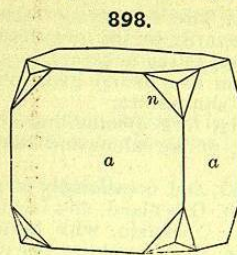
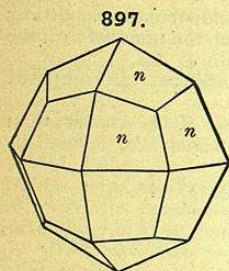


Magee, Antrim; at Dalsnypen, Färöer; in Iceland; in the basalt of Table Mountain near Golden, Colorado.

Offretite. A potash zeolite, related to the species of the chabazite group. In basalt of Mont Simiouse, France.

ANALCITE. Analcime.

Isometric. Usually in trapezohedrons; also cubes with faces n (211); again the cubic faces replaced by a vicinal trisoctahedron. Sometimes in composite groups about a single crystal as nucleus (Fig. 351, p. 119). Also massive granular; compact with concentric structure.



Cleavage: cubic, in traces. Fracture subconchoidal. Brittle. $H. = 5-5.5$. $G. = 2.22-2.29$; 2.278 Thomson. Luster vitreous. Colorless, white; occasionally grayish, greenish, yellowish, or reddish white. Transparent to nearly opaque. Often shows weak double refraction, which is apparently connected with loss of water and consequent change in molecular structure (Art. 411). $n_r = 1.4874$.

Comp.— $\text{NaAlSi}_2\text{O}_6 + \text{H}_2\text{O} = \text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot 2\text{H}_2\text{O} = \text{Silica } 54.5, \text{ alumina } 23.2, \text{ soda } 14.1, \text{ water } 8.2 = 100$.

Pyr., etc.—Yields water in the closed tube. B.B. fuses at 2.5 to a colorless glass. Gelatinizes with hydrochloric acid.

Diff.—Characterized by trapezohedral form, but is softer than garnet, and yields water B.B. unlike leucite (which is also infusible); fuses without intumescence to a clear glass unlike chabazite.

Recognized in thin sections by its very low relief and isotropic character; often shows optical anomalies. From leucite and sodalite surely distinguished only by chemical tests, i.e., absence of chlorine in the nitric-acid test (see sodalite, p. 444), absence of much potash and abundance of soda in the solution, and evolution of much water from the powder in a closed glass tube below a red heat.

Obs.—Occurs frequently with other zeolites, also prehnite, calcite, etc., in cavities and seams in basic igneous rocks, as basalt, diabase, etc.; also in granite, gneiss, etc. Recently shown to be also a rather widespread component of the groundmass of various basic igneous rocks, at times being the only alkali-alumina silicate present, as in the so-called analcite-basalts. Has been held in such cases to be a primary mineral produced by the crystallization of a magma containing considerable soda and water vapor held under pressure.

The Cyclopean Islands, near Catania, Sicily, afford pellucid crystals; also the Fassathal in Tyrol; other localities are, in Scotland, in the Kilpatrick Hills; Co. Antrim, etc., in Ireland; the Färöer; Iceland; near Aussig, Bohemia; at Arendal, Norway, in beds of iron ore; at Andreasberg, in the Harz, in silver mines.

In the U. S., occurs at Bergen Hill, New Jersey; in gneiss near Yonkers, Westchester Co., N. Y.; abundant in fine crystals, with prehnite, datolite, and calcite, in the Lake Superior region; at Table Mt. near Golden, Colorado, with other zeolites. Nova Scotia affords fine specimens.

The name *Analcime* is from *ἀναλκίς*, weak, and alludes to its weak electric power when heated or rubbed. The correct derivative is *analcite*, as here adopted for the species.

Faujasite. Perhaps $\text{H}_4\text{Na}_2\text{CaAl}_4\text{Si}_6\text{O}_{38} + 18\text{H}_2\text{O}$.

In isometric octahedrons. $H. = 5$. $G. = 1.923$. Colorless, white. Occurs with augite in the limburgite of Sasbach in the Kaiserstuhl, Baden, etc.

Edingtonite. Perhaps $\text{BaAl}_2\text{Si}_2\text{O}_8 + 3\text{H}_2\text{O}$. Crystals pyramidal in habit (tetragonal-sphenoidal); also massive. $H. = 4-4.5$. $G. = 2.694$. White, grayish white, pink. Occurs in the Kilpatrick Hills, near Glasgow, Scotland, with harmotome.

Natrolite Group. Orthorhombic and Monoclinic.

		$\tilde{a} : \tilde{b} : \tilde{c}$	
Natrolite	$\text{Na}_2\text{Al}_2\text{Si}_3\text{O}_{10} + 2\text{H}_2\text{O}$	0.9785 : 1 : 0.3536	
		$\tilde{a} : \tilde{b} : \tilde{c}$	β
Scolecite	$\text{Ca}(\text{AlOH})_2(\text{SiO}_3)_3 + 2\text{H}_2\text{O}$	0.9764 : 1 : 0.3434	$89^\circ 18'$
Mesolite	$\left\{ \begin{array}{l} \text{Na}_2\text{Al}_2\text{Si}_3\text{O}_{10} + 2\text{H}_2\text{O} \\ 2[\text{CaAl}_2\text{Si}_2\text{O}_{10} + 3\text{H}_2\text{O}] \end{array} \right.$		

The three species of the NATROLITE GROUP agree closely in angle, though varying in crystalline system; Natrolite is orthorhombic usually, also rarely monoclinic; Scolecite is monoclinic, perhaps also in part triclinic; Mesolite seems to be both monoclinic and triclinic. Fibrous, radiating or divergent groups are common to all these species.

The Natrolite Group includes the sodium silicate, Natrolite, with the empirical formula $\text{Na}_2\text{Al}_2\text{Si}_3\text{O}_{10} \cdot 2\text{H}_2\text{O}$; the calcium silicate, Scolecite, $\text{CaAl}_2\text{Si}_2\text{O}_{10} \cdot 3\text{H}_2\text{O}$; also Mesolite intermediate between these and corresponding to $\left\{ \begin{array}{l} m\text{Na}_2\text{Al}_2\text{Si}_3\text{O}_{10} \cdot 2\text{H}_2\text{O} \\ n\text{CaAl}_2\text{Si}_2\text{O}_{10} \cdot 3\text{H}_2\text{O} \end{array} \right.$

NATROLITE. Nadelzeolith *Germ.*

Orthorhombic.* Axes $\tilde{a} : \tilde{b} : \tilde{c} = 0.9785 : 1 : 0.3536$.

mm'' , $110 \wedge \bar{1}\bar{1}0 = 88^\circ 45\frac{1}{2}'$.

mo' , $110 \wedge 111 = 63^\circ 11'$.

oo' , $111 \wedge \bar{1}\bar{1}1 = 37^\circ 38'$.

oo'' , $111 \wedge \bar{1}\bar{1}\bar{1} = 36^\circ 47\frac{1}{2}'$.

Crystals prismatic, usually very slender to acicular; frequently divergent, or in stellate group. Also fibrous, radiating, massive, granular, or compact.

Cleavage: m perfect; b imperfect, perhaps only a plane of parting. Fracture uneven.

$H. = 5-5.5$. $G. = 2.20-2.25$. Luster vitreous, sometimes inclining to pearly, especially in fibrous varieties. Color white, or colorless; to grayish, yellowish, reddish to red. Transparent to translucent. Optically +. $\text{Ax. pl.} \parallel b$. $\text{Bx} \perp c$. $2E_r = 93^\circ 28'$. $\beta_r = 1.4797$; $\gamma - \alpha = 0.012$.

Var.—Ordinary. Commonly either (a) in groups of slender colorless prismatic crystals, varying but little in angle from square prisms, often acicular, or (b) in fibrous divergent or radiated masses, vitreous in luster, or but slightly pearly (these radiated forms often resemble those of thomsonite and pectolite); often also (c) solid amygdulose, usually radiated fibrous, and somewhat silky in luster within; (d) rarely compact massive. *Galactite* is ordinarily natrolite, in colorless needles from southern Scotland.

Bergmannite, *spreustein*, *brevicite*, are names which have been given to the natrolite from the augite-syenite of southern Norway, on the Langesund fiord, in the "Brevik" region, where it occurs fibrous, massive, and in long prismatic crystallizations, and from white to red in color. Derived in part from ekaolite, in part from sodalite. *Iron-natrolite* is a dark green opaque variety, either crystalline or amorphous, from the Brevik region; the iron is due to inclusions.

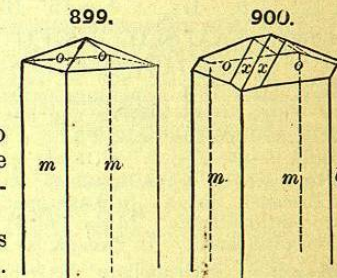
Comp.— $\text{Na}_2\text{Al}_2\text{Si}_3\text{O}_{10} + 2\text{H}_2\text{O}$ or $\text{Na}_2\text{O} \cdot \text{Al}_2\text{O}_3 \cdot 3\text{SiO}_2 + 2\text{H}_2\text{O} = \text{Silica } 47.4, \text{ alumina } 26.8, \text{ Na}_2\text{O } 16.3, \text{ water } 9.5 = 100$.

Pyr., etc.—In the closed tube whitens and becomes opaque. B.B. fuses quietly at 2 to a colorless glass. Fusible in the flame of an ordinary stearine or wax candle. Gelatinizes with acids.

Diff.—Distinguished from aragonite and pectolite by its easy fusibility and gelatinization with acid.

Obs.—Occurs in cavities in amygdaloidal basalt, and other related igneous rocks:

*In rare cases the crystals seem to be monoclinic.



sometimes in seams in granite, gneiss, and syenite. Found at Aussig and Teplitz in Bohemia; in fine crystals in Auvergne; Fassathal, Tyrol; Kapnik, Hungary. In red amygduloids (*crocolite*) in amygdaloid of Ireland, Scotland and Tyrol; the amygdaloid of Bishopston (*galactite*); at Glen Farg (*fargite*) in Fifeshire. Common in the augite-syenite of the Langesund fiord, near Brevik, southern Norway.

In North America, in the trap of Nova Scotia; at Bergen Hill, N. J.; at Copper Falls, Lake Superior.

Named *Mesotype* by Haüy, from μέσος, *middle*, and τύπος, *type*, because the form of the crystal—in his view a square prism—was intermediate between the forms of stilbite and analcite. *Natrolite*, of Klaproth, is from *natron, soda*; it alludes to the presence of soda, whence also the name *soda-mesotype*, in contrast with *scolecite*, or *lime-mesotype*.

SCOLECITE.

Monoclinic. Axes $a : b : c = 0.9764 : 1 : 0.3434$; $\beta = 89^\circ 18'$.

Crystals slender prismatic ($mm''' = 88^\circ 37\frac{1}{2}'$), twins showing a feather-like striation on *b*, diverging upward; also as penetration-twins. Crystals in divergent groups. Also massive, fibrous and radiated, and in nodules.

Cleavage: *m* nearly perfect. *H.* = 5-5.5. *G.* = 2.16-2.4. Luster vitreous, or silky when fibrous. Transparent to subtranslucent. Optically —. Ax. pl. and $Bx \perp b$. $Bx_a \wedge c = 15^\circ-16^\circ$. $2H_{ar} = 32^\circ 26'$. $\beta = 1.4952$.

Comp.— $CaAl_2Si_2O_{10} + 3H_2O$ or $CaO \cdot Al_2O_3 \cdot 3SiO_2 \cdot 3H_2O =$ Silica 45.9, alumina 26.0, lime 14.3, water 13.8 = 100.

Pyr., etc.—B.B. sometimes curls up like a worm (whence the name from σκώληξ, *a worm*, which gives *scolecite*, and not *scolesite* or *scolezite*); other varieties intumescence but slightly, and all fuse at 2-2.2 to a white blebby enamel. Gelatinizes with acids like natrolite.

Obs.—Occurs in the Beruford, Iceland; in amygdaloid at Staffa; in Skye, at Talisker; near Eisenach, Saxony; in Auvergne; common in fine crystallizations in the Deccan trap area, in British India. In the United States, in *Colorado* at Table Mountain near Golden in cavities in basalt. In Canada, at Black Lake, Megantic Co., Quebec.

Mesolite. Intermediate between natrolite and scolecite (see p. 432). In acicular and capillary crystals; delicate divergent tufts, etc. *G.* = 2.29. White or colorless. In amygdaloidal basalt at numerous points.

THOMSONITE.

Orthorhombic. Axes $a : b : c = 0.9932 : 1 : 1.0066$.

Distinct crystals rare; in prisms, $mm''' = 89^\circ 37'$. Commonly columnar, structure radiated; in radiated spherical concretions; also closely compact.

Cleavage: *b* perfect; *a* less so; *c* in traces. Fracture uneven to subconchoidal. Brittle. *H.* = 5-5.5. *G.* = 2.3-2.4. Luster vitreous, more or less pearly. Snow-white; reddish, green; impure varieties brown. Streak uncolored. Transparent to translucent. Pyroelectric. Optically +. Ax. pl. $\parallel c$. $Bx \perp b$. Dispersion $\rho > v$ strong. $2E_r = 82^\circ$. $\beta_r = 1.503$.

Var.—1. *Ordinary*. (*a*) In regular crystals, usually more or less rectangular in outline, prismatic in habit. (*b*) Prisms slender, often vesicular to radiated. (*c*) Radiated fibrous. (*d*) Spherical concretions, consisting of radiated fibers or slender crystals. Also massive, granular to impalpable, and white to reddish brown, less often green as in *lintonite*. The spherical massive forms also radiated with several centers and of varying colors, hence of much beauty when polished. *Ozarkite* is a white massive thomsonite from Arkansas.

Comp.— $(Na_2, Ca)Al_2Si_2O_8 + \frac{5}{2}H_2O$ or $(Na_2, Ca)O \cdot Al_2O_3 \cdot 2SiO_2 \cdot \frac{5}{2}H_2O$. The ratio of $Na_2 : Ca$ varies from 3 : 1 to 1 : 1. If $Ca : Na_2 = 3 : 1$ the percentage composition requires: SiO_2 37.0, Al_2O_3 31.4, CaO 12.9, Na_2O 4.8, H_2O 13.9 = 100.

Pyr., etc.—B.B. fuses with intumescence at 2 to a white enamel. Gelatinizes with hydrochloric acid.

Dif.—Resembles some natrolite, but fuses to an opaque not to a clear glass.

Obs.—Found in cavities in lava in amygdaloidal igneous rocks, sometimes with *elæolite* as a result of its alteration. Occurs near Kilpatrick, Scotland; in the lavas of Somma (*comptonite*); in basalt at the Pflasterkaute in Saxe Weimar; in Bohemia, in *phonolite*; the Cyclopean islands, Sicily; near Brevik, Norway; the Färöer; Iceland (*carphostilbite*, straw-yellow); at Mt. Monzoni, Fassathal.

Occurs at Peter's Point, Nova Scotia. In the U. S. at Magnet Cove (*ozarkite*) in the Ozark Mts., Arkansas; in the amygdaloid of Grand Marais, L. Superior, which yields the water-worn pebbles resembling agate, in part green (*lintonite*); in the basalt of Table Mt. near Golden, Colo.

Hydronephelite. $HNa_2Al_2Si_2O_{10} + 3H_2O$. Massive, radiated. *H.* = 4.5-6. *G.* = 2.263. Color white; also dark gray. From Litchfield, Maine. *Ranite* from the Langesund fiord, Norway, is similar.

II. Mica Division.

The species embraced under this Division fall into three groups: 1, the MICA GROUP, including the Micas proper; 2, the CLINTONITE GROUP, or the Brittle Micas; 3, the CHLORITE GROUP. Supplementary to these are the Vermiculites, hydrated compounds chiefly results of the alteration of some one of the micas.

All of the above species have the characteristic micaceous structure, that is, they have highly perfect basal cleavage and yield easily thin laminae. They belong to the monoclinic system, but the position of the bisectrix in general deviates but little from the normal to the plane of cleavage; all of them show on the basal section plane angles of 60° or 120° , marking the relative position of the chief zones of forms present, and giving them the appearance of hexagonal or rhombohedral symmetry; further, they are more or less closely related among themselves in the angles of prominent forms.

The species of this Division all yield water upon ignition, the micas mostly from 4 to 5 p. c., the chlorites from 10 to 13 p. c.; this is probably to be regarded in all cases as water of constitution, and hence they are not properly *hydrous* silicates.

More or less closely related to these species are those of the Serpentine and Talc Division and the Kaolin Division following, many of which show distinctly a mica-like structure and cleavage and also pseudo-hexagonal symmetry.

1. Mica Group. Monoclinic.

Muscovite	Potassium Mica	$H_2KAl_3(SiO_4)_3$ $a : b : c = 0.57735 : 1 : 3.3128$ $\beta = 89^\circ 54'$
Paragonite	Sodium Mica	$H_2NaAl_3(SiO_4)_3$
Lepidolite	Lithium Mica	$KLi[Al(OH,F)_2]Al(SiO_4)_3$ pt.
Zinnwaldite	Lithium-iron Mica	
Biotite	Magnesium-iron Mica	$(H,K)_2(Mg,Fe)_2(Al,Fe)_2(SiO_4)_3$ pt. $a : b : c = 0.57735 : 1 : 3.2743$ $\beta = 90^\circ 0'$
Phlogopite	Magnesium Mica; usually containing fluorine, nearly free from iron.	$(H,K,(MgF))_2Mg_2Al(SiO_4)_3$
Lepidomelane	Annite	
	Iron Micas. Contain ferric iron in large amount.	

The species of the MICA GROUP crystallize in the monoclinic system, but with a close approximation to either rhombohedral or orthorhombic symmetry; the plane angles of the base are in all cases 60° or 120° . They are all charac-

terized by highly perfect basal cleavage, yielding very thin, tough, and more or less elastic laminae. The negative bisectrix, a , is very nearly normal to the basal plane, varying at most but a few degrees from this; hence a cleavage plate shows the axial interference-figure, which for the pseudo-rhombohedral kinds is often uniaxial or nearly uniaxial. Of the species named above, biotite has usually a very small axial angle, and is often sensibly uniaxial; the axial angle of phlogopite is also small, usually 10° to 12° ; for muscovite, paragonite, lepidolite the angle is large, in air commonly from 50° to 70° .

The Micas may be referred to the same fundamental axial ratio with an angle of obliquity differing but little from 90° ; they show to a considerable extent the same forms, and their isomorphism is further indicated by their not infrequent intercrystallization in parallel position, as biotite with muscovite, lepidolite with muscovite, etc.

A blow with a somewhat dull-pointed instrument on a cleavage plate of mica develops in all the species a six-rayed *percussion-figure* (Fig. 901, also Fig. 477, p. 149), two lines of which are nearly parallel to the prismatic edges; the third, which is the most strongly characterized (Leitstrahl *Germ.*), is parallel to the clinopinacoid or plane of symmetry. The micas are often divided into two classes, according to the position of the plane of the optic axes. In the *first class* belong those kinds for which the optic axial plane is normal to b (010), the plane of symmetry (Fig. 901); in the *second class* the axial plane is parallel to the plane of symmetry. The percussion-figure serves to fix the crystallographic orientation when crystalline faces are wanting. A second series of lines at right angles to those mentioned may be more or less distinctly developed by

pressure of a dull point on an elastic surface, forming the so-called *pressure-figure*; this is sometimes six-rayed, more often shows three branches only, and sometimes only two are developed. In Fig. 901 the position of the pressure-figure is indicated by the dotted lines. These lines are connected with gliding-planes inclined some 67° to the plane of cleavage (see beyond).

The micas of the *first class* include: Muscovite, paragonite, lepidolite, also some rare varieties of biotite called anomite.

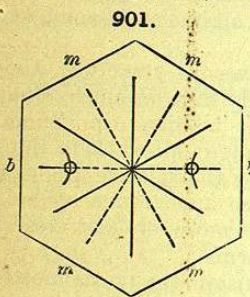
The *second class* embraces: Zinnwaldite and most biotite, including lepidomelane and phlogopite.

Chemically considered, the micas are silicates, and in most cases orthosilicates, of aluminium with potassium and hydrogen, also often magnesium, ferrous iron, and in certain cases ferric iron, sodium, lithium (rarely rubidium and caesium); further, rarely, barium, manganese, chromium. Fluorine is prominent in some species, and titanium is also sometimes present. Other elements (boron, etc.) may be present in traces. All micas yield water upon ignition in consequence of the hydrogen (or hydroxyl) which they contain.

MUSCOVITE. Common Mica. Potash Mica. Kaliglimmer *Germ.*

Monoclinic. Axes $a : b : c = 0.57735 : 1 : 3.3128$; $\beta = 89^\circ 54'$.

Twins common according to the *mica-law*: tw. plane a plane in the zone cM normal to c , the crystals often united by c . Crystals rhombic or hexagonal in outline with plane angles of 60° or 120° . Habit tabular, passing into tapering forms with planes more or less rough and strongly striated horizontally;

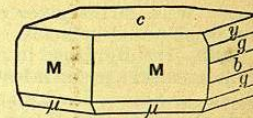
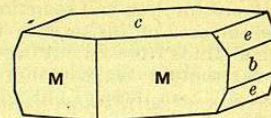


901.

vicinal forms common. Folia often very small and aggregated in stellate, plumose, or globular forms; or in scales, and scaly massive; also crypto-crystalline and compact massive.

Cleavage: basal, eminent. Also planes of secondary cleavage as shown in the percussion-figure (see pp. 464 and 149); natural plates hence often yield

902.
 $cM, 001 \wedge 221 = 85^\circ 36'$
 $c\mu, 001 \wedge \bar{1}11 = 81^\circ 30'$
 $MM', 221 \wedge 2\bar{2}1 = 59^\circ 48'$
 $\mu\mu', \bar{1}11 \wedge \bar{1}\bar{1}1 = 59^\circ 16\frac{1}{2}'$



903.

narrow strips or thin fibers \parallel axis b , and less distinct in directions inclined 60° to this. Thin laminae flexible and elastic when bent, very tough, harsh to the touch, passing into kinds which are less elastic and have a more or less unctuous or talc-like feel. Etching-figures on c monoclinic in symmetry (Fig. 481, p. 150).

$H. = 2.2-5$. $G. = 2.76-3$. Luster vitreous to more or less pearly or silky. Colorless, gray, brown, hair-brown, pale green, and violet, yellow, dark olive-green, rarely rose-red. Streak uncolored. Transparent to translucent.

Pleochroism usually feeble; distinct in some deep-colored varieties (see beyond). Absorption in the direction normal to the cleavage plane (vibrations $\parallel b, c$) strong, much more so than transversely (vibrations $\parallel a$); hence a crystal unless thin is nearly or quite opaque in the first direction though translucent through the prism. Optically —. Ax. pl. $\perp b$ and nearly $\perp c$. Bx_a ($= a$) inclined about -1° (behind) to a normal to c . Dispersion $\rho > v$. Axial angle variable, usually about 70° , but diminishing to 50° in kinds (phengite) relatively high in silica. Birefringence rather high, $\gamma - \alpha = 0.039$; $\beta_\gamma = 1.5941$.

Var.—1. Ordinary Muscovite. In crystals as above described, often tabular $\parallel c$, also tapering with vertical faces rough and striated; the basal plane often rough unless as developed by cleavage. More commonly in plates without distinct outline, except as developed by pressure (see above); the plates sometimes very large, but passing into fine scales, arranged in plumose or other forms. In normal muscovite the thin laminae spring back with force when bent, the scales are more or less harsh to the touch, unless very small, and a pearly luster is seldom prominent.

2. DAMOURITE. Including *margarodite*, *gilbertite*, *hydro-muscovite*, and most **HYDROMICA** in general. Folia less elastic; luster somewhat pearly or silky and feel unctuous like talc. The scales are usually small and it passes into forms which are fine scaly or fibrous, as *sericite*, and finally into the compact crypto-crystalline kinds called *oncosine*, including much *pinite*. Axial angle for damourite chiefly from 60° to 70° . Often derived by alteration of cyanite, topaz, corundum, etc. Although often spoken of as *hydrous* micas, it does not appear that damourite and the allied varieties necessarily contain more water than ordinary muscovite; they may, however, give it off more readily.

Margarodite, as originally named, was the talc-like mica of Mt. Greiner in the Zillertal; granular to scaly in structure, luster pearly, color grayish white. *Gilbertite* occurs in whitish, silky forms from the tin mine of St. Austell, Cornwall. *Sericite* is a fine scaly muscovite united in fibrous aggregates and characterized by its silky luster (hence the name from *σηρικός*, *silky*).

Comp., Var.—For the most part an orthosilicate of aluminium and potassium $(H,K)AlSiO_3$. If, as in the common kinds, $H : K = 2 : 1$, this becomes $H_2KA_1(SiO_3)_2 = 2H_2O.K_2O.3Al_2O_3.6SiO_2 =$ Silica 45.2, alumina 38.5, potash 11.8, water 4.5 = 100.

Some kinds give a larger amount of silica (47 to 49 p. c.) than corresponds to a normal orthosilicate, and they have been called *phengite*. As shown by Clarke, these acid muscovites can be most simply regarded as molecular mixtures of $H_2KAl_3(SiO_4)_3$ and $H_2KAl_3(Si_3O_{10})_3$.

Iron is usually present in small amount only. Barium is rarely present, as in *oellacherite*. $G. = 2.88-2.99$. Chromium is also present in *fuchsite* from Schwarzenstein, Zillertal, and elsewhere.

Pyr., etc.—In the closed tube gives water, which with Brazil-wood often reacts for fluorine. B.B. whitens and fuses on the thin edges ($F. = 5.7$, v. Kobell) to a gray or yellow glass. With fluxes gives reactions for iron and sometimes manganese, rarely chromium. Not decomposed by acids. Decomposed on fusion with alkaline carbonates.

Diff.—Distinguished in normal kinds from all but the species of this division by the perfect basal cleavage and micaceous structure; the pale color separates it from most biotite; the laminae are more flexible and elastic than those of phlogopite and still more than those of the brittle micas and the chlorites.

In thin sections recognized by want of color and by the perfect cleavage shown by fine lines (as in Fig. 907, p. 344) in sections $\perp c$, in a direction parallel to c . By reflected light under the microscope the same sections show a peculiar mottled surface with satin-like luster; birefringence rather high, hence interference-colors bright.

Obs.—Muscovite is the most common of the micas. It is an essential constituent of mica schist and related rocks, and is a prominent component of certain common varieties of granite and gneiss; also found at times in fragmental rocks and limestones; in volcanic rocks it is rare and appears only as a secondary product. The largest and best developed crystals occur in the pegmatite dikes associated with granitic intrusions, either directly cutting the granite or in its vicinity. Often in such occurrences in enormous plates from which the mica or "isinglass" of commerce is obtained. It is then often associated with crystallized orthoclase, quartz, albite; also apatite, tourmaline, garnet, beryl, columbite, etc., and other mineral species characteristic of granitic veins. Further, muscovite often encloses flattened crystals of garnet, tourmaline, also quartz in thin plates between the sheets; further not infrequently magnetite in dendrite-like forms following in part the directions of the percussion-figure.

Some of the best known localities are: Abühl in the Sulzbachthal, with adularia; Rothenkopf in the Zillertal, Tyrol; Soboth, Styria; St. Gothard, Binnenthal, and elsewhere in Switzerland; Mourne Mts., Ireland; Cornwall; Utö, Falun, Sweden; Skutterud, Norway. Obtained in large plates from Greenland and the East Indies.

In *Maine*, at Mount Mica in the town of Paris; at Buckfield, in fine crystals. In *N. Hamp.*, at Acworth, Grafton. In *Mass.*, at Chesterfield; South Royalston; at Goshen, rose-red. In *Conn.*, at Monroe; at Litchfield, with cyanite; at the Middletown feldspar quarry; at Haddam; at Branchville, with albite, etc.; New Milford. In *N. York*, near Warwick; Edenville; Edwards. In *Penn.*, at Pennsbury, Chester Co.; at Unionville, Delaware Co., and at Middletown. In *Maryland*, at Jones's Falls, Baltimore. In *Virginia*, at Amelia Court-House. In *No. Carolina*, extensively mined at many places in the western part of the state; the chief mines are in Mitchell, Yancey, Jackson and Macon Cos. The mica mines have also afforded many rare species; as columbite, samarskite, hatchettolite, uraninite, etc.; in good crystals in Alexander Co. In *S. Carolina*, there are also muscovite deposits; also in Georgia and Alabama.

Mica mines have also been worked to some extent in the Black Hills, South Dakota; in Washington, at Rockford, Spokane Co.; in Colorado.

Muscovite is named from *Vitrum Muscoviticum* or *Muscovy-glass*, formerly a popular name of the mineral.

Pinite. A general term used to include a large number of alteration-products especially of iolite, also spodumene, nephelite, scapolite, feldspar and other minerals. In composition essentially a hydrous silicate of aluminium and potassium corresponding more or less closely to muscovite, of which it is probably to be regarded as a massive, compact variety, usually very impure from the admixture of clay and other substances. Characters as follows: Amorphous; granular to cryptocrystalline. Rarely a submicaceous cleavage. $H. = 2.5-3.5$. $G. = 2.6-2.85$. Luster feeble, waxy. Color grayish white, grayish green, pea-green, dull green, brownish, reddish. Translucent to opaque. The following are some of the minerals classed as pinite: *gigantolite*, *giesseckite* (see p. 355), *liebenerite*, *dysyntribite*, *parophite*, *rosite*, *polyargite*, *wilsonite*, *killinite*.

Agalmatolite (pagodite) is like ordinary massive pinite in its amorphous compact texture, luster, and other physical characters, but contains more silica, which may be from free quartz or feldspar as impurity. The Chinese has $H. = 2.2-2.5$; $G. = 2.785-2.815$. Colors usually grayish, grayish green, brownish, yellowish. Named from *ἄγαλμα*, an image;

pagodite is from *pagoda*, the Chinese carving the soft stone into miniature pagodas, images, etc. Part of the so-called agalmatolite of China is true pinite in composition, another part is compact pyrophyllite, and still another steatite (see these species).

Paragonite. A sodium mica, corresponding to muscovite in composition; formula, $H_2NaAl_3(SiO_4)_3$. In fine pearly scales; also compact. $G. = 2.78-2.90$. Color yellowish, grayish, greenish; constitutes the mass of the rock at Monte Campione near Faido in Canton Tessin, Switzerland, containing cyanite and staurolite; called paragonite-schist. Occurs associated with tourmaline and corundum at Unionville, Delaware Co., Pa.

LEPIDOLITE. Lithia Mica. Lithionglimmer *Germ.*

In aggregates of short prisms, often with rounded terminal faces. Crystals sometimes twins or trillings according to the mica law. Also in cleavable plates, but commonly massive scaly-granular, coarse or fine.

Cleavage: basal, highly eminent. $H. = 2.5-4$. $G. = 2.8-2.9$. Luster pearly. Color rose-red, violet-gray or lilac, yellowish, grayish white, white. Translucent. Optically —. Ax. pl. usually $\perp b$; rarely $\parallel b$. Bx_a (a) inclined $1^\circ 47'$ red, and $1^\circ 33\frac{1}{2}'$ yellow (Na) to normal to c . Axial angle large, from $50^\circ-72^\circ$, $\beta = 1.5975$.

Comp.—In part a metasilicate, $R_2Al(SiO_3)_2$ or $KLi[Al(OH,F)_2]Al(SiO_3)_3$. The ratio of fluorine and hydroxyl is variable. The following are analyses (Riggs):

	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	FeO	MnO	K ₂ O	Li ₂ O	Na ₂ O	H ₂ O	F
Paris,	50.92	24.99	0.30	0.23	tr.	11.38	4.20	2.11	1.96	6.29 = 102.38
Hebron,	48.80	28.30	0.29	0.09	0.08	12.21*	4.49	0.74	1.73	4.96
										[CaO, MgO 0.17 = 101.86

* With 0.77 (Rb, Cs)₂O.

Pyr., etc.—In the closed tube gives water and reaction for fluorine. B.B. fuses with intumescence at 2-2.5 to a white or grayish glass, sometimes magnetic, coloring the flame purplish red at the moment of fusion (lithia). With the fluxes some varieties give reactions for iron and manganese. Attacked but not completely decomposed by acids. After fusion, gelatinizes with hydrochloric acid.

Obs.—Occurs in granite and gneiss, especially in granitic veins; often associated with lithia, tourmaline; also with amblygonite, spodumene, cassiterite, etc.; sometimes associated with muscovite in parallel position.

Found near Utö in Sweden; Penig, Saxony; Rozena (or Rožna), Moravia, etc. In the United States, common in the western part of Maine, in Hebron, Auburn, Paris, etc.; at Chesterfield, Mass.; Middletown, Conn.; with rubellite near San Diego, California.

Named lepidolite from *λεπίς*, scale, after the earlier German name *Schuppenstein*, alluding to the scaly structure of the massive variety of Rozena.

COOKEITE is a micaceous mineral occurring in rounded aggregations on rubellite, also with lepidolite, tourmaline, etc., at Hebron, Me. Composition $Li[Al(OH)_2]_2(SiO_3)_2$.

Zinnwaldite. An iron-lithia mica in form near biotite. Color pale violet, yellow to brown and dark gray. Occurs at Zinnwald and Altenberg; similarly in Cornwall.

Cryophyllite is a related lithium mica from Rockport, Mass. *Polyolithionite* is a lithium mica from Kangerdluarsuk, Greenland.

BIOTITE.

Monoclinic; pseudo-rhombohedral. Axes $a : b : c = 0.57735 : 1 : 3.2743$; $\beta = 90^\circ$.

Habit tabular or short prismatic; the pyramidal faces often repeated in oscillatory combination. Crystals often apparently rhombohedral in symmetry since r (101) and z (132), z' (132), which are inclined to c at sensibly the same angle, often occur together; further, the zones to which these faces belong are inclined 120° to each other, hence the hexagonal outline of basal sections. Twins, according to the mica law, tw. pl. a plane in the prismatic