A

SYSTEM

OF

MINERALOGY,

COMPRISING THE

MOST RECENT DISCOVERIES:

INCLUDING

FULL DESCRIPTIONS OF SPECIES AND THEIR LOCALITIES, CHEMICAL ANALYSES AND FORMULAS, TABLES FOR THE DETERMINATION OF MINERALS, AND A TREATISE ON MATHEMATICAL CRYSTALLOGRAPHY AND THE DRAWING OF FIGURES OF CRYSTALS.

ILLUSTRATED BY NUMEROUS WOOD CUTS AND FOUR COPPER PLATES.

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tite. The Allanite from Jotun Fjeld gelatinizes with acids, while that from Snarum is not affected by acids. *Cerine* occurs at Bastnäs in Sweden with hornblende and copper pyrites. *Orthite* occurs in acicular crystals sometimes a foot in length at Finbo near Fahlun, and at Ytterby in Sweden; at Skeppsholm near Stockholm, in black vitreous masses disseminated through gneiss; also at Hitteroe and Fille Fjeld in Norway, at Miask in the Ural. The name is derived from *ορθος, straight*. *Uralorthite* occurs with small crystals of zircon in flesh-red feldspar at Miask in the Ural.

In the United States, Allanite has been found in large crystals in Allen's vein at the gneiss quarries, Haddam, Conn.; in small crystals at the Bolton quarry, Mass.; at South Royalston in boulders; at Athol on the road to Westminster in gneiss. A massive pitch-black mineral from Monroe, Orange Co., N. Y., (Anal. 8), has been referred to this species; a similar variety is found at East Bradford, Chester Co., Pa.; G.=3·5.

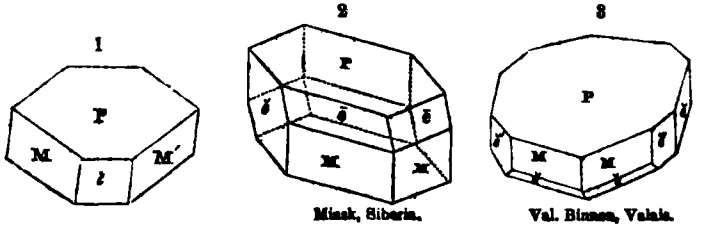
MICA FAMILY.

Under the term Mica, various aluminous compounds are included, which are alike in having an eminently easy cleavage in one direction. The species are distinguished often with great difficulty by external characters, and at times not at all, even when crystallized, except by means of chemical analysis or polarized light.*

The oblique micas contain, in general, potash or lithia, and little magnesia. The trimetric and hexagonal micas contain magnesia and often little alkali.

MUSCOVITE, *D.* Oblique Mica. Biaxial Mica. Potash Mica. Glimmer, *in part*. Muscovy Glass. Verre de Moscovie.

Monoclinic; M : M=120°, P : M=98° 40′, Phillips; in figure 3, according to Marignac, M : M=120° 40′, P : M=94° 50′, M : $\breve{e}$ =119° 40′, P : $\breve{e}$=98° 30′ (approximately), M : $\breve{e}'$=150°; crystals



supposed from St. Gothard, M : M=121°, P : M=95° 30′, Marignac; from Middletown, Ct., M : M=121°, P : M=95° to 98°, D.; in figure 2, according to Levy, M : M=120°, P on the axis 100°, P : $\breve{e}'$=121° 7′. Cleavage basal, eminent; occasionally a transverse cleavage in one direction tolerably perfect. Folia sometimes aggregated in stellate, plumose, or globular forms; or in scales and scaly massive.

H.=2—2·5. G.=2·75—3·1. Lustre more or less pearly. Color white, gray, pale-green, and violet-yellow, sometimes brown and

* See Appendix for remarks on the mode of observing the optical distinctions of micas.

dark olive-green; colors different in axial and diametral directions. Streak uncolored. Transparent—translucent. Thin laminæ flexible and elastic, very tough. Sectile. Biaxial; angle between the axes of polarization 55°—75°.

Composition.—Analyses: 1, 2, H. Rose, (Schw. Jour. xxix, 282, and Gilb. Ann. lxxi, 18, and Pogg. i, 757); 3, Svanberg, (K. V. Ac. H. 1839, 155); 4, 5, 6, Rose, (loc. cit.); 7, Klaproth, (Beit. v, 64); 8, Svanberg, (loc. cit.); 9, Schafhäutl, (Ann. d Ch. u. Pharm. xliv, 40); 10, J. D. Darrack, in the laboratory of J. C. Booth, (private communication from Prof. B.):

	Si	Al	Fe	Mn	Mg	K	HF
1. Utö,	47·50	37·30	3·20	0·90	——	9·60	0·56, H 2·63=101·59, Rose.
2. Broddbo,	46·10	31·60	8·65	1·40	——	8·39	1·12 H 1·00=98·26, Rose.
3. "	47·97	31·69	5·37	1·67	——	8·31	—, F 0·72, Al 0·35, H 3·32= 99·40, Svanberg.
4. Fahlun,	46·22	34·52	6·04	2·11		8·22	1·09, H 0·98, Ti *trace*=99·18, R.
5. Kimito,	46·36	36·80	4·53	*trace*		9·22	0·71, H 1·84=99·52, Rose.
6. Ochotsk,	47·19	33·80	4·47	2·58		8·35	0·29, H 4·07, Ca 0·13=100·88, R.
7. Siberia.	48·00	34·25	4·50	0·50		8·75	—, ign. 1·25=97·25, Klap.
8. Abborfors,	39·45	9·27	35·78	——	3·29	5·06	—, F 0·29, Ca 0·31, Fe 1·45, Mn 2·57=99·59. Svanberg.
9. *Fuchsite*,	47·95	34·45	1·80	——	0·72	10·75	—, F 0·35, Cr 3·95, Na 0·37, Ca 0·42=100·76, Schaf.
10. Unionville,	46·75	39·20	*trace*	——	1·02	6·56	—, Ca 0·89, H 4·90=98·82, D.

In analyses 1 to 7, the oxygen of the peroxyds and silica has closely the ratio 3 : 4; or for the protoxyds, peroxyds and silica 1 : 12 : 16, affording $3\dot{R}$, $12\ddot{R}$, $16\breve{S}i$.

H. Rose suggested the formula $\dot{K}\breve{S}i+4\ddot{A}l\breve{S}i$, corresponding to the ratio 1 : 12 : 15, or a ratio of 4 to 5 between the oxygen of the alumina and silica. But the analyses alluded to, afford quite uniformly the ratio 3 : 4, instead of 4 : 5.

The Abborfors mica (No. 8) also has closely the same ratio 3 : 4; or for the whole 2 : 9 : 12, giving the formula $\dot{R}^2\breve{S}i+3\ddot{R}\breve{S}i$.

Analysis No. 9 has nearly the ratio 3 : 4 for the peroxyds and silica, and the whole ratio 1 : 9 : 12 (or more nearly 1½ : 9 : 12.) The formula, as Rammelsberg states, may be $\dot{R}\breve{S}i+3\ddot{A}l\breve{S}i$.

Analysis No. 10 has the oxygen ratio 1·61 : 18·32 : 24·29 (and for the water 4·35). This gives 3 : 4 for the peroxyds and silica, and very nearly 1 : 12 : 16 : 3 for the whole ratio. The mica is a granular variety.

In recapitulation, the analyses afford, excluding the water, the following ratios for the oxygen of the protoxyds, peroxyds, and silica:

Nos. 1 to 7,	½ : 3 : 4.
No. 8,	¾ : 3 : 4.
No. 9,	½ : 3 : 4.
No. 10,	½ : 3 : 4.

B.B. fuses with some difficulty to a grayish-yellow blebby glass. Dissolves easily with borax and salt of phosphorus, leaving with the last a silica skeleton.

The variety composed of scales arranged in plumose forms is called *plumose mica*; and that with a diagonal cleavage, *prismatic mica*.

In the Pennsbury (Penn.) mica, the cleavage direction is not the line of either diagonal, but makes an angle of 30° with the shorter, so that the plates formed by it are often nearly rectangular, two of the edges being cleavage edges and two primary edges of the crystal.

Mica is one of the constituents of granite, and its associate rocks, gneiss, syenite, and mica slate. It also occurs in more recent aggregate rocks; also in imbedded crystals in granular limestone, wacke, trachyte, and basalt. Coarse lamellar aggregations often form the matrix of crystals of topaz, tourmaline, and other mineral species.

Siberia affords laminæ of mica, sometimes exceeding a yard in diameter, and other remarkable foreign localities are at Finbo in Sweden, and Skutterud in Norway.

Fine crystallizations of mica occur in granite at Acworth, Grafton, and Alstead, N. H., and the plates are at times a yard across and perfectly transparent; also at Paris and Streaked Mountain, Maine. In Massachusetts, at Chesterfield with tourmaline and albite, Barre and South Royalston with beryl, and at Mendon and Brimfield; at Chester,

Hampden Co., Mass., faint greenish. A green variety occurs at Unity, Me., on the estate of James Neal; and prismatic mica at Russell, Mass. In Connecticut, at Monroe of a dusky brown color, having internal hexagonal bands of a darker shade; in brown hexagonal crystal at the Middletown feldspar quarry; at Haddam pale brownish, with columbite, and also similar at another locality with garnets. Six miles southeast of Warwick, N. Y., crystals and plates sometimes a foot in diameter, in a vein of feldspar; a mile northwest of Edenville in six-sided and rhombic prisms; a silvery mica near Edenville; in St. Lawrence Co., eight miles from Potsdam, on the road to Pierrepont, mica is found in plates seven inches across; town of Edwards in large prisms, six-sided or rhombic; Greenfield, near Saratoga, in reddish-brown crystals with chrysoberyl; on the Croton acqueduct near Yonkers, in rhombs with a cleavage in the direction of the shorter diagonal. In Pennsylvania, in fine hexagonal crystals of a dark brown color at Pennsbury near Pennsville, Chester Co.; at the Unionville Corundum locality, of a whitish color; and also at another locality one and a half miles distant; in Philadelphia Co. on the railroad near Philadelphia, smoky brown with hexagonal internal bands; at Chesnut Hill near the Wissahiccon, a green variety; at Leiperville, Delaware Co., faint greenish; in New Jersey, crystals are obtained at Newtown and Franklin. In Delaware, Newcastle Co., at Dixon's quarry, associated with apatite; on the Wilmington road near the woodlands. In Maryland, at Jones's Falls, a mile and three quarters from Baltimore; the plates show by transmitted light a series of concentric hexagons, the sides of which are parallel with the sides of a hexagonal prism.

The biaxial character of many of these micas has been particularly examined by the author, in connection with B. Silliman, Jr. (See Appendix).

Thomson has analyzed (Min. i, 360) a mica reported from Orange Co., N. Y., and stated to be in "fine rhomboidal prisms," and obtained

$\dot{S}i$ 49·38, $\dot{A}l$ 23·67, $\dot{F}e$ 7·31, $\dot{K}$ 15·29, $\dot{C}a$ 6·13, $\dot{L}i$ 0·06=101·89,

affording the oxygen ratio 1 : 3 : 6, and the formula $\dot{R}\ddot{S}i+\dot{R}\ddot{S}i$, corresponding to some Lithia micas.

An *oblique mica* from Vesuvius of a blackish-green color, and another from Zillerthal, have been found to have the composition of magnesia mica or biotite, giving the formula $\dot{R}^3\ddot{S}i+\dot{R}\ddot{S}i$; P : M=98° 40′; M : M=120° 46′. Analysis of the former, by Chodnew, (Pogg. lxi, 381, mean of two analyses); and by Varrentrapp, of the latter, (ib.):

1. $\dot{S}i$ 40·91, $\dot{A}l$ 17·79, $\dot{F}e$ 11·02, $\dot{M}g$ 19·04, $\dot{K}$ 9·96, $\dot{C}a$ 0·3=99·02, Chodnew.
2. 39·85, 16·07, 13·21, 15·60, $\dot{K}$, $\dot{N}a$ and loss 13·68, $\dot{C}a$ 0·42=100, V.

Another mica from Chamouni, (probably biaxial, but not fully ascertained,) afforded Delesse, (Ann. Ch. Phys. [3], xxv),

$\dot{S}i$ 41·22, $\dot{A}l$ 13·92, $\dot{F}e$ 21·31, $\dot{M}g$ 4·70, $\dot{K}$ 6·05, $\dot{N}a$ 1·40, $\dot{C}a$ 2·58, $\dot{F}e$ 5·03, $\dot{M}n$ 1·09, ign. 0·9, F 1·58=99·78. It gives the ratio 1 : 2½ : 4, and the formula $3\dot{R}^3\ddot{S}i+5\dot{R}\ddot{S}i$. G.=3·127.

As there are more than one "potash mica," "oblique mica," or "common mica," a distinctive name for the above species has become necessary. The designation Muscovite, on this account adopted, is already so far connected with the mineral, as to be sufficiently familiar and unobjectionable.

MARGARODITE, *Schafhäutl.* Schistose Talc of Zillerthal.

Foliated like common mica; sometimes in small plates or scales aggregated into wedge shapes, or forming a scaly mass. Refraction biaxial; angle between the axes of polarization, nearly as in Muscovite.

H.=2·5—3. G.=2·872, Schafhäutl; 2·79—2·81, Brewer; 2·817, Delesse; 2·831, Rammelsberg. Lustre pearly. Color silvery-white. Translucent to nearly opaque. Laminæ more or less elastic.

Composition.—$\dot{R}\ddot{S}i+2\dot{R}\ddot{S}i$, (with $\frac{1}{2}\dot{H}$ to $1\frac{1}{2}\dot{H}$). Analyses: 1, Schafhäutl; 2, Delesse, (Ann. d. Mines, [4], xvi, 202, 1849); 3, 4, Brewer, (Private communication); 5, Rammelsberg, (4th Supp. 75):