.—As for orthoclase.

Diff.—Resembles orthoclase but distinguished by optical characters (*e.g.*, the grating structure in polarized light, Fig. 734); also often shows fine twinning-striations on a basal surface (albite law).

Obs.—Occurs under the same conditions as much common orthoclase. The beautiful amazonstone from the Ural, also that occurring in fine groups of large crystals of deep color in the granite of Pike's Peak, Colorado, is microcline. *Chesterlite* from Poorhouse quarry, Chester Co., Penn., and the aventurine feldspar of Mineral Hill, Penn., belong here. A pure variety occurs at Magnet Cove, Arkansas. Ordinary microcline is common at many points.

Anorthoclase. A triclinic feldspar with a cleavage-angle, bc , varying but little from 90° . Form like that of the ordinary feldspars. Twinning as with orthoclase; also polysynthetic according to the albite and pericline laws; but in many cases the twinning laminae very narrow and hence not distinct. Rhombic section (see p. 375) inclined on b , 4° to 6° to edge b/c . $G. = 2.57$ – 2.60 . Cleavage, hardness, luster, and color as with other members of the group. Optically —. Extinction-angle on c , $+ 5^{\circ} 45'$ to $+ 2^{\circ}$; on b , 6° to $9^{\circ} 8'$. Bx_a nearly $\perp y$. Dispersion $\rho > v$; horizontal distinct. Axial angle variable with temperature, becoming in part monoclinic in optical symmetry between 86° and $264^{\circ} C.$, but again triclinic on cooling; this is true of those containing little calcium.

Chiefly a soda-potash feldspar, $NaAlSi_3O_8$ and $KAlSi_3O_8$, the sodium silicate usually in larger proportion (2 : 1, 3 : 1, etc.), as if consisting of albite and orthoclase molecules. Calcium ($CaAl_2Si_2O_8$) is also present in relatively very small amount.

These triclinic soda-potash feldspars are chiefly known from the andesitic lavas of Pantelleria. Most of these feldspars come from a rock, called pantellerite. Also prominent from the augite-syenite of southern Norway and from the "Rhomben-porphyr" near Christiania. Here is referred also a feldspar in crystals, tabular $\parallel c$, and twinned according to the Manebach and less often Baveno laws occurring in the lithophyses of the rhyolite of Obsidian Cliff, Yellowstone Park. It shows the blue opalescence in a direction parallel with a steep orthodome (*cf.* p. 371).

Albite-Anorthite Series. Plagioclase Feldspars.*

Between the isomorphous species

| | | |
|-----------|-----------------|----|
| ALBITE | $NaAlSi_3O_8$ | Ab |
| ANORTHITE | $CaAl_2Si_2O_8$ | An |

there are a number of intermediate subspecies, regarded, as urged by Tschermak, as isomorphous mixtures of these molecules, and defined according to the ratio in which they enter; their composition is expressed in general by the formula Ab_nAn_m . They are:

| | |
|---------------|--------------------------|
| OLIGOCLASE | Ab_nAn_1 to Ab_nAn_1 |
| ANDESINE | Ab_nAn_1 to Ab_nAn_1 |
| LABRADORITE | Ab_nAn_1 to Ab_nAn_1 |
| and Bytownite | Ab_nAn_1 to Ab_nAn_1 |

From albite through the successive intermediate compounds to anorthite with the progressive change in composition (and specific gravity), there is also

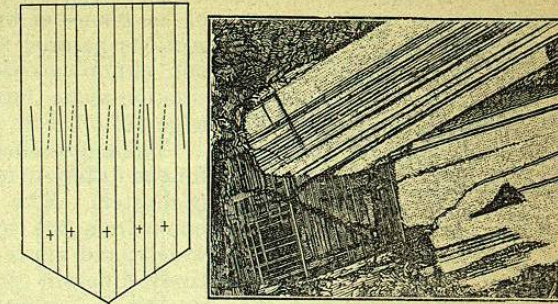
* The triclinic feldspars of this series, in which the two cleavages b and c are oblique to each other, are often called in general *plagioclase* (from $\pi\lambda\acute{\alpha}\gamma\iota\omicron\varsigma$, *oblique*).

a corresponding change in crystallographic form, and in certain fundamental optical properties.

Crystalline form. The axial ratios and angles given on p. 369 show that these triclinic feldspars approach orthoclase closely in form, the most obvious difference being in the cleavage-angle bc , which is 90° in orthoclase, $86^{\circ} 24'$ in albite, and $85^{\circ} 50'$ in anorthite. There is also a change in the axial angle γ , which is 88° in albite, about 90° in oligoclase and andesine, and 91° in anorthite. This transition appears still more strikingly in the position of the "rhombic section," by which the twins according to the pericline law are

735.

736.



united as explained below.

Twinning. The plagioclase feldspars are often twinned in accordance with the Carlsbad, Baveno, and Manebach laws common with orthoclase (pp. 370, 371). Twinning is also almost universal according to the *albite law*—twinning plane the brachypinacoid; this is usually polysynthetic, i.e. repeated in the form of thin lamellæ, giving rise to fine striations on the basal cleavage surface (Figs. 735, 736). Twinning is also common according to the *pericline law*—twinning axis the macrodiagonal axis b ; when polysynthetic this gives another series of fine striations seen on the brachypinacoid.

The composition-plane in this pericline twinning is a plane passing through the crystal in such a direction that its intersections with the prismatic faces and the brachypinacoid make equal plane angles with each other. The position of this rhombic section and the consequent direction of the striations on the brachypinacoid change rapidly with a small variation in the angle γ . In general it may be said to be approximately parallel to the base, but in albite it is inclined backward (+, Figs. 737 and 739*) and in anorthite to the front (–, Fig. 738); for the intermediate species its position varies progressively with the composition. Thus for the angle between the trace of this plane on the brachypinacoid and the edge b/c , we have for Albite $+ 22^{\circ}$ to $+ 20^{\circ}$; for Oligoclase $+ 9^{\circ}$ to $+ 3\frac{1}{2}^{\circ}$; for Andesine $+ 1^{\circ}$ to $- 2^{\circ}$; for Labradorite $- 9^{\circ}$ to $- 10^{\circ}$; for Anorthite $- 15^{\circ}$ to $- 17^{\circ}$.

737.

738.

739.

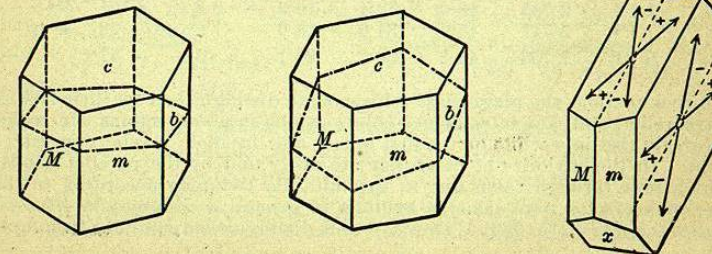
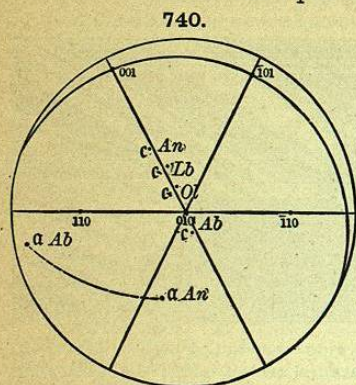


Fig. 737, Rhombic section in albite. 738, Same in anorthite. 739, Typical form showing + and – extinction-directions on c (001) and b (010).

* The faces of this fundamental form are often lettered as follows: c (001) = P , b (010) = M , m (110) = l , M (110) = T .

If the composition-plane is at right angles to the twinning axis in the pericline twinning, the polysynthetic lamellae then show prominently in a basal section, together with those due to the albite twinning. Hence the grating structure characteristic of microcline.

Optical Characters. There is also a progressive change in the position of the ether-axes and the optic axial plane in passing from albite to anorthite.



This is most simply exhibited by the position of the planes of light-vibration, as observed in sections parallel to the two cleavages, basal *c* and clinopinacoidal *b*, in other words the extinction-angle formed on each face with the edge *b/c* (cf. Fig. 739).

The approximate position of the ether-axes for the different feldspars is shown in Fig. 740 (Schuster). The axis *c* does not vary very much from the zone *bc*, but the axis *a* varies widely, and hence the axial plane has an entirely different position in albite from what it has in anorthite. Furthermore albite is optically positive, that is *c* = Bx, while anorthite is negative or *a* = Bx; for certain

andesines the axial angle is sensibly 90°.

The following table gives the percentage composition of the various molecular compounds of albite and anorthite, with the calculated specific gravity (Tschermak), and also certain of the optical characters connected with them. These latter values were calculated by Schuster from an equation deduced by Mallard, in which certain observed values were assumed as fundamental :*

| | Ratio of Albite to Anorthite | | Percentage Composition | | | | | Extinction-angle with edge <i>c/b</i> | |
|-------------------|-------------------------------------|--------------|------------------------|------------------|--------------------------------|------|-------------------|---------------------------------------|-------------|
| | <i>Ab_nAn_m</i> | <i>n : m</i> | G. | SiO ₂ | Al ₂ O ₃ | CaO | Na ₂ O | on <i>c</i> | on <i>b</i> |
| Albite | | 1 : 0 | 2.624 | 68.7 | 19.5 | 0 | 11.8 | + 4° 30' | + 19° |
| Oligoclase-albite | { | 12 : 1 | 2.635 | 66.6 | 20.9 | 1.6 | 10.9 | + 3° 38' | + 15° 35' |
| | | 6 : 1 | 2.645 | 64.9 | 22.1 | 3.0 | 10.0 | to + 2° 45' to + 11° 59' | |
| Oligoclase | { | 4 : 1 | 2.652 | 63.3 | 23.1 | 4.2 | 9.4 | + 1° 55' | + 8° 17' |
| | | 2 : 1 | 2.671 | 59.9 | 25.4 | 7.0 | 7.7 | to - 0° 35' to - 2° 15' | |
| Andesine | { | 3 : 2 | 2.630 | 58.1 | 26.6 | 8.4 | 6.9 | - 2° 12' | - 7° 58' |
| | | 1 : 1 | 2.694 | 55.6 | 28.3 | 10.4 | 5.7 | to - 5° 10' to - 16° | |
| Labradorite | { | 3 : 4 | 2.703 | 53.7 | 29.6 | 11.8 | 4.9 | - 7° 53' | - 20° 52' |
| | | 1 : 3 | 2.728 | 49.3 | 32.6 | 15.3 | 2.8 | to - 17° 40' to - 29° 28' | |
| Bytownite | { | 1 : 4 | 2.735 | 48.0 | 33.4 | 16.3 | 2.3 | - 21° 5' | - 31° 10' |
| | | 1 : 8 | 2.747 | 45.9 | 34.9 | 18.0 | 1.2 | to - 28° 4' to - 33° 40' | |
| Anorthite | | 0 : 1 | 2.758 | 43.2 | 36.7 | 20.1 | 0 | - 37° | - 36° |

Diff.—In rock sections the plagioclase feldspars are distinguished by their lack of color, low refractive relief, and low interference-colors, which in good sections are mainly dark gray and scarcely rise into white of the first order; also by their biaxial character in converging light. In the majority of cases they are easily told by the parallel bands or fine lamellae which pass through them due to the multiple twinning according to the albite law; one set of bands or twin lamellae exhibits in general a different interference-color from the other (cf. Figs. 735, 736). They are thus distinguished not only from quartz and

* See Tschermak, Ber. Ak. Wien, 50 (1), 566, 1865; Schuster, Min. Mitth., 3, 117, 1881, 5, 189, 1882; Mallard, Bull. Soc. Min., 4, 96, 1881. Also Michel-Lévy and other authors referred to on p. 212; further, G. F. Becker, Am. J. Sc., 5, p. 349, May 1898.

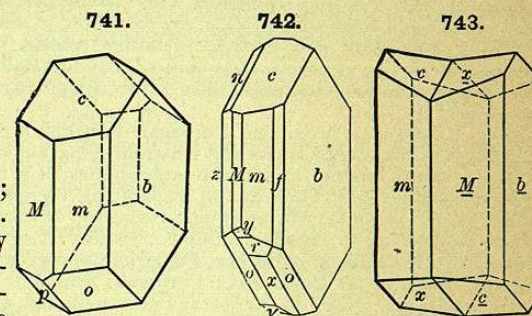
orthoclase, with which they are often associated, but from all the common rock-making minerals. To distinguish the different species and sub-species from one another, as albite from labradorite or andesine, is more difficult. In sections having a definite orientation ($\parallel c$ (001) and $\parallel b$ (010)) this can generally be done by determining the extinction angles (cf. p. 375 and Fig. 739). In general in rock sections special methods are required; these are discussed by the authors referred to in the note on p. 376.

ALBITE.

Triclinic. Axes $a : b : c = 0.6335 : 1 : 0.5577$; $\alpha = 94^\circ 3'$, $\beta = 116^\circ 29'$, $\gamma = 88^\circ 9'$.

- bc*, 010 \wedge 001 = 86° 24'.
- mM*, 110 \wedge 110 = 59° 14'.
- bm*, 110 \wedge 010 = 60° 26'.
- cm*, 001 \wedge 110 = 65° 17'.
- cM*, 001 \wedge 110 = 69° 10'.
- cx*, 001 \wedge 101 = 52° 16'.

Twins as with orthoclase; also very common, the tw. pl. *b*, albite law (p. 375), usually contact-twins, and polysynthetic, consisting of thin lamellae and with consequent fine striations on *c*; tw. axis *b*, pericline law, contact-twins whose composition-face is the rhombic section (Figs. 737 and 745); often polysynthetic and showing fine striations which on *b* are inclined backward + 22° to the edge *b/c*.

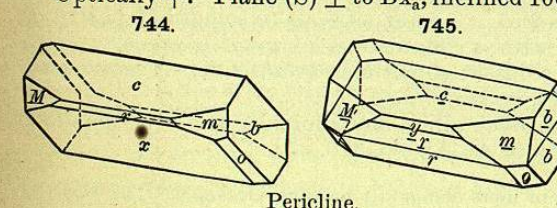


Crystals often tabular $\parallel b$; also elongated \parallel axis *b*, as in the variety pericline. Also massive, either lamellar or granular; the laminae often curved, sometimes divergent; granular varieties occasionally quite fine to impalpable. Cleavage: *c* perfect; *b* somewhat less so; *m* imperfect. Fracture uneven to conchoidal. Brittle. H. = 6-6.5. G. = 2.62-2.65. Luster vitreous; on a cleavage surface often pearly. Color white; also occasionally bluish, gray, reddish, greenish, and green; sometimes having a bluish opalescence or play of colors on *c*. Streak uncolored. Transparent to subtranslucent.

Optically +. Plane (S) \perp to Bx_a, inclined 100° to 102° to *c* on acute edge *b/c*. Extinction-angle with edge *b/c* = + 4° 30' to 2° on *c*, and = + 20° to 15° on *b* (Fig. 737). Dispersion for Bx_a, $\rho < v$; also inclined, horizontal; for Bx_o, $\rho > v$; inclined, crossed, Dx. $2H_{a,r} = 80^\circ$ to 84° Dx. Birefringence weak, $\gamma - \alpha = 0.008$.

Comp.—A silicate of aluminium and sodium, NaAlSi₃O₈ or Na₂O.Al₂O₃.6SiO₂ = Silica 68.7, alumina 19.5, soda 11.8 = 100. Calcium is usually present in small amount, as anorthite (CaAl₂Si₂O₈), and as this increases it graduates through oligoclase-albite to oligoclase (cf. p. 376). Potassium may also be present, and it is then connected with orthoclase and microcline.

Var.—Ordinary. In crystals and massive. The crystals often tabular $\parallel b$. The massive forms are usually nearly pure white, and often show wavy or curved laminae. *Peristerite* is a whitish adularia-like albite, slightly iridescent, named from *περιστέρα*, pigeon. *Aventurine* and *moonstone* varieties also occur. *Pericline* from the chloritic schists of the Alps



is in rather large opaque white crystals, with characteristic elongation in the direction of the *b* axis, as shown in Figs. 744 and 745, and commonly twinned with this as the twinning axis (pericline law).

Pyr., etc.—B.B. fuses at 4 to a colorless or white glass, imparting an intense yellow to the flame. Not acted upon by acids.

Diff.—Resembles barite in some forms, but is harder and of lower specific gravity; does not effervesce with acid (like calcite). Distinguished optically and by the common twinning striations on *c* from orthoclase; from the other triclinic feldspars partially by specific gravity and better by optical means (see p. 376).

Obs.—Albite is a constituent of many igneous rocks, especially those of alkaline type, as granite, elaeolite-syenite, diorite, etc.; also in the corresponding feldspathic lavas. In *perthite* (p. 373) it is interlaminated with orthoclase or microcline, and similar aggregations, often on a microscopic scale, are common in many rocks. Albite is common also in gneiss, and sometimes in the crystalline schists. Veins of albitic granite are often repositories of the rarer minerals and of fine crystallizations of gems, including beryl, tourmaline, allanite, columbite, etc. It is found in disseminated crystals in granular limestone.

Some of the most prominent European localities are in cavities and veins in the granite or granitoid rocks of the Swiss and Austrian Alps, associated with adularia, smoky quartz, chlorite, titanite, apatite, and many rarer species; it is often implanted in parallel position upon the orthoclase. Thus in the St. Gothard region; Roc Tourné near Modane, Savoy; on Mt. Skopi (*pericline*); Tavetschthal; Schmirn, Tyrol; also Pfitsch, Rauris, the Zillertal, Kriml, Schneeberg in Passeir in simple crystals. Also in Dauphiné in similar association; Elba. Also Hirschberg in Silesia; Penig in Saxony; with topaz at Mursinka in the Ural and near Miask in the Ilmen Mts.; Cornwall, England; Mourne Mts. in Ireland.

In the United States, in *Maine*, at Paris, with red and blue tourmalines. In *Mass.*, at Chesterfield, in lamellar masses (*cleavelandite*), slightly bluish, also fine granular. In *New Hamp.*, at Acworth and Alstead. In *Conn.*, at Haddam; at the Middletown feldspar quarry; at Branchville, in fine crystals and massive. In *N. York*, at Moriah, Essex Co., of a greenish color. In *Penn.*, at Unionville, Chester Co. In *Virginia*, at the mica mines near Amelia Court-House in splendid crystallizations. In *Colorado*, in the Pike's Peak region with smoky quartz and amazon-stone.

The name *albite* is derived from *albus*, white, in allusion to its common color.

Oligoclase.

Triclinic. Axes, see p. 369 *bc*, $010 \wedge 001 = 86^\circ 32'$. Twins observed according to the Carlsbad, albite, and pericline laws. Crystals not common. Usually massive, cleavable to compact.

Cleavage: *c* perfect; *b* somewhat less so. Fracture conchoidal to uneven. Brittle. *H.* = 6–6.5. *G.* = 2.65–2.67. Luster vitreous to somewhat pearly or waxy. Color usually whitish, with a faint tinge of grayish green, grayish white, reddish white, greenish, reddish; sometimes aventurine. Transparent, subtranslucent. Optical characters, see p. 376.

Comp., Var.—Intermediate between albite and anorthite and corresponding to Ab_2An_1 to Ab_1An_2 , but chiefly to Ab_2An_1 , p. 376.

Var.—1. *Ordinary*. In crystals or more commonly massive, cleavable. The varieties containing soda up to 10 p. c. are called *oligoclase-albite*. 2. *Aventurine oligoclase*, or *sunstone*, is of a grayish-white to reddish-gray color, usually the latter, with internal yellowish or reddish fire-like reflections proceeding from disseminated crystals of probably either hematite or goëthite.

Pyr., etc.—B.B. fuses at 3.5 to a clear or enamel-like glass. Not materially acted upon by acids.

Diff.—See orthoclase (p. 372) and albite (p. 377); also pp. 370, 376.

Obs.—Occurs in porphyry, granite, syenite, and also in different effusive rocks, as andesite. It is sometimes associated with orthoclase in granite, or other granite-like rock. Among its localities are Danviks-Zoll near Stockholm; Pargas in Finland; Shaitansk, Ural; in syenite of the Vosges; at Albula in the Grisons; Marienbad, Bohemia; Chalanches in Allumont, and Bourg d'Oisans, Dauphiné; as *sunstone* at Tvedestrand, Norway; at Hitterö; Lake Baikal.

In the United States, at Fine and Macomb, St. Lawrence Co., N. Y., in good crystals; at Danbury, Ct., with orthoclase and danburite; Haddam, Ct.; at the emery mine, Chester, Mass., granular; at Unionville, Pa., with euphyllite and corundum; Mineral Hill, Delaware Co.; at Bakersville, N. C., in clear glassy masses, showing cleavage but no twinning. Named in 1826 by Breithaupt from *ὀλιγος*, *little*, and *κλάσις*, *fracture*.

Andesine.

Triclinic. Axes, see p. 369. *bc*, $010 \wedge 001 = 86^\circ 14'$. Twins as with albite. Crystals rare. Usually massive cleavable or granular.

Cleavage: *c* perfect; *b* less so; also *M* sometimes observed. *H.* = 5–6. *G.* = 2.68–2.69. Color white, gray, greenish, yellowish, flesh-red. Luster subvitreous to pearly. Optical characters, see p. 376.

Comp.—Intermediate between albite and anorthite, corresponding to Ab : An in the ratio of 3:2, 4:3 to 1:1, see p. 376.

Pyr., etc.—Fuses in thin splinters before the blowpipe. Imperfectly soluble in acids.

Obs.—Observed in many granular and volcanic rocks; thus occurs in the Andes, at Marmato, as an ingredient of the rock called *andesite*; in the porphyry of l'Estérel, Dept. du Var, France; in the syenite of Alsace in the Vosges; at Vapnefjord, Iceland; Bodenmais, Bavaria. Sanford, Me., with vesuvianite. Common in the igneous rocks of the Rocky Mts.

Labradorite. Labrador Feldspar.

Triclinic. Form near that of andesine, but not accurately known (p. 369). Cleavage angle *bc* = $86^\circ 4'$. Forms and twinning similar to the other plagioclase species. Crystals often very thin tabular $\parallel b$, and rhombic in outline bounded by *cy* or *cx* (Fig. 425, p. 131). Also massive, cleavable or granular; sometimes cryptocrystalline or hornstone-like.

Cleavage: *c* perfect; *b* less so; *M* ($1\bar{1}0$) sometimes distinct. *H.* = 5–6. *G.* = 2.70–2.72. Luster on *c* pearly, passing into vitreous; elsewhere vitreous or subresinous. Color gray, brown, or greenish; sometimes colorless and glassy; rarely porcelain-white; usually a beautiful change of colors in cleavable varieties, especially $\parallel b$. Streak uncolored. Translucent to subtranslucent. Optical characters, see p. 376.

Play of colors a common character, but sometimes wanting, as in some colorless crystals. Blue and green are the predominant colors; but yellow, fire-red, and pearl-gray also occur. Vogelsang regards the common blue color of labradorite as an interference-phenomenon due to its lamellar structure, while the golden or reddish schiller, with the other colors, is due to the presence of black acicular microlites and yellowish-red microscopic lamellæ, or to the combined effect of these with the blue reflections. Schrauf has examined the inclusions, their position, etc., and given the names *microplakite* and *microphyllite* to two groups of them. (See references on p. 142.)

Comp., Var.—Intermediate between albite and anorthite and corresponding chiefly to Ab : An in a ratio of from 1:1 to 1:3, p. 376.

The feldspars which lie between labradorite proper and anorthite have been embraced by Tschermak under the name *bytownite*. The original bytownite of Thomson was a greenish-white feldspathic mineral found in a boulder near Bytown (now Ottawa) in Ontario, Canada.

Pyr., etc.—B.B. fuses at 3 to a colorless glass. Decomposed with difficulty by hydrochloric acid, generally leaving a portion of undecomposed mineral.

Diff.—The beautiful play of colors is a common but not universal character. Otherwise distinguished as are the other feldspars (pp. 370, 376).

Obs.—Labradorite is an essential constituent of various igneous rocks, especially of the basic kinds, and usually associated with some member of the pyroxene or amphibole groups. Thus with hypersthene in norite, with diallage in gabbro, with some form of pyroxene in diabase, basalt, dolerite, also andesite, tephrite, etc. Labradorite also occurs in other

kinds of lava, and is sometimes found in them in glassy crystals, as in those of Etna, Vesuvius, the Sandwich Islands at Kilauea.

The labradoritic massive rocks are most common among the formations of the Archæan era. Such are part of those of British America, northern New York, Pennsylvania, Arkansas; those of Greenland, Norway, Finland, Sweden, and probably of the Vosges.

On the coast of Labrador, labradorite is associated with hornblende, hypersthene, and magnetite. It is met with in many places in Quebec. Occurs abundantly through the central Adirondack region in northern New York; in the Wichita Mts., Arkansas.

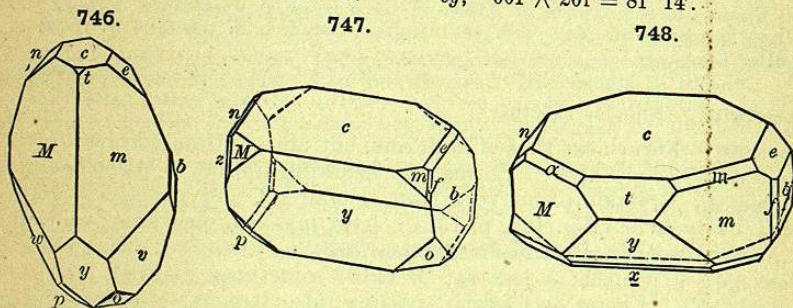
Labradorite was first brought from the Isle of Paul, on the coast of Labrador, by Mr. Wolfe, a Moravian missionary, about the year 1770.

MASKELYNITE. In colorless isotropic grains in meteorites; composition near labradorite.

ANORTHITE. Indianite.

Triclinic. Axes $a : b : c = 0.6347 : 1 : 0.5501$; $\alpha = 93^\circ 13'$, $\beta = 115^\circ 55\frac{1}{2}'$, $\gamma = 91^\circ 12'$.

| | |
|--|--|
| bc , $010 \wedge 001 = 85^\circ 50'$. | cm , $001 \wedge 110 = 65^\circ 53'$. |
| mM , $110 \wedge \bar{1}\bar{1}0 = 59^\circ 29'$. | cM , $001 \wedge \bar{1}\bar{1}0 = 69^\circ 20'$. |
| bm , $010 \wedge 110 = 58^\circ 4'$. | cy , $001 \wedge \bar{2}01 = 81^\circ 14'$. |



Twins as with albite (p. 375 and p. 377). Crystals usually prismatic $\parallel c$ (746, also Fig. 338, p. 108), less often elongated $\parallel b$, like pericline (Fig. 747). Also massive, cleavable, with granular or coarse lamellar structure.

Cleavage: c perfect; b somewhat less so. Fracture conchoidal to uneven. Brittle. $H. = 6-6.5$. $G. = 2.74-2.76$. Color white, grayish, reddish. Streak uncolored. Transparent to translucent.

Optically —. Ax. pl. nearly $\perp e$ (021), and its trace inclined 60° to the edge c/e from left above behind to right in front below. Extinction-angles on c , -34° to -42° with edge b/c ; on b , -35° to -43° (Fig. 739, p. 375). Dispersion $\rho < v$, also inclined. $2H_{ar} = 84^\circ 50'$. Birefringence stronger than with albite, $\gamma - \alpha = 0.013$.

Comp.—A silicate of aluminium and calcium, $CaAl_2Si_2O_8$ or $CaO \cdot Al_2O_3 \cdot 2SiO_2$, = Silica 43.2, alumina 36.7, lime 20.1 = 100. Soda (as $NaAlSi_3O_8$) is usually present in small amount, and as it increases there is a gradual transition through bytownite to labradorite.

Var.—*Anorthite* was described from the glassy crystals of Somma; and *christianite* and *biotine* are the same mineral. *Thioursaite* is the same from Iceland. *Indianite* is a white, grayish, or reddish granular anorthite from India, where it occurs as the gangue of corundum, first described in 1802 by Count Bournon. *Cyclopitite* occurs in small, transparent, and glassy crystals, tabular $\parallel b$, coating cavities in the dolerite of the Cyclopean Islands and near Trezza on Etna. *Amphodelite*, *lepolite*, *latrobite* also belong to anorthite.

Pyr., etc.—B.B. fuses at 5 to a colorless glass. Anorthite from Mte. Somma, and indianite from the Carnatic, are decomposed by hydrochloric acid, with separation of gelatinous silica.

Obs.—Occurs in some diorites; occasionally in connection with gabbro and serpentine rocks; in some cases along with corundum; in many volcanic rocks, andesites, basalts, etc.; as a constituent of some meteorites (Juvenas, Stannern).

Anorthite (*christianite* and *biotine*) occurs at Mount Vesuvius in isolated blocks among the old lavas in the ravines of Monte Somma; in the Albani Mts.; on the Pesmeda Alp, Monzoni, Tyrol, as a contact mineral; Aranyer Berg, Transylvania, in andesite; on Iceland; near Bogoslovsk in the Ural. In the Cyclopean Islands (*cyclopitite*). In the lava of the island of Miyake, Japan.

Anorthite was named in 1823 by Rose from $\alpha\nu\theta\rho\theta\acute{\sigma}\varsigma$, *oblique*, the crystallization being triclinic.

Celsian. $BaAl_2Si_2O_8$, similar to anorthite, but containing barium instead of calcium. Massive, with the usual cleavages c (001) and b (010), $cb = 89^\circ 36'$. $H. = 6-6.5$. $G. = 3.37$. Colorless. Extinction: on c , $3^\circ 10'$; on b , $26^\circ 45'$. From Jakobsberg, Sweden.

II. Metasilicates. $RSiO_3$.

Salts of Metasilicic Acid, H_2SiO_3 ; characterized by an oxygen ratio of 2 : 1 for silicon to bases. The Division closes with a number of species, in part of somewhat doubtful composition, forming a transition to the Orthosilicates.

The metasilicates include two prominent and well-characterized groups, viz., the Pyroxene Group and the Amphibole Group. There are also others less important.

Leucite Group. Isometric.

In several respects leucite is allied to the species of the FELDSPAR GROUP, which immediately precede.

| | | |
|------------------|------------------------|--|
| Leucite | $KAl(SiO_3)_2$ | Isometric at 500° |
| | | Pseudo-isometric at ordinary temperatures. |
| Pollucite | $H_2Cs_4Al_4(SiO_3)_8$ | Isometric |

LEUCITE. Amphigène.

Isometric at $500^\circ C.$; pseudo-isometric under ordinary conditions (see p. 230). Commonly in crystals varying in angle but little from the tetragonal trisoctahedron n (211), sometimes with a (100), and d (110) as subordinate forms. Faces often showing fine striations due to twinning (Fig. 749). Also in disseminated grains; rarely massive granular.

Cleavage: d (110) very imperfect. Fracture conchoidal. Brittle. $H. = 5.5-6$. $G. = 2.45-2.50$. Luster vitreous. Color white, ash-gray or smoke-gray. Streak uncolored. Translucent to opaque. Usually shows very feeble double refraction: $\omega = 1.508$, $\epsilon = 1.509$ (p. 230).

Comp.— $KAl(SiO_3)_2$ or $K_2O \cdot Al_2O_3 \cdot 4SiO_2$, = Silica 55.0, alumina 23.5, potash 21.5 = 100.

Soda is present only in small quantities, unless as introduced by alteration; traces of lithium, also of rubidium and cesium, have been detected.

Pyr., etc.—B.B. infusible; with cobalt solution gives a blue color (aluminium). Decomposed by hydrochloric acid without gelatinization.

Diff.—Characterized by its trapezohedral form, absence of color, and infusibility. It is softer than garnet and harder than analcite; the latter yields water and fuses.

