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A System of mineralogy

Dana, James Dwight

New Haven, 1837

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Class II. Entogaea.

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CLASS II. ENTOGÆA.

ORDER II. HALINEA.

OXALATE OF LIME. Astasialus phytogeneus.

Humboldtine. Eisen Resin *Breithaupt.*

164. Earthy; crystallization undetermined.

G.=2·13—2·489. Soft; may be scratched by the nail. Dull.

Color yellow. *Fracture* uneven, earthy. Acquires negative electricity by friction, when insulated.

Its constituents, according to Mariano de Rivero, are Oxalic Acid 46·14, and Protoxyd of Iron 53·86.

It blackens in the flame of a candle instantly, and then is attractable by the magnet. A continuance of the heat causes the evolution of a vegetable odor, and soon decomposes it, leaving a stain, at first yellow, then black, and finally red.

Obs. It occurs at Koloseruk, in Bohemia, and, according to the supposition of Rivero, has resulted from the decomposition of succulent plants.

CRYOLITE. Cryalus fusilis.

Prismatic Cyrone-Haloid, *M.* Alumine Fluatée Alcaline, *H.*

165. *Primary form:* a right rectangular prism. *Cleavage* parallel to P perfect, parallel to the lateral faces less so. Occurs in lamellar masses.

H.=2·25—2·5. G.=2·949. *Lustre* vitreous; slightly pearly on P. *Streak* white. *Color* white; sometimes reddish or brownish. Subtransparent—translucent. Immersion in water increases its transparency. Brittle.

The analysis of Berzelius, (Kong. Vet. Acad. Handl. 1823, p. 315,) shows it to be composed of Alumina 24·4, Soda 31·35, and Hydrofluoric Acid 44·25. It is fusible in the flame of a candle, and hence its name, from κρυος, *ice*. Before the blowpipe, it first fuses, then becomes hard, white, and opaque, and ultimately assumes a slaggy appearance.

Obs. Arksutfiord, in West Greenland, is the only known locality of this mineral. It was discovered by Giesècké, in two veins in gneiss, associated with galena, pyrites, and spathic iron. Specimens may there be obtained from six inches to a foot in diameter.

ALUM STONE. ALUMINUS RHOMBOHEDRUS.

Rhombohedral Alum Haloide, *M.* Alumine Sous-sulfatée Alcaline, *H.*

166. *Primary form:* an obtuse rhombohedron; R : R=92° 50′. *Secondary form:* fig. 113, Pl. II. *Cleavage* nearly perfect parallel to a; indistinct parallel to R. It also occurs massive, having a granular or impalpable composition.

H=5. G.=2·58—2·752. *Lustre* vitreous on R, inclining to pearly on a. *Streak* white. *Color* white, sometimes grayish or reddish. Transparent—subtranslucent. *Fracture* flat, conchoidal, uneven; of massive varieties, splintery, and sometimes earthy. Brittle.

The analyses of Vauquelin and Cordier, give the following composition:

	From Mont d'Or, in Auvergue.	From Tolfa.
Sulphuric Acid	27·05	25·00
Alumina	31·80	43·92
Silica	28·40	24·00
Potash	5·79	3·08
Water and loss,	3·72, Cordier.	4·00, Vauquelin.

It decrepitates in the blowpipe flame, and is infusible both alone and with soda. With borax, it forms a colorless globule. When pulverized, it is soluble in sulphuric acid.

Obs. This mineral is met with in crystals at Tolfa, near Civita Vecchia, in the neighborhood of Rome; also at Beregh, in Hungary. It occurs only in volcanic rocks. The compact varieties from Hungary are so hard, as to admit of being used for millstones. Alum is obtained from this mineral by repeatedly roasting and lixiviating, and, finally, crystallizing by evaporation.

FLUELLITE. FLUELLUS PYRAMIDALIS.

Fluate of Alumina. Fluorid of Aluminum.

167. *Primary form:* a right rhombic prism; M : M=105° nearly. It commonly appears under the form of an acute rhombic octahedron, fig. 76, Pl. II., in which a : a=109°

Color white. Transparent.

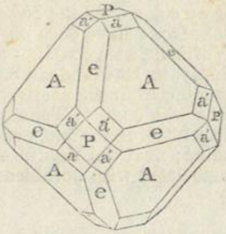
Contains Fluoric Acid and Alumina, according to an imperfect analysis by Wollaston.

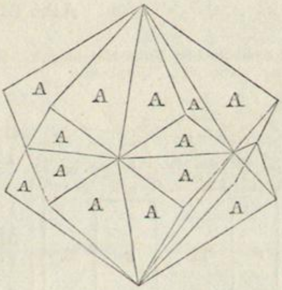
Obs. Fluellite is an extremely rare mineral, and was first discovered by Levy. The few specimens that have been obtained, were found at Stenna-gwyn, in Cornwall, with Wavellite and uranite, in minute crystals, on quartz.

I hesitate somewhat in connecting this species in the same genus with fluor spar, &c. If a new genus should be instituted, it would have its place between Cryalus and Fluellus.

FLUOR SPAR. Fluellus octahedrus.

Fluate of Lime. Fluorid of Calcium. Ratoffkit. Chlorophane. Octahedral Fluor-Haloide, *M.* Chaux Fluatée, *H.* Muria Phosphorans, *Linn.*





168. *Primary form:* the regular octahedron, fig. 4, Pl. I. *Secondary forms:* form of the most common occurrence is the cube, fig. 1, Pl. II. Some of its other forms are represented in figures 2, 3, 5, 6, 7, 9, 10, 11, 14, 16, 24, and 25, of the same plate. These simple forms also occur in combination, as in the annexed figure. *Cleavage* obtained with facility parallel to A. *Compound crystals:* fig. 129, Pl. II.; also the annexed figure, which is an instance of the same kind of composition; but the individuals are continued beyond the face of composition, and one is partially enveloped by the other. *Imperfect crystallizations:* structure rarely columnar; often granular, particles of various sizes.

H.=4. G.=3·14—3·178. *Lustre* vitreous; sometimes splendent; usually glimmering of the massive impalpable varieties. *Streak* white. *Color* white, wine-yellow, emerald-, pistachio-, bluish-green, rose and crimson-red, violet-blue, and sky-blue. Wine-yellow and violet-blue are the most common; and the red varieties the rarest. The colors of massive varieties are often arranged in concentric lines; and occasionally in crystals they are arranged along the axes, or in concentric coats. Transparent—subtranslucent. Brittle. *Fracture* of massive impalpable varieties, flat, conchoidal, and splintery.

It is composed of Fluorine 47·37, and Calcium 52·63.

Below a red heat, the coarsely pulverized spar becomes vividly phosphorescent. The colors of the light thus produced are very various, and are independent of the external color. The variety chlorophane emits a bright emerald-green light. At a high temperature, phosphorescence ceases. The passage of the electric fluid through it, is said to restore this property. Under the blowpipe, fluor spar decrepitates, and ultimately fuses into an enamel. If the flame be continued, the fluorine is in part expelled, and the specimen assumes a cauliflower-like appearance.

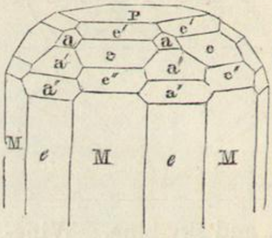
Obs. Fluor spar seldom occurs in beds in rocks. It generally constitutes veins, and in this state occurs in great abundance in the north of England, where it is the gangue of the lead mines, which intersect the coal formations of Northumberland, Cumberland, Durham, and Yorkshire. In Derbyshire, also, it is very abundant; and also in Cornwall, where the veins intersect much older rocks. In the mining districts of Saxony, it is a common mineral.

The most remarkable locality of fluor spar in the United States, has been discovered within a few years, on the borders of Muscalonge lake, in St. Lawrence county, New York, where it occurs in cavities in granite. Cubical crystals of an enormous size, some, more than a foot in each of their dimensions, have been obtained at this place. The spar of this region has usually an emerald or bluish-green color. In Gallatin county, Illinois, in the region southwest of Caves rock, for thirty miles along the Ohio, at Shawneetown and other places, this mineral is found scattered through the soil or imbedded in limestone. The prevailing color is a dark purple. Large crystals are often obtained at this locality.

The chlorophane variety forms a vein in gneiss, in the town of Trumbull, Conn., where it is associated with topaz and magnetic pyrites. It seldom occurs in distinct crystals, but commonly in coarsely granular masses of a light reddish or reddish-gray color. At the Notch of the White mountains, in New Hampshire, green octahedrons have been observed in a crystalline quartz. The mica slate at Putney, Vermont, also contains a green variety, in small quantities. It also occurs, sparingly, in Shenandoah county, Virginia, near Woodstock, in the fissures of a limestone containing shells; also on the Potomac, at Shepardstown, in white limestone; in Smith county, Tennessee, in white and purple cubes; at Lockport, in white cubes in a black limestone, accompanying celestine; in Massachusetts, at the Southampton mine; near the Franklin furnace, New Jersey; at Amity, New York, in thin seams, associated with hornblende, spinel, and turmaline.

APATITE. FLUELLUS HEXAGONUS.

Rhombohedral Fluor-Haloide, *M.* Phosphate of Lime. Spargelstein, Phosphorit, *W.* Asparagus stone. Moroxite. Chrysolite.



169. *Primary form:* a hexagonal prism, fig. 114, Pl. II. *Secondary forms:* fig. 125, Pl. II., also the annexed figure.

P : e=139° 48′, P : e′=157° 6′, P : e″=120° 36′, M : e=130° 12′, M : e′=112° 54′, M : e″=149° 24′, P : a=143° 48′, P : a′=124° 20′, P : a″=108° 51′, *e* : a=126° 12′, *e* : a′=145° 40′, *e* : a″=161° 9′. *Cleavage* imperfect, parallel both to P and M. *Imperfect crystallizations:* globular and reniform shapes; structure imperfectly columnar: massive, structure granular.

H.=5, sometimes 4·5. G.=3—3·235. *Lustre* vitreous, inclining to subresinous. *Streak* white. *Color* usually sea-green, bluish-green or violet-blue; sometimes white; also occasionally yellow, gray, red, and brown; none bright. Transparent—opaque. A bluish opalescence is observed in the direction of the vertical axis in some specimens, especially in the white varieties. Cross *fracture* conchoidal and uneven. Brittle. Some varieties are *phosphorescent* when heated, particularly those crystals which are but slightly modified at their extremities; others become electric by friction.

The following table contains several analyses of G. Rose, (Poggendorf's Annalen, ix.)

	Snorum, Norway.	Cabo de Gata, Spain.	Arendal, Norway.	Greiner, Tyrol.	St. Gothard, Tyrol.
Chlorid of Calcium	4·28	0·885	0·801	0·15	a trace.
Fluorid of Calcium	4·59	7·049	7·01	7·69	7·69
Subsesquiphosphate of Lime	91·13	92·066	92·189	92·16	92·31
	G.=3·174	G.=2·35	G.=3·194	G.=3·175	G.=3·197

It is infusible alone before the blowpipe except at the edges. With biphosphate of soda or borax, it fuses without difficulty into a glass, which, on cooling, has a crystalline structure. It also fuses if mixed with carbonate of iron. It dissolves slowly in nitric acid, and without effervescence.

Obs. Apatite usually occurs in primitive formations. It is often found in veins, and particularly those containing tin and iron ore, also, in veins of primitive limestone traversing granite. It also occurs in serpentine, and occasionally, as in Spain, in ancient volcanic rocks.

Its principal foreign localities are Ehrenfriedersdorf, in Saxony; Slackenwald, in Bohemia; Caldbeck Fell, in Cumberland, Devonshire; St. Gothard, in Switzerland. The greenish-blue variety, called *moroxite*, occurs at Arendal, in Norway.

The *asparagus stone* or *spargelstein* variety, which is obtained at Zillerthal, in the Tyrol, is translucent and has a wine-yellow color; it is imbedded in talc. The *phosphorite* or massive varieties, are mostly obtained from Estremadura, in Spain, and Slackenwald, in Bohemia.

Its most important locality in the United States, is at Gouverneur, St. Lawrence Co., N. Y., where it occurs in a vein of limestone, intersecting granite, and within a foot or two of the granite: the crystals are most abundant near the junction of the two rocks. Crystals have been obtained at this locality, six inches long and one and a half in diameter, possessing a fine sea-green color, and variously modified at their extremities. It is associated with finely crystallized scapolite and sphene, and a purplish or brown pyroxene. At Amity, N. Y., it occurs of a green color in white limestone, presenting the primary form, and is accompanied with pyroxene and scapolite. Crystallized and massive specimens, of a bluish-green color, occur at Bolton, Mass., associated with sphene, petalite, and also the minerals occurring at the abovementioned localities. Reddish-brown crystals of an inch in length, have been obtained from a vein of granite, at Greenfield, N. Y. Also, it has been found near Baltimore, Md.; Wilmington, Del.; Green Pond, Morris Co., N. Y.; and at Anthony's Nose, in the Highlands on the Hudson.

Apatite was thus named by Werner, from απαταω, *to deceive*, in allusion to the deception of the older mineralogists, respecting the nature of its several varieties.

WAGNERITE. Fluellus obliquus.

Hemi-prismatic Fluor-Haloide, *Haid.* Wagnerit, *Fuchs.* Fluophosphate of Magnesia, *Thom.*

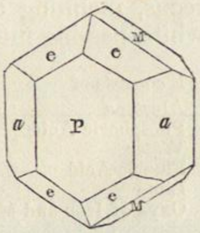
170. *Primary form:* an oblique rhombic prism; M : M=95° 25′. P : M=109° 20′. Most of the prismatic planes are deeply striated, H.=5—5·5. G.=3·11. *Lustre* vitreous. *Streak* white. *Color* yellow, of different shades; often grayish. Translucent. *Fracture* uneven and splintery across the prism.

It contains, according to Fuchs, Phosphoric Acid 41·71, Hydrofluoric Acid 6·50, Magnesia 46·66, Oxyd of Iron 5, Oxyd of Manganese 0·5. It fuses with difficulty, *per se*, before the blowpipe, into a dark greenish-gray glass: with borax or biphosphate of soda, it is readily dissolved. Nitric or sulphuric acid, gently heated, evolves from its powder fumes of fluoric acid.

Obs. This rare species occurs in the valley of Holgraben, near Werfen, in Saltzburg, in irregular veins of quartz, traversing clay slate.

HERDERITE. Fluellus rhombicus.

Prismatic Fluor-Haloide, *Haid.* Brewster's Journal, IX, 360.

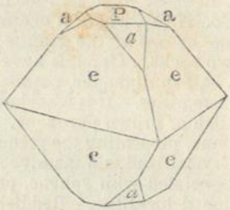


171. *Primary form:* a right rhombic prism; M : M=115° 53′. *Secondary form:* P : *a*=147° 34′, *a* : *a*, (adjacent planes,) 64° 51′, e : e=144° 16′, M : e=128° 40′, P : e=141° 20′. *Cleavage* interrupted parallel to M, also traces parallel to P. Surfaces M and e very smooth, and delicately marked with lines parallel to their edges of intersection with M.

H.=5. G=2·985. *Lustre* vitreous, inclining to subresinous. *Streak* white. *Color* various shades of yellowish and greenish-white. Translucent. *Fracture* small conchoidal. Very brittle.

Obs. The only specimen of this mineral as yet found, was obtained at the tin mines of Ehrenfriedersdorf, in Saxony, imbedded in fluor spar. It much resembles the asparagus variety of apatite, for which it was mistaken till proved to be a distinct species by Haidinger, who gave it the above name in compliment to Baron Von Herder, the director of the Saxon mines.

CHILDRENITE. Fluellus Childrenii.



172. *Primary form:* trimetric. *Secondary form:* e : e (adjacent planes in the same pyramid,) =97° 50′ and 102° 30′, e : e (different pyramids,) =130° 20′, a : a=124° 54′. *Cleavage* imperfect, parallel with P.

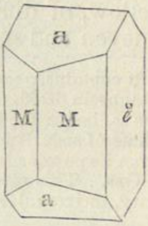
H.=4·5—5. *Lustre* vitreous, inclining to resinous. *Streak* white. *Color* yellow, and pale yellowish-brown, also yellowish-white. Translucent. *Fracture* uneven.

It is composed, according to Wollaston, of Phosphoric Acid, Alumina and Iron.

Obs. Occurs in minute crystals and crystalline coats, on spathic iron or quartz, near Lavistock, in Derbyshire. It was discovered by Levy, and named in honor of Mr. Children.

WAVELLITE. Astralus rhombicus.

Prismatic Wavelline-Haloide, *Haid.* Subphosphate of Alumine. Devonite. Hydrargyrite. Lasionite.



173. *Primary form:* a right rhombic prism; M : M=122° 15′. *Secondary form:* a : a (adjacent planes,) =107° 26′, M : ĕ=118° 53′. *Cleavage* perfect parallel to M, and also to ĕ or the longer diagonal. It usually occurs in minute crystals radiating from a point, and so closely aggregated as to form hemispherical or globular concretions. These concretions vary from a minute size, to an inch or more in diameter.

H.=3·25—4. G.=2·337—2·3616. *Lustre* vitreous, inclining to pearly and resinous. *Streak* white. *Color* white, passing into yellow, green, gray, brown, black. Translucent.

It consists of

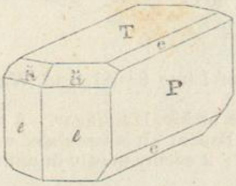
Alumina	37·20	35·35
Phosphoric Acid	35·12	33·40
Water	28·00	26·80
Fluoric Acid	0·00	2·06
Lime	0·00	0·50
Oxyd of Iron and Manganese	0·00=100·32 *Fuchs.*	1·25=99·36 *Berzelius.*

Becomes white under the blowpipe, losing its translucency, but is infusible. With boracic acid and iron wire, it affords a globule of phosphuret of iron. Reduced to powder, it dissolves in heated nitric or sulphuric acid, giving off a vapor which corrodes glass.

Obs. Wavellite was first discovered in a tender clay slate near Barnstaple, in Devonshire, by Dr. Wavell. It has since been found at Clommell, near Cork, in the Shiant isles of Scotland; at Zbirow, in Bohemia; on brown iron ore at Amberg, in Bavaria, (a variety called *Lasionite*, by Fuchs.)

PHARMACOLITE. Gypsalus stellatus.

Hemi-prismatic Euclase-Haloide, *Haid.* Arsenate of Lime. Arsenic bluth, *Werner.* Picropharmacolite.



174. *Primary form:* a right rhomboidal prism, whose oblique angle equals 96° 46′. *Secondary form:* T : M (plane truncating the edge *e* : *e*)=83° 14′, and 96° 46′; *e* : *e*=117° 24′; P : *e*=121° 18′. *Cleavage* parallel to T eminent. The crystals are usually lengthened in the direction of P, and often one face *e* is obliterated by the extension of the other; in these instances the crystal is attached to the rock parallel to the extended *e*, and receives its increase of attraction in the direction of this axis. (See § 81.) The surfaces T and e are usually striated parallel to their mutual intersection. Occurs rarely in distinct crystals; commonly in delicate silky fibres or acicular crystallizations, aggregated in stellated groups. It also presents botryoidal and stalactitic shapes, and sometimes its composition is impalpable.

H.=2—2·5. G.=2·64—2·73. *Lustre* vitreous, except on P, on which it inclines to pearly. *Streak* white. *Color* white or grayish; frequently tinged red by the arsenate of cobalt which often accompanies it. Translucent—opaque. *Fracture* uneven.

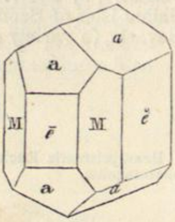
According to Klaproth, a specimen from Wittichen, (Beitrage, iii. 277,) contained Lime 25, Arsenic Acid 50·54, Water 24·46. John's analysis of a specimen from Andreasberg, gives Lime 27·28, Arsenic Acid 45·68, Water 23·86. Pure specimens from Mr. Ferguson's collection were analyzed by Dr. Turner, and found to contain Arsenate of Lime 79·01, and Water 20·99. Exposed to the blowpipe it is almost entirely volatilized, and gives off dense white fumes of arsenic. It dissolves readily in nitric acid without effervescence.

Obs. Crystals of pharmacolite have been found in the grand-duchy of Baden: also in botryoidal or globular groups of delicate white silky crystals at St. Marie aux Mines in the Vosges, at Andreasberg in the Hartz, and at Riegelsdorf, in Hessia; at Wittichen, near Furstenberg in Germany, it occurs in acicular crystals associated with cobalt, and disseminated on granite.

The picropharmacolite, from Riegelsdorf, differs from the above species, according to Stromeyer, (Untersuchungen, p. 135,) merely in containing about three per cent. of magnesia.

HAIDINGERITE. GYPSALUS RHOMBICUS.

Diatomous Gypsum-Haloide, *Haid.* Brewster's Journal, Vol. III. p. 303.



175. *Primary form:* a right rhombic prism; M : M=100°. *Secondary form:* M : ē=140°, M : ĕ=130°, *a* : *a* (adjacent planes,)=126° 58′, ĕ : *a*=116° 31′. *Cleavage* highly perfect and easily obtained, parallel to ĕ.

H.=1·5—2·5. G.=2·848. *Lustre* vitreous. *Streak* white. *Color* white. Transparent—translucent. Sectile; thin laminæ slightly flexible.

According to Turner, it is composed of Arsenate of Lime 85·681, and Water 14·319. Dissolves easily in nitric acid.

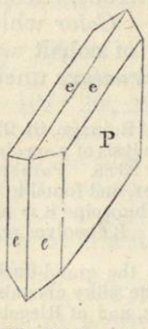
Obs. This mineral was first distinguished as a species by Mr. Haidinger. A single specimen only has been obtained from its locality at Baden. It is associated with pharmacolite, of which it was supposed to be a variety; it occurs mostly in minute crystals, aggregated into botryoidal forms.

GYPSUM. GYPSALUS RHOMBOIDEUS.

Prismatoidal Gypsum-Haloide, *M.* Sulphate of Lime. Alabaster. Selenite. Gypseus vulgaris, *Cartheuser.* Γύψος.

176. *Primary form:* a right rhomboidal prism; M : T=113° 18′. *Secondary forms:*

1.



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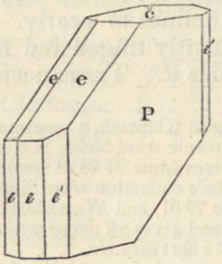


P : e=108° 34′, e : e=142° 52′, P : *e*=124° 42′, P : *e′*=134° 21. *Cleavage* highly eminent, parallel to P; parallel to M much less perfect, parallel to T obtained with difficulty on account of the flexibility of the mineral in this direction. *Compound crystals:* composition of the *first kind* parallel to each of the three primary faces. The arrow-shaped crystals result from a composition parallel to T. Crystals of gypsum vary from an enormous size to delicate acicular fibres. *Imperfect crystallizations:* stellated aggregations, composed of sublamellar particles; also lamellar and granular; sometimes nearly impalpable.

H.=1·5—2. G.=2·31—2·3257. *Lustre* of P pearly and shining, of M and T vitreous. Massive varieties have often a glistening lustre, and sometimes are dull and earthy. *Streak* white. *Color* usually white, sometimes gray, flesh-red, honey-yellow, ochre-yellow, and blue: in pure varieties are often black, brown-red, or reddish-brown. Transparent—opaque. Brittle parallel to M.

Gypsum is composed of Sulphuric Acid 44·8, Lime 33·0, and Water 21·0. Before the blowpipe it becomes opaque and of a white color, exfoliates, and falls to a powder. At a high heat it fuses with difficulty into a white enamel. The white powder obtained by heat, if moistened, soon becomes very firmly solid. It does not effervesce with acids when pure.

Obs. The transparent varieties have been distinguished by the name *Selenite;* and the fine massive varieties are called *Alabaster*. Gypsum often forms very extensive beds in secondary countries, and is usually found in connection with the new red sandstone. It also occurs in clay, and in coal formations; and sparingly in several rock strata besides the sandstone: it is also a product of volcanoes.

The finest foreign specimens are found in the salt mines of Bex, in Switzerland; at Hall, in the Tyrol; in the sulphur mines of Sicily; in the gypsum formation, near Ocana, in Spain; and in the clay of Shotover Hill, near Oxford. Large lenticular crystals have been met with at Montmartre, near Paris. Derbyshire produces the fibrous varieties. Near Sienna, in Tuscany, it occurs extremely pure and compact. It is transported from this place to Florence, and there employed for the manufacture of vases, figures, &c. It also occurs in acicular crystals covering lavas.

This species occurs in extensive beds in several of the United States; and more particularly New York, Ohio, Illinois, Virginia, Tennessee, and Arkansas, and is usually associated with salt springs.

Transparent crystals, of the form in fig. 1, have been found at Poland, and Canfield, Trumbull Co. Ohio. Beautiful specimens of the selenite variety occur near Lockport, N. Y., associated with calcareous spar in scalene dodecahedrons, and rhombohedral crystals of brown spar.

The value of gypsum in the arts, depends principally on the property it possesses of hardening, when moistened after having been heated. It is used for making moulds, taking casts of statues, medals, &c., for producing a hard finish on walls; also in the manufacture of artificial marbles, as the scagliola tables of Leghorn; it is also ground up and employed for improving lands.

The fibrous variety when cut *en cabochon*, and polished, reflects light similarly to cat's eye.

This mineral is easily distinguished from mica by its inferior hardness and want of elasticity, and by the inferior facility of its cleavage; and, in general, its softness will distinguish it from the minerals it most resembles.

ANHYDRITE. GYPSALUS RECTANGULUS.

Prismatic Gypsum-Haloide, *M.* Cube Spar, Muriacite, *W.* Karstenite *Haus.* Vulpinite.

177. *Primary form:* a right rectangular prism. *Secondary form:* similar to fig. 70, Pl. II. $\bar{M} : e$=140° 4′. *Cleavage* nearly equally perfect parallel to $\breve{M}$ and $\bar{M}$, less so parallel to P. *Imperfect crystallizations:* structure fibrous, lamellar, or granular, and sometimes impalpable. The lamellar and fibrous particles are often variously contorted.

H.=2·75—3·5. G.=2·899—2.957. *Lustre* somewhat pearly, parallel to $\bar{M}$ and $\breve{M}$; vitreous parallel to P; and in the imperfectly crystallized varieties, vitreous inclining to pearly. *Streak* grayish-white. *Color* white, sometimes with a grayish, bluish, or reddish tint; also brick-red. *Fracture* uneven; of finely lamellar and fibrous varieties, splintery.

It is composed, according to Klaproth, of Lime 41·75, Sulphuric Acid 55·0, and Chlorid of Sodium 1·0.

It whitens under the blowpipe, but does not exfoliate like gypsum, and finally is covered with a friable enamel. With borax, it dissolves with effervescence into a transparent glass, becoming yellow, or brownish-yellow, on cooling.

Anhydrite sometimes attracts moisture, and assumes an appearance somewhat resembling gypsum. It is, however, readily distinguished by its cleavage.

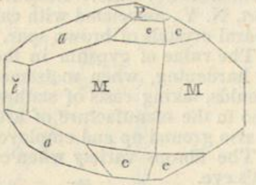
Obs. Anhydrite has been variously denominated muriacite, anhydrite, tripe stone, (gekrösstein,) according to its structure; the first, when crystallized in broad lamellæ; the second, when granular; and the third, when composed of contorted particles. Fine specimens of the crystalline variety occur at the salt mines of Bex, in Switzerland; and at Hall, in the Tyrol. At Aussee, both the crystalline and massive varieties occur; the latter of a brick-red color. It is also found at Sultz, on the Neckar; at Bleiberg, in Carinthia; at Ischil, in Upper Austria; and at Berchtesgaden, in Bavaria: the variety *gekrösstein* has been found principally at Wieliczka, in Poland. The *Vulpinite*, from Vulpino, Italy, is harder than the other varieties, and admits of being cut and polished for ornamental purposes.

In the United States, it has been found at Lockport, N. Y., of a fine blue color, in geodes of black limestone, accompanied with crystals of calcareous spar and gypsum. The decomposed variety has also been observed at the same place, forming a thin incrustation on the foliated variety, and also between the foliæ.

ROSELITE. Gypsalus Cobalticus.

178. *Primary form:* a right rhombic prism; M : M = 132° 48′. *Secondary form:* the annexed figure. *Cleavage* distinct and brilliant, parallel to *ĕ*. Twin crystals are of common occurrence.

H.=3. *Lustre* vitreous. *Streak* white. *Color* deep rose-red. Translucent.



According to an imperfect analysis by Children, it contains Oxyd of Cobalt, Lime, Arsenic Acid, Magnesia, and Water. Before the blowpipe, it parts with its water of crystallization, and becomes black. With borax and salt of phosphorus, it yields a blue globule.

Obs. Its only known locality is at Schneeberg, in Saxony, where it has been found in small quantities on quartz. It resembles cobalt-bloom in color, and was at first mistaken for it. Its distinctive characters, particularly crystallographic, were observed by Levy, who named the mineral after the distinguished Dr. Gustavus Rose, of Berlin.

HYDROBORACITE. Gypsalus fusilis.

Hydrous Calcareo-biborate of Magnesia, *Thom.*

179. Resembles fibrous and foliated gypsum.

H.=2. G.=1·9. *Color* white, with spots of red from iron. Thin plates translucent.

It contains, according to Mr. Hess,

Boracic Acid	49·922	49·22
Lime	13.298	13·74
Magnesia	10·430	10·71
Water	26·330=99·98.	26·33=100.

Fusible under the blowpipe.

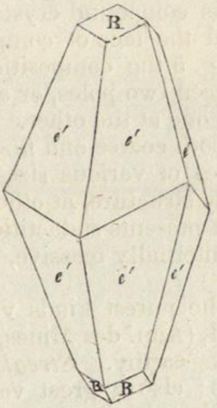
Obs. It was observed by Mr. Hess, in a collection of Caucasian minerals. The specimen was full of holes, filled with clay, containing different salts. It has been mistaken for gypsum; but it is readily distinguished by its easy fusibility.

CALCAREOUS SPAR. Calcius rhombohedrus.

Rhombohedral Lime-Haloide, *M.* Carbonate of Lime. Marl, Agaric Mineral, Anthraconite, Aphrite. Argentine, Chalk, Inolite, Marble, Oolite, Ostreocolla, Peastone, Pisolite, Slate Spar, Travestine, Tufa.

180. *Primary form:* an obtuse rhombohedron; R : R=105° 5′. *Secondary forms:* figures from 109 to 122, Pl. II.; also the annexed figures, of which fig. 2 has been observed at Derbyshire.

1



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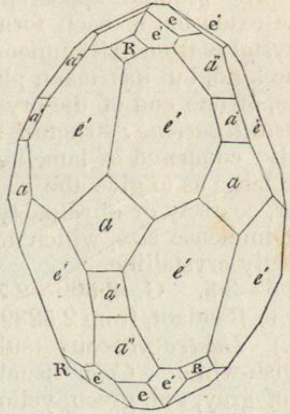

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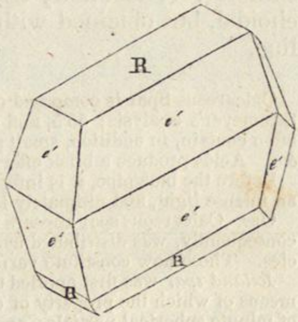
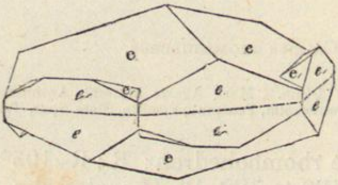


R : e′=150° 58′ 16″. e′ : e′=132° 58′. R : a=134° 36′. R : e=142° 32′. e : e= 134° 57′. e : a=116° 15′. Several rhombohedrons of different angles, formed on the lateral angles of the primary, occur in nature. That which is commenced by the planes a′, in fig. 121, Pl. II., and when completed, resembles fig. 122, has its interfacial angles a′ : a′= 78° 5′. Another, still more acute, is occasionally observed, the inclination of whose faces equals 65° 50′; and another of 60° 36′. Fig. 3 is a distorted scalene dodecahedron, from Rossie, St. Lawrence Co., N.Y. The lettering of its planes will explain its relation to the primary rhombohedron, and the scalene dodecahedron represented in fig. 1. *Cleavage* highly perfect, parallel to the primary faces R. *Compound crystals:* fig. 16, Pl. III. This form has been already remarked upon, § 75. Fig. 4 is an instance of a similar kind of composition. The faces e are formed by a truncation of the terminal edges, fig. 119, Pl. II. The peculiar appearance of this compound crystal arises from the extension of each form beyond the face of composition. This crystal is from Alstonmoor. In fig. 5 the composition is of the same kind, but has taken place between two poles, or axial extremities, of one end of the crystal, and one at the other. *Imperfect crystallizations:* structure fibrous, both coarse and finely delicate; also composed of lamellar particles of various sizes, sometimes so large as to give the rock a slaty structure, at other times granular, coarsely or impalpably; also it presents stalactitic forms, some of immense size, which may be internally massive, fibrous, or perfectly crystalline.

4



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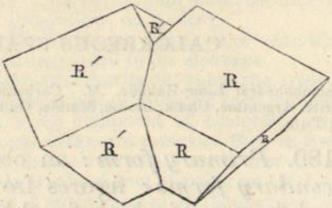


H.=2·5—3·5. G.=2·508—2·778. The purest kinds vary, according to Beudant, from 2·5239—2·7234, (Ann. des Mines, 2d Ser. V. 275.) *Lustre* vitreous—subvitreous—earthy. *Streak* white, or grayish-white. *Color* usually white; also a great variety of shades of gray, red, green, yellow, all pale; also brown and black, when impure. Transparent—opaque. The transparent varieties exhibit very distinctly *double refraction*. *Fracture* usually conchoidal, but obtained with difficulty, when the specimen is crystalline.

Calcareous Spar is composed of Lime 56·15, and Carbonic Acid 43·7, according to Stromeyer's analysis; 55·5, and 44·0, according to Phillips. The colored varieties often contain, in addition, small portions of iron, silica, magnesia, alumina, bitumen, &c. Acids produce a brisk effervescence.

Before the blowpipe, it is infusible; it loses, however, its carbonic acid, gives out an intense light, and ultimately is reduced to pure lime, or *quicklime*.

Obs. Calcareous spar appears under a very great variety of forms and aspects, and, consequently, was distributed by the earlier mineralogists into several distinct species. These now constitute varieties.

Iceland spar was first applied to a transparent crystallized variety from Iceland, by means of which the property of double refraction was first observed. *Oolite* consists of minute spherical particles, aggregated by a calcareous cement, so as to produce a massive structure, and nearly earthy appearance. It occurs in extensive beds. It is so called from its resemblance to the roe of fish, from *ὠον, egg*. The ***Peastone***, or ***Pisolite***, differs from oolite in the larger size of its particles. These particles are composed of concentric laminæ. *Chalk* is a massive opaque variety, usually white, and possessing a purely earthy aspect, and absence of lustre. It is usually much softer than the other varieties of this species. *Agaric Mineral*, or ***Rock Milk***, is a loose friable variety, deposited from waters containing carbonate of lime in solution. It is formed about lakes, whose waters are impregnated with lime; also in fissures in limestone, and in limestone caverns. *Marble* includes all the imperfectly crystalline and earthy varieties which admit of a high polish. The *Stinkstone*, *Swinestone*, or *Anthraconite*, which is found columnar, granular, and compact, of various shades, emits a fetid odor, when struck with the hammer. *Stalactites* are pendent masses of limestone, formed in limestone caverns by the percolation of water, holding lime in solution, through their rocky roofs; the evaporation of the water causes the deposition of the lime; and thus, in time, columns are often formed extending from the roof to the floor of a cavern. The water which drops to the floor from the roof also evaporates, and causes the formation of a layer of limestone over the floor. This variety has been called *Stalagmite*. *Argentine* possesses a silvery white lustre, and contains a little silica. *Marl* is a mixture of clay and carbonate of lime. *Calcareous Tufa* occurs in beds formed by deposition from water, and has a very porous structure. The *Fontainebleau Limestone* is an aggregate of secondary rhombohedrons, containing, mechanically mingled, large portions of sand. This species, in some of its forms, is very generally diffused. England and France contain extensive strata of chalk. Italy, from her Carrara beds, and Greece, from the Pentelican quarries, have provided the world with statuary marble. The greater part of the middle and western sections of the United States are underlaid with strata of limestone.

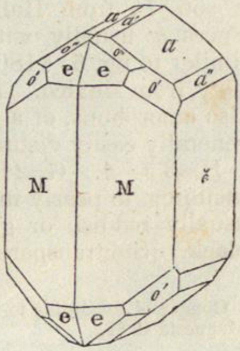
At Oxbow, St. Lawrence Co., N. Y., crystals, of the form of the scalene dodecahedron, occur, a foot or more in length, in veins of primary limestone. Fine transparent rhombohedrons, of two inches or more in each of their dimensions, are also found in the same region, in connection with veins of lead. The specimens of dog-tooth spar, (scalene dodecahedral crystallizations,) from Lockport, N. Y., are often extremely beautiful and delicate. They occur, covering the sides of cavities in limestone. Argentine occurs near Williamsburg and Southampton, Mass.; also in the iron mines of Franconia, N. H. Agaric mineral covers the sides of a cave at Watertown, N. Y., to the thickness of six to twelve inches. Stalactites occur in the celebrated Wier's cave of Virginia, and in the large caves of Kentucky; also in the cave at Scoharie, N. Y., and in many parts of the western states.

Calcareous spar is the principle source of our polished marbles, the material for sculpture, quicklime, flux for smelting ores, &c. A peculiar fine grained, compact variety is employed in lithography; the best for this purpose occurs at Pappenheim and Sohlenhofer, in Bavaria.

ARRAGONITE. CALCIUS RHOMBICUS.

Prismatic Lime-Haloide, *M.* Eisenbluth, *W.* Igloite. Flos-ferri. Needle Spar.

181. *Primary form:* a right rhombic prism; $M:M=116^\circ\ 10'$. *Secondary form:* $M:\breve{e}=121^\circ\ 55'$, $\breve{e}:a=125^\circ\ 50'$, $\breve{e}:a'=109^\circ\ 49'$, $\breve{e}:a''=145^\circ\ 19'$. *Cleavage* parallel with M. *Compound crystals:* similar to the figures 13, Pl. III., and 3, 5, 6, and 11, Pl. IV., which have been described in § 74 and § 76. *Imperfect crystallizations:* globular, reniform, and coralloidal shapes; columnar masses, composed of straight or divergent columns, or fibres of various sizes.



H.=3·5—4. G=2·931, Haidinger, –2·927 Biot. *Lustre* vitreous, sometimes inclining to resinous on surfaces of fracture. *Streak* grayish-white. *Color* white; also passing into gray, yellow, green, and violet-blue. Transparent–translucent. *Fracture* subconchoidal. Brittle. It possesses double refraction, but in a less degree than calcareous spar.

Arragonite, according to Stromeyer, contains

Carbonate of Lime	95·2965	99·2922
Carbonate of Strontia	0·5090	4·1043
Water	0·1544=95·9599.	0·5992=103·9957.

The carbonate of strontian is a very variable ingredient and does not exist in all the varieties. Carbonate of lime is, therefore, one of the dimorphous substances, calc spar being one of its forms, and the rhombic crystals of Arragonite the other. (See remarks on dimorphism, § 83.)

When Arragonite is heated, it parts with its water of crystallization and falls to powder. It is phosphorescent on red hot iron, and is soluble with effervescence in nitric and muriatic acids.

Obs. The most common repositories of Arragonite are beds of gypsum, beds of iron ore, (where it occurs in coralloidal forms, and is denominated flos-ferri, '*flower of iron*,') basalt and trap rocks; occasionally, it occurs in lavas. It is often associated with copper and iron pyrites, galena, and malachite.

This mineral was first discovered at Arragon, in Spain, (whence it derives its name,) in large detached compound crystals, imbedded in a ferruginous clay and accompanied by gypsum. It has since been obtained in fine compound hexagonal prisms at Bilin, in Bohemia, in a vein traversing basalt. The *flos-ferri* variety is found in the greatest perfection in the Styrian mines of Eisenerz, coating cavities and even caves of considerable extent, and associated with spathic iron. At Dufton, the silky fibrous variety called *Satin Spar*, is obtained, where it occurs traversing shale in thin veins, generally associated with pyrites. In Buckinghamshire, Devonshire, &c., it occurs in stalatitic forms in caverns.

The flos-ferri occurs at Lockport, N. Y., coating gypsum in geodes; also at Edenville, N. Y., lining cavities of mispickel and cube ore, and at Haddam, Conn., in thin seams between layers of gneiss. Veins of this mineral occur at Scoharie.

DOLOMITE. CALCIUS DOLOMÆI.

Macrotypous Lime-Haloide, *M.* Bitter Spar. Pearl Spar. Magnesian Limestone.

182 *Primary form :* an obtuse rhombohedron; R : R=106° 15′. *Secondary forms :* the most common are two acute rhombohedrons; in one, $a' : a'$=79° 36′, from Gotha, in Saxony, in the other, $a'' : a''$=66° 7′, from Hall, Tyrol. *Cleavage* perfect parallel to R. Faces a' usually with horizontal striæ. *Compound crystals :* similar to fig. 5, § 180, presented by a greenish-white cleavable variety, from Mexico. *Imperfect crystallizations :* imitative shapes; also amorphous, of a granular structure; particles of various sizes, generally easily distinguishable, and often slightly coherent.

H.=3·5—4. G=2·884. *Streak* grayish-white. *Lustre* vitreous, inclining to pearly in some varieties. *Color* white, seldom pure, usually reddish or greenish; also rose-red, green, brown, gray, black. Subtransparent to translucent. Brittle.

Composed, according to Klaproth, of Carbonate of Lime 54·18, and Carbonate of Magnesia 45·82.

This species is soluble in the acids, but more slowly than calcareous spar. Before the blowpipe, some varieties darken and increase in hardness.

Obs. The names *Rhomb spar* and *Bitter spar*, have been applied to the perfectly crystallized specimens, excepting those with curved faces and a pearly lustre, which have been designated *Pearl spar*. Those varieties of rhomb spar of a reddish-brown color, have also been named *Brown spar*. The name, Dolomite, has been restricted to the imperfectly crystallized varieties of a granular structure.

The Dolomite variety occurs in beds; rhomb spar usually in imbedded crystals; brown spar commonly in metalliferous veins. Dolomite occurs at Traversella, in Piedmont, and at St. Gothard, in the Appenines. Rhomb spar is found in Salzburg, the Tyrol, Miemo, in Tuscany, from which the name *Miemite* was derived. Brown spar and pearl spar are obtained at Schemnitz, in Hungary, Kapnik, in Transylvania, at Freiburg, in Saxony, in the lead mines of Alston, in Derbyshire, and at other places in Devonshire.

Roxbury, Vt., affords large yellow transparent crystals of the rhomb spar variety, imbedded in greenish-transparent talc. A large grained cleavable variety, occasionally presenting perfect crystals, is associated with white talc in calcareous spar, at Smithfield, R. I. The pearl spar variety is very abundant in geodes at Lockport, N. Y., accompanying calcareous spar, celestine, and gypsum. Massive Dolomite forms extensive beds in Litchfield Co., Conn., in the south-western towns of Massachusetts, and in Vermont. The gray-wackes and secondary limestones in various places in New York and Ohio, contain brown spar in veins and seams.

For agricultural purposes Dolomite is inferior to calcareous spar, the magnesia it contains being injurious to the soil. For the formation of mortar it is highly valued, it being less subject to disintegration than ordinary mortar. It is also much inferior to common limestone for a building material, on account of its friability or the loose coherence of its particles. This species was named in honor of Dolomieu.

ANKERITE. CALCIUS DECOLORANS.

Paratomous Lime-Haloide, *M.* Rohe Wand and Wandstein of the Styrian miners.

183. *Primary form:* an obtuse rhombohedron; R : R=106° 12′. *Cleavage* parallel with R. Occurs commonly in easily cleavable masses; also of a compact granular composition, in which the grains are distinctly discernible.

H.=3·5—4. G.=2·95—3.1. *Lustre* vitreous. *Streak* white. *Color* white, sometimes yellowish or brownish from an admixture of iron. Translucent—subtranslucent. *Fracture* uneven.

Its constituents, according to Schrötter's analysis, are

Carbonic Acid with Oxyd of Iron	35·308
Lime	50·113
Magnesia	11·846
Oxyd of Manganese	3·084=100·351.

Before the blowpipe it blackens, and then will act upon the magnetic needle, but is infusible. A pearly globule is formed with borax. Exposure to the air darkens its surface.

Obs. This species occurs at Rathhausberg and Salzburg; also at the Styrian mines of Eisenerz, where it is valued both as an iron ore and a flux.

The transition limestone about Quebec contains it in veins, and at West Springfield, Mass., it occurs in connection with the coal formation.

It was first distinguished as a distinct species by Mohs, who named it after Prof. Anker, of the Johanneum, in Gratz.

CARBONATE OF LIME AND SODA.

Ann. of Phil. May, 1830.

184. *Primary form:* a rhombohedron. Occurs massive—structure laminated. *Cleavage* parallel to the faces of a rhombohedron.

H.=3—3·5. G.=2·92. *Lustre* vitreous, resembling Arragonite. Fragments perfectly transparent. Possesses double refraction.

It contains Carbonate of Lime 70, Carbonate of Soda 14, Water 9·7, Peroxyd of Iron 1·0, besides 5·0 of matrix. It decrepitates slightly before the blowpipe, becomes brown, and finally affords lime. It dissolves with effervescence in nitric acid.

Obs. Locality unknown.

RHOMB SPAR. MAGNESIALUS RHOMBOHEDRUS.

Brachytypous Lime-Haloide, *M.* Bitter Spar, in part. Dolomite, in part. Breunnerite. Carbonate of Magnesia and Iron.

185. *Primary form:* an obtuse rhombohedron; R : R=107° 22′. *Cleavage* eminent parallel to R. Imperfectly crystalline varieties occur, having a compact granular composition.

H.=4—4·5. G.=3·001—3·112. *Lustre* vitreous, inclining to pearly in some varieties. *Streak* grayish-white. *Color* white, commonly yellowish, or brownish. Transparent—translucent. *Fracture* subconchoidal. Brittle.

It contains Carbonate of Magnesia and Carbonate of Iron, in the ratio of 86·85 to 13·15, according to Brooke. It turns brown on exposure, or under the blowpipe.

Obs. Its foreign localities are Salzburg, the Tyrol, and Switzerland. It occurs at Marlborough, Vermont, in steatite, at Middlefield, Mass., and in most of the soapstone quarries of New England.

MAGNESITE. MAGNESIALUS FIBROSUS.

Baudisserite. Carbonate of Magnesia. Razoumuffskin.

186. Amorphous, reniform, also in crusts. Composed occasionally of delicate diverging fibres, possessing a silky lustre: usually having an impalpable composition, and sometimes earthy.

H. of earthy varieties, sometimes as low as 2. The compact magnesite varies from 3 to 4. G. of earthy varieties, 1·2—2·6, of the compact 2·808—2·95.

Lustre earthy, dull, sometimes silky. *Streak* white. *Color* white—yellowish-white, or gray. Opaque. *Fracture* flat conchoidal.

Its constituents are, according to

	Klaproth; Sp. from Steyermark.	Stromeyer; Sp. from Baumgarten.
Magnesia	48·00	47·6334
Carbonic Acid	49·00	50·7512
Water	3·00	1·4037
Ox. Mang.	——=100.	0·2117=100.

It dissolves slowly, with little effervescence, in nitric, or dilute sulphuric acid, and is infusible before the blowpipe.

Obs. This species occurs at Hrubschitz, in Moravia, at the Gulsen mountains, in Styria, at Baumgarten, in Silesia, at Baudissero, in Piedmont, at Valeccas, in Spain. At Hoboken, N. J., it occupies seams and cavities in Dolomite, and serpentine, having a closely aggregated fibrous structure; also at Bolton, Mass., where it appears in delicate, indistinctly fibrous masses, traversing white limestone.

HYDROMAGNESITE. MAGNESIALUS PULVEREUS.

Hydro-carbonate of Magnesia.

187. Occurs in crusts; also as a white powder. H.=2. *Lustre* earthy. *Streak* and *Color* white.

It contains, according to Wachtmeister and Kobell,

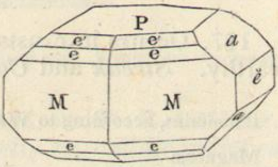
Magnesia	42·41	43·96
Carbonic Acid	36·82	36·00
Water	18·53	19·68
Silica	0·57	0·36
Peroxyd of Iron, and foreign matter	1·66=99·99. W.	——=100. K.

Obs. It occurs, accompanying magnesite, in India; also in seams and in crusts, coating Arragonite, at Hoboken, N. J. This species is usually united with the preceding, from which it differs merely in the water it contains.

ORDER II. BARYTINEA.

STRONTIANITE. Barytes rubefaciens.

Peritomous Hal-Baryte, *M.* Carbonate of Strontian.



188. *Primary form :* a right rhombic prism; M : M=117° 32′. *Secondary form:* M : ĕ=121° 14′, e′ : e′=108° 12′, e : e′= 144° 20′. Simple crystals of this mineral are rare, it usually presenting compound forms, which in general resemble those of Arragonite. The near approximation of the value of the angle M : M, to 120°, accounts for the so frequent occurrence of compound forms, (§ 76.) The surface P is usually striated parallel to the shorter diagonal. *Cleavage* parallel with M nearly perfect; traces parallel to ĕ. *Imperfect crystallizations :* structure often aggregated in columnar globular forms; also fibrous. A granular composition sometimes occurs, but is unfrequent.

H.=3·5—4. G.=3·605—3·713. *Lustre* vitreous, slightly inclining to resinous on uneven faces of fracture. *Streak* white. *Color* asparagus-green, apple-green; also white, gray, yellow, and yellowish-brown. Transparent—translucent. *Fracture* uneven. Brittle.

Klaproth's and Hope's analyses give for its composition,

Strontia	69·5	61·21
Carbonic Acid	30·0	30·20
Water	0·5=100, Klaproth.	8·59=100, Hope.

Thomson found the two varieties from Strontian to contain,

	Green.	Brown.
Carbonate of Strontia	93·49	91·17
Carbonate of Lime	6·28=99·77.	8·64=99·81.

Another variety from the United States, which he has named *Emmonite,* in honor of Prof. Emmons, of Williams College, Mass., contains 12·5 per cent of Carbonate of Lime. These are probably mechanical mixtures.

Nitric and hydrochloric acids dissolve strontianite with effervescence; and paper wet with the solution, and afterwards dried, burns with a red flame. The flame of the blowpipe is also tinged red by it. It melts only on the thinnest edges. In a very strong heat, the carbonic acid and water are expelled. With borax, it effervesces violently, and yields a transparent globule.

Obs. Strontianite was first discovered at Strontian, in Argyleshire, in veins traversing gneiss, with galena and heavy spar. It occurs there in stellated and fibrous groups, rarely perfectly crystallized. Yorkshire and Braunsdorf, in Saxony, are other localities.

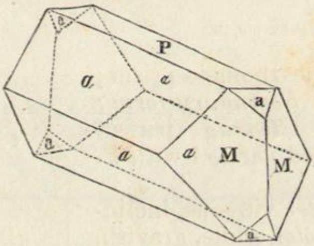
In the United States it occurs at Scoharie, both in granular masses, and also presenting columnar crystallizations or acicular crystals; also in finely terminated crystals of considerable size. It exists there in a secondary limerock, forming veins, and sometimes crystallized in geodes. It is associated with heavy spar, iron pyrites, and crystals of calcareous spar. The massive variety occurs in large quantities.

CELESTINE. Baralus prismaticus.

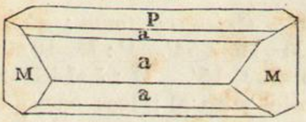
Prismatoidal Hal-Baryte, *M.* Sulphate of Strontian. Zölestine, *Wern.*

189. *Primary form:* a right rhombic prism; M : M=103° 58′. *Secondary forms:*

1. Etna.



2. Lake Erie.



P : a=128° 31′, a : a=102° 58′, P : a=140° 44′, a : a=78° 35′, P : a′=157° 45′, a : a′=162° 59′, Fig. 1 is lengthened in the direction of its shorter lateral axis, and fig. 2 in the direction of the longer. *Cleavage* distinct parallel with M, less so parallel with P. *Imperfect crystallizations:* structure fibrous; also in globular masses of columnar composition. Occasionally it appears granular of various sizes of grains.

H.=3—3·5. G.=3·92—3·963. *Lustre* vitreous, sometimes inclining to pearly. *Streak* white. *Color* generally white, often bluish or reddish. Transparent—subtranslucent. *Fracture* imperfectly conchoidal—uneven. Very brittle.

According to Thomson's analysis, of specimens from Bristol and from Sicily, it is composed of

	Bristol.	Sicily.
Sulphate of Strontia	98·353	98·68
Sulphate of Lime	1·073	1·02
Moisture	0·200	0·30
Silica and Alumina	0·374=100.	——=100.

Before the blowpipe it decrepitates and fuses into a white friable enamel. Heat destroys its transparency, and causes a phosphorescence of the pulverized mineral.

Obs. Celestine is usually associated with secondary, or transition limestone, or secondary sandstone. It also occurs in trap rocks and in beds of gypsum, in which it is often associated with sulphur. Sicily has long been famous for the splendid groups of crystals of this mineral which there occur, accompanied with sulphur and gypsum. Fine specimens are met with also at Bex, in Switzerland, and Conil, in Spain. Fibrous varieties occur of a blue color, in clay, at Dornberg, near Jena. It is also found at Aust Ferry, near Bristol; in trap rocks near Tamtallan, in East Lothian; near Knaresborough, in Yorkshire; at Norton, in Hanover.

Beautiful specimens, finely crystallized, of a bluish tint, are found in great abundance in the secondary limestone about Lake Erie, and particularly on Strontian island, where the rock is full of splendid crystallizations of this species. Scoharie and Lockport, N. Y., also afford fine specimens. At the latter place they are associated with the crystallized calc spar of the region.

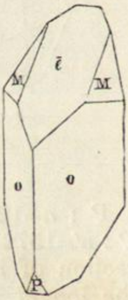
Dr. Thomson separates the radiated celestine, found on Drummond island, Lake Erie, and at Kingston, U. C., from the above species. An analysis, performed in his laboratory, gave for its composition, Sulphate of Barytes 35·195, and Sulphate of Strontian 63·204, with a little Iron and Water. Its Hardness he states at 2·75, Specific gravity 3·921; color white, with a bluish tint; structure laminated, laminæ diverging.

BARYTO-CALCITE. Baralus obliquus.

Hemi-prismatic Hal-Baryte, *M.*

190. *Primary form:* an oblique rhombic prism; M : M=106° 54′. P : M=102° 54′. *Secondary form:* o : o=95° 15′. M : ē=143° 27′. *Cleavage* perfect parallel with M; less easily effected parallel with P. Occurs also massive.

H.=4. G.=3·6363—3·66. *Lustre* vitreous, inclining to resinous. *Streak* white. *Color* white, grayish, greenish, or yellowish. Transparent—translucent. *Fracture* uneven.



Analyses by Mr. Children and Mr. Richardson determine the following for the constituents of this mineral:

	Children.	Richardson.
Carbonate of Baryta	65·9	62·20
Carbonate of Lime	33·6	31·65
Sulphate of Baryta	——	0·30
Peroxyd of Iron	——	0·85
Water, or volatile matter,	—— =99·5.	3·45=98·45.

Before the blowpipe, it is infusible alone. With borax, or biphosphate of soda, it fuses into a transparent glass. It effervesces with hydrochloric acid.

Obs. It occurs at Alstonmoor, in Cumberland, both massive and crystallized.

Another compound of carbonate of lime and carbonate of barytes, is described by Thomson as a *bicalcareo-carbonate of barytes.*

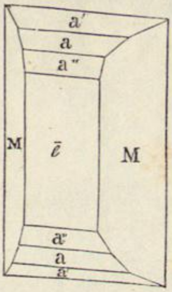
The form presented by the specimen examined, was an isosceles dodecahedron, fig. 124, Pl. II.; the inclination of two adjacent faces in the same pyramid, about 132°. H.=2·25. G.=3·718. *Lustre* vitreous. *Color* snow-white. Translucent, It contained Carbonate of Barytes 49·31. and Carbonate of Lime 50·69, which is equivalent to one atom of the former to two of the latter. The crystals were in groups, implanted upon a white crystalline substance, which appeared to be a heavy spar. Locality unknown.

WITHERITE. BARALUS FUSILIS.

Diprismatic Hal-Baryte, *M.* Carbonate of Barytes Barolite.

191. *Primary form:* a right rhombic prism; M : M=118° 30′. *Secondary form:* M : ē=149° 15′. ē : a″=145° 30′, ē : a=126° 16′, ē : a′=110° 30. *Cleavage* imperfect. *Compound crystals:* composition of the first kind, presenting the form of a hexagonal prism, similar to those of Arragonite. *Imperfect crystallizations:* globular, tuberose, and botryoidal forms; structure either columnar or granular; also amorphous.

H.=3—3·75. G.=4·29—4·30. *Lustre* vitreous, inclining to resinous. *Streak* white. *Color* white, often yellowish, or grayish. Subtransparent—translucent. *Fracture* uneven. Brittle.



Klaproth found the Styrian variety of Witherite, (Beitrage i. 271,) to be composed of Carbonic Acid 2·75, and Baryta 9·50. Bucholz obtained 79·76 of Baryta, and 20 of Carbonic Acid. It decrepitates under the blowpipe, and melts easily into a transparent globule, which becomes opaque on cooling. It dissolves with effervescence in dilute nitric or hydrochloric acids.

Obs. Witherite was first observed at Alstonmoor, in Cumberland, associated with galena, in veins traversing the coal formation. It was described, in 1784, (Phil. Trans. 1784, p. 293,) by Dr. Withering, after whom the mineral was named by Werner. The compact fibrous and translucent variety occurs at Anglezark, in Lancashire. Styria, Hungary, Siberia, and Sicily are mentioned as other localities. But it is only abundant in England.

This mineral is so poisonous, that it is used in the north of England for the purpose of killing rats.

DREELITE. BARALUS RHOMBOHEDRUS.

Dufrénoy, Ann. de Ch. et de Ph. LX. 102.

192. *Primary form:* an obtuse rhombohedron; R : R=93° or 94°. *Cleavage* apparent only in traces.

H.=3·5. G=3·2—3·4. *Lustre* pearly; splendent on a surface of fracture. *Streak* and *Color* white.

It contains, according to Dufrénoy, Sulphate of Baryta 61·701, Sulphate of Lime 14·274, Carbonate of Lime 8·050, Lime in excess 1·521, Silica 9·712, Alumina 2·404, Water 2·308=100.

Obs. It occurs in small unmodified crystals, disseminated on the surface, and in the cavities of a quartzose rock.

It was named by Dufrénoy in compliment to M. de Dree, a liberal patron of science.

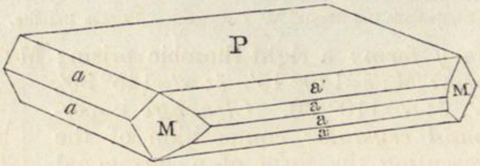
HEAVY SPAR. BARALUS PONDEROSUS.

Prismatic Hal-Baryte, *M.* Sulphate of Barytes. Hepatite, *Haus.* Baroselenite. Aerhensten. Bolognian Spar. Cawk. Litheospore.

193. *Primary form:* a right rhombic prism; M : M=101° 42′.

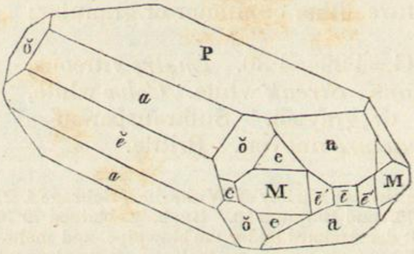
Secondary forms:

1.



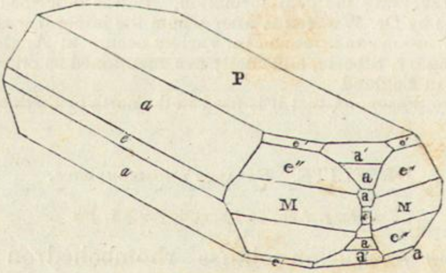
Cheshire, Conn.

2.



Cheshire, Conn.

3.



Cheshire, Conn.

M : ē=140° 51′, M : ĕ=129° 9′, P : a=141° 11′, P : a′=158° 2′, P : a″=121° 48′, P : e′=165° 26′, P : e″=115° 41′, P : *a*=127° 18′, *a* : ĕ=142° 42′, M : e′=154° 19′. *Cleavage* P and M perfect. *Imperfect crystallizations:* globular forms, with a columnar or lamellar composition; broad coarse laminæ, often slightly diverging and curved; impalpably granular forms, sometimes possessing the banded colors of stalagmite.

H.=2·5—3·5. G=4·3—4·72; the latter was obtained by Thomson, with a transparent colorless crystal. *Lustre* vitreous, inclining to resinous, sometimes pearly. *Streak* white. *Color* white; also inclining to yellow, gray, blue, red, or brown. Transparent to translucent—opaque.

Pure specimens are composed of Sulphuric Acid 34, and Baryta 66. Oxyd of Iron, Silica, Carbonate of Lime, and Alumina, occur sometimes as impurities in specimens of this mineral. Under the action of the blowpipe it decrepitates, and is difficultly fusible. Some specimens loose their color when heated.

Obs. Heavy Spar occurs commonly in connection with beds or veins of metallic ores. It is also met with in secondary limestones, sometimes forming distinct veins, at others, in crystals, along with crystallizations of lime and strontian.

The most noted English locality is at Dufton, where large transparent crystals occur. In Mr. Allan's cabinet there is one crystal from this locality of a tabular form, which weighs forty-two pounds, and whose face P measures ten inches across.

Some of the most important European repositories of this mineral, are at Felsobanya and Cremnitz, in Hungary; Roya and Roure, in Auvergne. At Freiberg, in Saxony, a variety occurs composed of indistinct prismatic crystals and having a pearly lustre; this is the *Stangenspath* of Werner. Rounded masses, composed of diverging columnar particles, occur at Mount Paterno, near Bologna, and have hence been called the *Bolognese stone*. At Staffordshire and Derbyshire, is found an opaque massive variety of an earthy appearance and dirty-white color. This variety has been called *cawk*. The term *hepatite* has been applied to specimens which, by friction, emit a fetid odor.

In Cheshire, Conn., large distinct crystals, three or four inches long, and nearly transparent, are occasionally met with, in connection with vitreous copper and green malachite, in red sandstone. Smaller crystals of perfect transparency are frequently obtained, and large foliated massive specimens are abundant. Other similar localities are at Berlin, Farmington, and Southington, of the same state. A variety, indistinctly and very delicately fibrous, occurs in large masses at Pillar Point, opposite Sackett's Harbor, N. Y. It here constitutes a solid vein, from two to three feet thick, in secondary limestone. Large slabs are sometimes obtained and polished; and owing to the banded arrangement of the different shades of color, they are often extremely beautiful; the more common colors are a reddish-white, and a grayish or yellowish-white. The earthy and foliated varieties are found at the Perkiomen lead mine, in Pennsylvania. At Scoharie, it occurs with strontianite. Throughout the lead country of the west, heavy spar is very abundant, in connection with this ore. Crystals of heavy spar, and also a friable granular variety, occur abundantly at Eldridge's gold mine, in Buckingham Co., Virginia; three miles S. W. from Lexington, in Rockbridge Co.; a beautiful white variety is found on the plantation of J. Hord, Esq., Fauquier Co., Virginia.

The pure white varieties of heavy spar are sometimes ground up and employed as a white paint, either *per se*, or mixed with white lead. Otherwise, it is of no importance in the arts.

SULPHATO-CARBONATE OF BARYTA. *Thomson.*

194. The specimen, from which Dr. Thomson has derived the following description, consisted of a congeries of large six sided prisms, terminated by low six sided pyramids. H.=3. G.=4·141. *Lustre* vitreous. *Color* snow-white. Translucent. It contained Sulphate of Baryta 34·30, Carbonate of Baryta 64·82, Carbonate of Lime 0·28, Moisture 0·60=100. Locality unknown.

FLUCERINE. Spanialus hexagonus.

Fluate of Cerium.

195. *Primary form:* a hexagonal prism; occurs in six sided prisms and plates; sometimes with the angles of the prism replaced; also in amorphous masses. *Cleavage* most distinct parallel to P or the base of the prism.

H.=4—5. G.=4·7. *Lustre* weak. *Streak* white or slightly yellowish. *Color* dark-tile-red or almost yellow; deeper when the mineral is wet. Subtranslucent—opaque.

Its constitution, according to Berzelius, (Afhandlingar, v. 56,) is as follows:—

Peroxyd and Protoxyd of Cerium	82·64
Yttria	1·12
Fluoric Acid	16·24=100.

It is infusible, *per se*, before the blowpipe. In borax and salt of phosphorus, it fuses slowly but completely. The globule is blood-red in the exterior flame, but becomes colorless on cooling. In the interior flame it is colorless at all temperatures. In carbonate of soda it does not fuse, but swells out and is decomposed.

Obs. This mineral is of very rare occurrence, having been observed only at Finbo and Broddbo, near Fahlun, in Sweden, where it occurs imbedded in quartz and albite, accompanying pyrophysalite and orthite.

SUBSESQUIFLUATE OF CERIUM. SPANIALUS DODECAHEDRUS.

196. Usually massive; sometimes exhibits traces of the rhombic dodecahedron.

H.=5. *Lustre* vitreous. *Streak* fine yellow. *Color* a beautiful yellow, with some red; and when impure, brownish-yellow. Subtranslucent—opaque.

According to Berzelius, (Afhand. v. 64,) it contains

Peroxyd of Cerium	84·20
Fluoric Acid	10·85
Water	4·95=100.

Infusible in the blowpipe flame, but blackens. On cooling, passes through dark-brown and red tints, and nearly reassumes its original color, being a little redder than at first. With borax, salt of phosphorus, and carbonate of soda, it acts like the last species. It dissolves in hot sulphuric acid, forming a yellow solution. With muriatic acid, chlorine is copiously evolved.

Obs. It accompanies the compact black allanite in small quantities at Bastnæs, in Sweden.

CARBONATE OF CERIUM. SPANIALUS QUADRATUS.

Berzelius, Brewster's Journ. III. 334.

197. In thin four sided crystalline plates of a grayish-white color.

It contains, according to Hisinger, Oxyd of Cerium 75·7, Carbonic Acid 10·8, and Water 13·5. Exposed to a low red heat, it loses 19 per cent. of its weight, without changing its appearance.

Obs. It is found coating the Cerite of Bastnæs, in Sweden, and probably is produced by the decomposition of that mineral.

SILICATE OF CERIUM. SPANIALUS WOLLASTONII.

Wollastonite. Brewster's Jour. VI. 357.

198. *Primary form:* a regular hexagonal prism. *Cleavage* parallel to the axis of the prism.

Color pale-yellowish brown. Translucent.

Obs. Accompanies emerald in magnesian carbonate of lime, at Santa Fe de Bogota, in Peru. Some fragments, associated with emerald, are preserved in the British Museum.

MICROLITE. SPANIALUS OCTAHEDRUS.

Shepard. Silliman's Amer. Journal, XXVII. 361.

199. *Primary form:* the regular octahedron. *Secondary forms:* figs. 3, 9, 17, Pl. I. *Cleavage* imperfect parallel with the faces of the octahedron.

H.=5—5·5. G.=4·75—5. *Lustre* resinous. *Streak* white, except when the color of the mineral is brown, it then resembles the color. *Color* straw-yellow—dark-reddish-brown. Transparent—subtranslucent.

Alone, before the blowpipe, it is unaltered. With borax, it fuses slowly into a yellow globule, which grows paler on cooling, and remains transparent, unless subjected to flaming, when it becomes nebulous, and presents on cooling a pale-yellow enamel. It is not readily acted upon by carbonate of soda. No action with nitric acid. It is supposed to contain, as its principal ingredient, the oxyd of cerium.

Obs. Occurs at Chesterfield, Mass., in the vein of albite, which contains the green and red turmaline, disseminated through the albite, and especially near its junction with the smoky quartz. The largest crystals yet seen, weigh but 0·4 of a grain. It was discovered by Prof. C. U. Shepard, and named as above, in allusion to the smallness of its crystals, from μικρος, *small.*

YTTRO-CERITE. SPANIALUS RHOMBICUS.

200. Massive. *Cleavage* apparent parallel to a rhombic prism of 108° 30′.

H.=4·5—5. G.=3·447. *Lustre* glistening; vitreous—pearly. *Color* violet-blue, inclining to gray and white, often white; sometimes reddish-brown. Opaque. *Fracture* uneven.

According to Berzelius, (Afhandlingar, iv. 151,) it is composed of Fluoric Acid 25.05, Lime 47·63, Oxyd of Cerium 18·22, Yttria 9·11. It whitens before the blowpipe, previous to its attaining a red heat, but is infusible *per se.* With the addition of gypsum, it fuses into a bead, which on cooling becomes of a white color. In a pulverized state, it dissolves completely in heated muriatic acid, forming a yellow solution.

Obs. It occurs sparingly at Finbo and Broddbo, near Fahlun, in Sweden, imbedded in quartz, and associated with albite and topaz.

XENOTIME. SPANIALUS PERITOMUS.

Phosphate of Yttria. Phosphorsaure Ytterde *of the Germans.*

201. *Primary form:* a right square prism. *Secondary form:* similar to fig. 54, Pl. I. M : e=about 135°. *Cleavage* perfect parallel to M.

H.=4·25—5. G.=4·5577. *Lustre* resinous. *Streak* pale-brown. *Color* yellowish-brown. Opaque. *Fracture* uneven and splintery.

According to the analysis of Berzelius, (Kong. Vet. Acad. Handl. 1824, p. 334,) it is composed of

Yttria	62·58
Phosphoric Acid	33·49
Subphosphate of Iron	3·93=100.

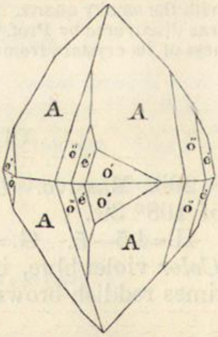
and consequently it contains 1 atom of Phosphoric Acid to 1½ of Yttria. Before the blowpipe, it comports itself like apatite, but differs from that mineral by its infusibility *per se*. With borax, it affords a colorless globule, which becomes milky on cooling. With biphosphate of soda, it dissolves with great difficulty into a clear colorless glass: in this particular, also, it differs from apatite, as that mineral fuses easily with this reagent. With carbonate of soda, it produces a strong effervescence, and a light-gray infusible slag. In acids, it is insoluble.

Obs. This mineral was discovered at Lindesnaes, in Norway, in a vein composed chiefly of a coarse granite.

TUNGSTATE OF LIME. Scheelius pyramidalis.

Pyramidal Scheelium Baryte, *M.* Tungsten. Scheelite. *L.*

202. *Primary form:* a right square prism, or a square octahedron. *Secondary forms:* similar to figs. 55 and 57, Pl. I.; also the annexed figure; A : A (over a terminal edge)=100° 8′, A : A (over a basal edge)=130° 20′. A : e=140° 4′. *Cleavage* parallel to A perfect, though interrupted by a conchoidal fracture; traces parallel to e. *Compound crystals:* composition parallel to planes truncating the basal angle, or parallel to the lateral faces of a right square prism. *Imperfect crystallizations:* reniform shapes with columnar structure; also granularly massive.



H.=4—4·5. G.=6·076, of a white crystalline variety from Schlaggenwald, as determined by Haidinger. *Lustre* vitreous, inclining to adamantine. *Streak* white. *Color* white, inclining to yellow and brown; sometimes almost orange-yellow. Subtransparent—translucent. *Fracture* uneven. Brittle.

Consists of lime 19·40, and Tungstic Acid 80·417, according to Berzelius. Bucholz and Brandes obtained

	Bucholz.	Brandes, (Schweig. xx. 285.)
Tungstic Acid	78·00	76·50
Lime	19·06	16·50
Oxyd of Iron	——	1·47
Silica	——	2·94
Alumina	——=97·06.	1·09=98·50.

It is infusible alone before the blowpipe, except that the thinnest edges are partially vitrified. With borax, it yields a white glass, whose transparency depends on the quantity of salt employed. When thrown into nitric acid, it becomes yellow, but does not dissolve.

Obs. Tungstate of lime is usually associated with primary rocks, and is commonly found in connection with tin ore, topaz, fluor, apatite, molybdena, or wolfram, in quartz.

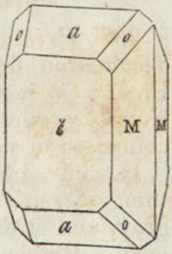
It occurs at Schlackenwald and Zinnwald, in Bohemia; in fine crystals at Caldbeckfell, near Keswick, with apatite, molybdena, and wolfram. Schellgaden, in Salzberg; Harzegerode, in Anhalt; and Cornwall, are other localities of this mineral.

In the United States it is found both crystallized, in the forms above referred to, and massive, at Monroe and Huntington, Conn., at Lane's mine, where it is associated with wolfram, pyrites, rutile, native bismuth, in quartz.

Tungstate of lime has not been employed in the arts. If found in abundance, it would yield a yellow paint, (tungstic acid,) superior in beauty to chrome yellow. Small quantities have been sold by the proprietor of the above mine. This oxyd, or rather acid, occurs native at Monroe, Conn., in a pulverulent or earthy form, filling small cavities in this species, and also wolfram: it was first detected by Prof. Silliman, (Silliman's Amer. Jour. IV. 52.)

WHITE ANTIMONY. Stimmius rhombeicus.

Prismatic Antimony-Baryte, *M.* Oxyd of Antimony. Antimony Bloom. Weiss-Spies Glaserz, *W. Hof.* Spiesglanzweiss, *Haus.* Antimonbluthe, *L.* Antimoine Oxidé, *H.*



203. *Primary form:* a right rhombic prism; M : M=136° 58′. *Secondary form:* rectangular plates, with the lateral edges replaced by planes which are inclined at an angle of 136° 31′; acicular rhombic prism; also the annexed figure; M : $\breve{e}$=111° 58′, *a* : $\breve{e}$=144° 44′, *a* : *a* (adjacent planes) =70° 32′. *Cleavage* highly perfect parallel with M, and easily obtained. *Compound crystals:* composition of the second kind, parallel with $\breve{e}$; the union of thin plates by this kind of composition produces the common forms of this species, which were formerly supposed to be simple forms, and the faces of junction to be the cleavage joints. *Imperfect crystallizations:* structure lamellar, columnar, and granular.

H.=2·5—3. G.=5·566, crystals from Braünsdorf. *Lustre* adamantine, $\breve{e}$ often pearly; shining. *Streak* white. *Color* snow-white, occasionally peach-blossom-red, and ash-gray. Translucent—subtransparent. Sectile.

Composition, according to Vauquelin, Oxyd of Antimony 86, ditto and Iron 3, Silica 8=97. It may therefore be considered, as Thomson remarks, a disilicate of antimony; but another analysis is needed, to determine with certainty its atomic constitution. It fuses in the flame of a candle, and before the blowpipe is entirely volatilized, covering the charcoal with a white coating.

Obs. The tabular crystallizations of this species occur at Przibram, in Bohemia, in small quantities, in veins traversing primitive rocks; and the prismatic have been observed at Braunsdorf, near Freiberg, in Saxony; Malaczka, in Hungary; Allemont, in Dauphiny; and elsewhere in Europe. It is usually associated with other ores of antimony, and also those of lead, together with blende and calcareous spar.

ANTIMONOPHYLLITE.

Breithaupt, Jahresbericht for 1832, p. 202.

204. Crystallized in thin unequiangular six sided prisms, of a grayish-white color. It contains Oxyd of Antimony. Locality unknown.

BISMUTH OCHRE. BISMUTALUS OCHRACEUS.

Oxyd of Bismuth. Wismuthochre, *W*. Bismuth Oxydé, *H*.

205. Crystalline form not observed. Occurs massive and disseminated, pulverulent, earthy; also passing into foliated.

G.=4·3611, Büsson. *Lustre* adamantine—dull, earthy. *Color* greenish-yellow, straw-yellow, grayish-white. *Fracture* conchoidal—earthy.

It contains, according to Lampadius, Oxyd of Bismuth 86·4, Oxyd of Iron 5·1, Carbonic Acid 4·1, Water 3·4=99. Before the blowpipe, on charcoal, it is easily reduced to the metallic state, and subsequently the greater part may be dissipated.

OBS. It occurs pulverulent at Schneeberg, in Saxony; at Joachimstahl, in Bohemia; and with native gold and an ore of bismuth at Beresof, in Siberia.

BISMUTH BLENDE. BISMUTALUS DODECAHEDRUS.

Arsenical Bismuth, *Breit*. Kieselwismuth. Silicate of Bismuth, *Thom*.

206. *Primary form:* according to Breithaupt, the rhombic dodecahedron, fig. 7, Pl. I. *Secondary forms:* figs. 30, 34, and 35, Pl. I. *Cleavage* parallel to the faces of the dodecahedron. It usually occurs in minute crystals, but also presents globular forms, composed of columnar, lamellar, or granular particles.

H.=3·5—4·5. G.=5·912—6·006. *Lustre* resinous, or adamantine. *Streak* yellowish-gray. *Color* dark hair-brown, yellowish-gray, and straw-yellow. Subtransparent—opaque. *Fracture* uneven. Rather brittle.

It consists, according to Hünefield, of

Carbonate of Bismuth	58·8
Arsenic Acid	2·2
Silica	23·8
Arsenate of Cobalt, Copper, and Iron	5·9
Matrix	9·1=99·8.

A careful analysis by Kersten, (Pogg. Ann. xxvii. 81,) obtained the following for its composition:

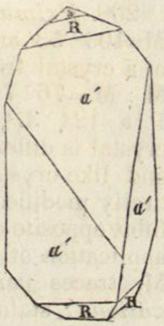
Oxyd of Bismuth	69·38
Silica	22·23
Phosphoric Acid	3·31
Peroxyd of Iron	2·40
Sesquoxyd of Manganese	0·30
Fluoric Acid and Water	1·01=98·6.

Heated in a glass tube, it decrepitates, and affords a trace of water. It fuses before the blowpipe into a dark-yellow mass, and gives out a sublimate destitute of smell. It fuses and froths on charcoal, staining it yellowish-brown, sometimes with a tinge of green. Fuses readily with carbonate of soda, into a button, at first greenish-yellow, and then reddish-yellow. On charcoal, with borax, it is ultimately reduced to the metallic state. With biphosphate of soda, it fuses into a yellow globule, which becomes colorless on cooling.

OBS. This mineral is found in the neighborhood of Schneeberg, in Saxony, in quartz. It was first described by Breithaupt, (Pogg. Ann. 1827, p. 175.)

CALAMINE. Zincalus rhombohedrus.

Rhombohedral Zinc-Baryte, ***M.*** **Zinkspath,** ***L.*** **Carbonate of Zinc.**



207. *Primary form:* an obtuse rhombohedron; R : R=107° 40′. *Secondary forms:* figure of a crystal from Retzbanya, $a' : a'$=113° 31′, and figure of a crystal from Siberia. Primary planes generally curved and rough. *Cleavage* perfect parallel to R. *Imperfect crystallizations:* reniform, botryoidal or stalactitic shapes; also massive, of a granular composition, sometimes impalpable. Occasionally, decomposition produces earthy and friable varieties. It also occurs in crystalline incrustations and as pseudomorphs imitative of crystals of calcareous spar.

H.=5. G=4·334, Smithson,—4·442 Haidinger, who examined a honey-yellow crystallized variety. *Lustre* vitreous, inclining to pearly. *Streak* white. *Color* white, often grayish, greenish, brownish, sometimes green and brown. Subtransparent—translucent. *Fracture* uneven, imperfectly conchoidal. Brittle.

It is composed, according to Smithson, (Nicholson's Jour., vi. 76,) of

	From Somersetshire.	From Derbyshire.
Oxyd of Zinc	35·2	34·8
Carbonic Acid	64·8=100.	65·2=100,

and is, therefore, a simple carbonate of zinc.

It loses its transparency in the blowpipe flame, but does not melt. The carbonic acid is driven off, and oxyd of zinc is obtained or passes off in white flakes. It dissolves with effervescence in nitric acid. It becomes negatively electrified by friction. Calamine is found both in veins and beds, especially in company with galena and blende; also with copper and iron. It usually occurs in calcareous rocks, and is generally associated with electric calamine.

Fine specimens of calamine are obtained in Siberia, one variety has a dark brown color and contains cadmium; another is of a beautiful bright green. Other localities are Dognatzka, and the Bannat of Temeswar, in Hungary; Bleiberg and Raibel, in Carinthia; Altenberg, near Aix la Chapelle. Concentric botryoidal groupes are met with in the Mendip hills, and at Wanlockhead, in Dumfreisshire.

In the United States, calamine is found in great abundance in Jefferson county, Missouri, at a lead mine called Valle's diggings. The Franklin iron mine, of New Jersey, and the Perkiomen lead mine, Pennsylvania, afford it in small quantities. At the Perkiomen mine it only occurs in a pulverulent form, and results from the decomposition of red zinc ore.

Smithson has analyzed a *dicarbonate* of zinc, of which the following is a description.

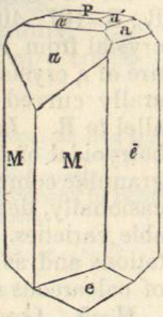
Occurs encrusting other minerals,having much the appearance of chalk. H.=2—2·5. G.=3·58—3·6. *Lustre* dull. *Color* white, grayish or yellowish; opaque. Immersed in water, it absorbs about one third of its weight of that liquid.

It contains Carbonic Acid 13·52, Oxyd of Zinc 69·36, Water 15·10=97·98. Dissipated in the reducing flame with an evolution of an abundance of flowers of zinc, which are deposited on the charcoal.

ELECTRIC CALAMINE. Zincalus peritomus.

Prismatic Zinc-Baryte, *M.* **Siliceous Oxyd of Zinc. Galmei, (in part,). Zink glas,** *Haus.* **Zinc Oxidé Silicifère,** *H.*

208. *Primary form:* a right rhombic prism; M : M=103° 53′ and 76° 7′. *Secondary form:* figure of a crystal from Altenberg, near Aix la Chapelle, M : M=76° 7′, M : ē=141° 46′, P : a′=154° 14′, P : a=124° 37′, P : *a′*=148° 20′, P : *a*=118° 23′. This crystal is differently modified at its two extremities, and like crystals of turmaline, and other hemihedrally modified crystals, its opposite extremities exhibit opposite electricities, either by friction or the application of heat. *Cleavage* perfect parallel to M, traces parallel to P. *Imperfect crystallizations:* stalactitic, mammillated, botryoidal, and fibrous forms; also massive, composition granular.



H.=4·5—5, the latter when crystallized. G=3·434 Smithson; —3·379 Haidinger. *Lustre* vitreous, subpearly on P, sometimes adamantine. *Streak* white. *Color* white; sometimes blue, green, yellow, or brown. Transparent—translucent. *Fracture* uneven. Brittle.

Its constituents are, according to Smithson, (Nicholson's Jour, vi. 78,) and Berzelius, (Kong. Vet. Acad. Handl. 1819, p. 141,) are

			Altenberg.
Silica	25·0	24·893	66·37
Oxyd of Zinc	68·3	66·837	26·23
Water	4·4	7·460	7·40
Carbonic Acid	—	0·450	—
Oxyds of Lead and Tin	—=97.7. S.	0·276=99.916. B.	—=100. B.

When pulverized, it dissolves in heated sulphuric or muriatic acid, and on cooling, the solution gelatinizes. In the blowpipe flame, it decrepitates, loses its transparency, intumesces, and emits a green phosphorescent light. It is infusible alone; but with borax melts into a clear glass, which becomes opaque on cooling. The hemihedral crystals assume polarity when rubbed or heated.

Obs. Electric calamine and calamine, are usually found associated with one another in veins, in calcareous rocks, accompanied by ores of blende, iron, and lead. The localities of this species are the same as given for the preceding. Pseudomorphs, imitative of calcareous spar, are common in Derbyshire, and also at Schemnitz, in Hungary.

WILLEMITE. Zincalus acrotomus.

209. *Primary form:* an obtuse rhombohedron; R : R= about 133°. *Secondary form:* similar to fig. 110. *Cleavage* indistinct at right angles with the vertical axis. Occurs also in reniform masses; also granular—impalpable.

H.=5—5·5. G.=4—4·1. *Lustre* resinous. *Streak* white or yellowish. *Color* yellow, yellowish-brown, reddish-brown. Translucent—opaque.

It is a silicate of zinc, containing a little oxyd of iron.

The following is an analysis, by Dr. Thomson, of a specimen supposed to belong to this species.

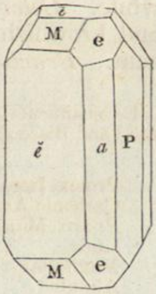
Oxyd of Zinc	68·77
Silica	26·97
Peroxyd of Iron	1·48
Alumina	0·66
Do. with a trace of Zinc and Iron	0·78
Water	1·25=99·91.

It decrepitates before the blowpipe, tinging the flame green, but does not fuse. With nitric or muriatic acid, it forms a jelly.

Obs. It is occasionally met with, associated with calamine, upon the Old Mountain, in Limburg.

HOPEITE. ZINCALUS DIATOMUS.

Brewstcr. Trans. Royal Soc. Edin. X, 107.



210. *Primary form:* a right rhombic prism; M : M=101° 24′ and 78° 36′. *Secondary form:* M : ē=140° 42′, M : ĕ=129° 18′, ĕ : *a*=130° 47′, P : *a*=139° 13′. *Cleavage* parallel with ĕ highly perfect. Plane P striated. It occurs also in reniform masses, and amorphous.

H.=2·5—3. G.=2·76. *Lustre* vitreous; somewhat pearly upon ĕ. *Streak* white. *Color* grayish-white; reddish-brown when compact. Transparent—translucent. Possesses double refraction. Sectile.

It dissolves without effervescence in the muriatic and nitric acids, but is slowly affected by sulphuric acid. It gives out its water of crystallization in the blowpipe flame, and then melts into a clear colorless globule, which tinges the flame green. The globule obtained with borax, remains clear on cooling. With soda, it affords a scoria which is yellow when hot, and gives out copious fumes of zinc and some of cadmium. The fused mineral forms a fine blue glass, with a solution of cobalt. Hopeite appears, therefore, to be a compound of phosphoric acid and zinc, with a small portion of cadmium, and some water.

Obs. It has been observed only in the calamine mines of Altenberg, near Aix la Chapelle. It was first distinguished as a species by Sir David Brewster, and named in honor of Prof. Hope, of Edinburgh.

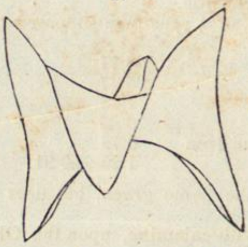
SPATHIC IRON. MARANTALUS RHOMBOHEDRUS.

Brachytypous Parachrose-Baryte, *M.* Carbonate of Iron. Sparry Iron. Brown Spar. Stahlstein. Sphærosiderite. Clay Iron Stone.

211. *Primary form:* an obtuse rhombohedron; R : R=107°. *Secondary forms:* similar to figs. 112, 113, Pl. II.; also 113, with the planes e of 119; e : e=136° 34′.

The faces often occur curved, as in the annexed figures. Fig. 1 is a singular instance of several curvatures arising in part from the compound nature of the crystal. *Cleavage* perfect parallel to R. *Imperfect crystallizations :* botryoidal and globular forms; occasionally in silky fibrous masses ; also of a coarse or impalpably granular structure.

1.



2.

H.=3—4. G.=3·7317—3·829. *Lustre* vitreous—pearly. *Streak* white. *Color* ash-gray, yellowish-gray, greenish-gray, also brown, and brownish-red ; sometimes white. Translucent—subtranslucent. *Fracture* uneven. Brittle.

It constituents are, according to Klaproth, (Beitrage, iv. 110,) Thomson, (Min. i. 445,) and Bischoff, (Ann. des Mines, 2d ser. i. 279.)

	From Dankerode.	Slitt lead mine, Durham.	Var. Sphærosiderite
Protox. Iron	57·50	54·570	52·128
Carbonic Acid	36·00	35·900	32·231
Protox. Mang.	3·50	1·155	——
Lime	1·25	3·176	9·965
Magnesia	——	——	
Alumina	——	——	5·676
Moisture	—— =98·25, K.	2·630=97·431, T.	—— =100, B.

In the blowpipe flame it blackens, giving off carbonic acid, and ultimately an oxyd of iron is obtained, which is attractable by the magnet. Alone, it is infusible. It colors borax green. It dissolves with difficulty in nitric acid, and scarcely effervesces, unless previously pulverized. Exposure to the atmosphere darkens its color, rendering it often of a blackish-brown, or brownish-red color.

Obs. Sparry iron occurs in several of the rock strata, in gneiss, mica-slate, graywacke, and in connection with coal formations. It is often associated with metallic ores. At Freiberg it occurs in silver veins. In Cornwall it accompanies tin. It is also found accompanying copper and iron pyrites, galena, vitreous copper, &c. Occasionally it is to be met with in trap rocks.

In the region in and about Styria and Carinthia, this ore forms coherent tracts in gneiss, which extend along the chain of the Alps, on one side into Austria, and on the other into Saltzburg. At Harzgerode, in the Hartz, it occurs in fine crystals in gray-wacke ; also in Cornwall, Alston Moor, and Devonshire.

The *Sphærosiderite* variety has a spheroidal form and radiated structure ; it occurs at Hanau, where it occupies cavities in greenstone. Clay iron stone, which is a mixture of carbonate of iron and clay, occurs in the coal beds in the neighborhood of Glasgow ; also at Mouillar, Magescote, &c., in France.

At Roxbury, Conn., a vein of considerable size occurs in a vein of quartz, which traverses a stratum of gneiss for the distance of a mile. It is also obtained in considerable quantities at Plymouth, Vt. In small quantities it occurs at Monroe, Conn., in Lane's mine.

This ore is employed very extensively for the manufacture of iron and steel. On the Styrian bed, at the celebrated Erzberg, between Eisenerz and Vordenberg, 1200 men are constantly employed. The beds which occur in the coal formation in England, supply all the ore requisite for the immense quantity of iron annually smelted in Great Britain.

JUNKERITE. MARANTALUS RHOMBICUS.

Dufrénoy. Ann. de Chim. et de Phys. LVI. 198.

212. *Primary form:* a right rhombic prism; M : M=108° 26′. *Secondary form:* a rectangular octahedron similar to fig. 89, Pl. II., with curved faces. *Cleavage* parallel with the lateral planes; highly perfect.

H.=3·5. G.=3·815. *Lustre* of external surface rather dull; of cleavage face, brilliant. *Color* yellowish-gray.

It contains, according to Dufrénoy,

Protoxyd of Iron	53·6	47·9
Carbonic Acid	33·5	30·0
Silica	8·1	16·8
Magnesia	3·7=98·9	3·9=98·6.

Before the blowpipe, with borax, it fuses into a yellowish-green glass, which becomes brown when the proportion of Junkerite is small.

OBS. This species appears to be identical in composition with spathic iron, and if so, carbonate of iron, like carbonate of lime, must rank among the dimorphous substances.

It has been found covering the surface of small quartz veins, which traverse the gray-wacke at the mine of Poullaouen, in a gallery of research. It was first observed by M. Paillette, sub-director of the mine, who named it in honor of the director, M. Junker.

DIALLOGITE. MARANTALUS DECREPITANS.

Macrotypous Parachrose-Baryte, *M.* Carbonate of Manganese. Rhodochrosite, and, (when mixed with Silicate of Manganese,) Allagite, Photizite, Rhodonite.

213. *Primary form:* an obtuse rhombohedron; R : R=105° 51′. *Secondary form:* similar to fig. 119, Pl. II. *Cleavage* parallel to R. *Imperfect crystallizations:* globular and botryoidal forms, having a columnar structure; sometimes indistinct. Also granular varieties, occasionally of an impalpable structure.

H.=3·5. G.=3·592. var. from Kapnik. *Lustre* vitreous, inclining to pearly. *Streak* white. *Color* various shades of rose-red; brownish. Translucent—subtranslucent. *Fracture* uneven. Brittle.

It is composed of

		From Nagyag.
Oxyd of Manganese	54·60	56·00
Carbonic Acid	33·75	38·60
Oxyd of Iron	1·87	——
Silica	4·37	——
Lime	2·50=97·09, Du Menil.	5·40=100, Berthier.

The action of the blowpipe changes the color to gray, brown, and black, and produces a strong decrepitation. It is infusible *per se.* With glass of borax it fuses readily into a violet-blue bead. It effervesces strongly with nitric acid. On exposure to the air, its color is changed to a brown. Some bright rose-red varieties become paler.

Obs. Diallogite occurs commonly in veins along with ores of silver, lead, and copper; it is said to have been found also in transition mountains with other ores of manganese.

It is not uncommon in the Saxon mines; it occurs also at Nagyag and Kapnik, in Transylvania, near Ellingerode in the Hartz, &c.

Breithaupt has separated from this species the ore from Kapnik, which contains, according to Berthier, (mechanical mixture in part?) 21 per cent. of Silica, 30·4 of Carbonic Acid, 41 of Protoxyd of Manganese, and 4·3 of Lime. Its Hardness he states to be 4·5—5. G.=3·592.

TRIPLITE. Marantalus quadratus.

214. Imperfectly crystalline. Cleavage in three directions perpendicular to each other; one the most distinct.

H.=5—5·5. G.=3·439—3·775. *Lustre* resinous, inclining to adamantine. *Streak* yellowish-gray. *Color* blackish-brown. Subtranslucent—opaque. *Fracture* small conchoidal.

According to Vauquelin's analysis, it consists of Oxyd of Iron 31, Oxyd of Manganese 42, and Phosphoric Acid 27.

Before the blowpipe it fuses easily into a black scoria. It dissolves readily in nitric acid, without effervescence.

Obs. It occurs at Limoges, in France, in a vein of quartz in granite, accompanied by apatite.

In the United States it is met with in considerable abundance, at Washington, Conn., where its situation is similar to that at Limoges. It is associated with pulverulent diallogite. It is found in small quantities accompanying spodumene, at Sterling, Mass.

HETEPOZITE. Marantalus Frencei.

Ann. of Phil. 1831. Ann. de Chim. XXX. 294.

215. *Primary form:* an oblique rhombic prism; occurs massive. *Cleavage* parallel with the faces of an oblique rhombic prism.

H. about 6. G. when fresh 3·52, after exposure 3·39. *Lustre* resinous, like that of apatite. *Color* greenish-gray or bluish; becomes violet after long exposure, and its lustre is changed to submetallic.

It contains, according to Dufrénoy, (Ann. de Ch. et de Ph. xli. 442,)

Phosphoric Acid	41·77
Oxyd of Iron	34·89
Red Oxyd of Manganese	17·57
Silica	0·22
Loss by Heat	4·40=98·85.

It dissolves in acids, excepting its silica. Before the blowpipe it yields by fusion a brown enamel, of a submetallic lustre.

Obs. It is met with at Thoreaux, in the Haute Vienne. It was first observed and described by Dufrénoy.

HURAULITE. Marantalus fusilis.

Vauquelin, Ann. de Chim. et de Ph. XXX. 302, and *Dufrénoy*, XLI. 338.

316. *Primary form:* an oblique rhombic prism; M : M=117° 30′, and 62° 30′. *Secondary form:* the primary, with the lateral solid angles deeply replaced. *Cleavage* none.

H. above 3. G.=2·27. *Lustre* vitreous. *Color* reddish-yellow, a little lighter than the color of hyacinth. Transparent.

It contains, according to Dufrénoy, Phosphoric Acid 38, Oxyd of Iron 11·1, Oxyd of Manganese 32·85, Water 18=99·95. It is very fusible. Before the blowpipe it melts into a black button, having a metallic lustre; heated in a glass tube, it affords some water.

Obs. It occurs in minute crystals, occupying small veins in granite, near Limoges, in the Commune of Hureaux, whence its name. It is associated with a fibrous phosphate of iron.

It resembles zircon in color, but is readily distinguished by the irregular form of its crystals and its inferior hardness.

CUBE ORE. Arealus cubicus.

Hexahedral Lirocone Malachite, *M.* Hexahedral Olivenite, *J.* Pharmakosiderit, *Haus.* Wurfelerz, *W.* Fer Arseniaté, *H.*

217. *Primary form:* the cube. *Secondary forms:* figs. 28, 33, also 28 and 5 combined, Pl. I. *Cleavage* parallel with the primary faces imperfect. P sometimes striated parallel to its edge of intersection, (fig. 28,) with a. Faces on the angles often curved. It occurs rarely massive; composition granular.

H.=2·5. G.=3. *Lustre* adamantine, not very distinct. *Streak* olive-green—brown, commonly pale. *Color* olive-green, passing into yellowish-brown, bordering sometimes upon hyacinth-red, and blackish-brown; also into grass-green, and emerald-green. Subtranslucent. Rather sectile.

According to Berzelius, (Kong. Vet. Acad. Handl. 1824, p. 354,) it is composed of

Arsenic Acid	37·28
Peroxyd of Iron	39·20
Water	18·61
Phosphoric Acid	2·53
Oxyd of Copper	0·65
Insoluble Matter	1·76=99·93.

Exposed to a gentle heat, it becomes of a red color; a higher temperature causes intumescence, but drives off little or no arsenic, and leaves a red powder. Copious arsenical fumes are emitted, when supported on charcoal before the blowpipe, and a metallic scoria is obtained in the reducing flame, which acts on the magnetic needle.

Obs. Cube ore is obtained at the mines of Huel Gorlan, Huel Unity, and Carharrak, in Cornwall, coating cavities in quartz, and associated with several of the ores of copper: also at St. Leonhard, in France; at Schneeburg and Schwarzenburg, in Saxony.

The iron sinter of Freiberg is closely allied to this species. It occurs of a yellowish-gray color, in reniform masses, soft, approaching to friable, coarse, earthy fracture, and adhering strongly to the tongue. Its constituents, according to Kersten's analysis, (Schweigger's Jahrbuch, xxiii. 176,) are,

Arsenic Acid	30·25
Peroxyd of Iron	40·45
Water, with trace of Sulphuric Acid,	28·50=99·20

ARSENATE OF IRON.

218. Massive. Usually in small porous masses, irregularly crystallized. Berzelius states that he has observed right square prisms, terminated by four sided pyramids. *Color* pale. *Streak* white.

It contains, according to Berzelius and Boussingault,

Arsenic Acid	50·78	49·6
Peroxyd of Iron	34·85	34·3
Oxyd of Lead	——	0·4
Arsenate of Alumina	0·67	——
Water	15·55=101·85, Berz.	16·9=101·2, Bouss.

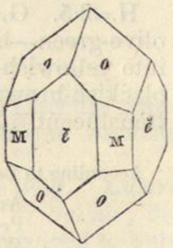
If heated in a glass tube, it gives out water, without an evolution of arsenous acid. Before the blowpipe, it becomes yellow, without altering its form.

Obs. It occurs at Antonia Pareira, Villa Rica, in Brazil, in small quantities in a silicious perhydrate of iron; also at Loaysa, near Marmato, in Popayan.

SCORODITE. Arealus trimetricus.

Dystomic Fluor-Haloide, *Haid.* Skorodite. Martial Arseniate of Copper, *P.* Cuprous Arseniate of Iron, *Bournon.* Skorodit, *Breit.*

219. *Primary form:* a right rhombic prism; M : M=119° 2′. *Secondary form:* M : ē=149° 31′. *o* : *o*=115° 6′ and 102° 1′. *Cleavage* indistinct parallel with M and ē.



H.=3·5—4. G.=3·163—3·3, Haidinger. *Lustre* vitreous—sub-adamantine. *Streak* white. *Color* pale-leek-green, or liver-brown. Subtransparent—translucent. *Fracture* uneven.

It contains, according to Chenevix, (Phil. Trans., 1801, pp. 191, 218,) and Ficinus, (Schweigger's Jahrbuch, iv. 198,)

Arsenous Acid	33·5		31·40
Oxyd of Copper	22·5	Protox. Mang.	4·00
Oxyd of Iron	27·5		36·25
Water	12·0		18·00
Silica	3·0	Sulphuric Acid	1·54
Lime	——		2·00
Magnesia	——		2·00
Gangue	——=98·5, C.		1·40=96·59, F.

It gives out an alliaceous odor before the blowpipe, and fuses into a reddish-brown scoria, which acts upon the magnet, when all the arsenic is expelled.

Obs. A brown-colored variety occurs in the primitive mountains of Schwarzenberg, in Saxony, associated with arsenical pyrites, and at Löling, near Huttenberg, in Carinthia, with leucopyrite. A leek-green scorodite is found in the Cornish mines, coating cavities of ferruginous quartz. Minas Geraes, in Brazil, have afforded some fine specimens.

The name of this species is derived from σκοροδον, *garlic*, and was applied because of its odor under the blowpipe.

CHENOCOPROLITE. AREALUS ARGENTIFERUS.

Gansekothig-Erz *of the Germans.*

220. Mammilated.

H.=2—3. *Lustre* resinous. *Streak* white. *Color* yellow, or pale-green. Translucent. *Fracture* conchoidal.

Before the blowpipe, it evolves copious arsenical fumes, and fuses into a blackish scoria; when the heat is continued on charcoal, it fuses and yields a button of silver, but the slag contains metallic iron, which strongly affects the magnet. Chencoprolite appears, therefore, to be an arsenate of silver and iron.

OBS. The principal localities of this species are in the Hartz, at the mines of Clausthal. It is also found in Cornwall, and at Allemont in Dauphiny. When abundant, it is highly valued as an ore of silver.

Chenocoprolite is a translation of the German name, which was given it in allusion to its peculiar color and general appearance.

TRIPHYLINE. AREALUS RHOMBICUS.

221. *Primary form:* a right rhombic prism; M : M=about 132°. *Cleavage* parallel with P perfect; parallel with M and one of the diagonals, imperfect, the latter the least so. Occurs commonly massive.

H.=5. G.=3·6. *Streak* grayish-white. *Color* greenish-gray; also bluish. Translucent in thin fragments.

It contains, according to Fuchs, (Erdmann und Schweigger-Seidel Journ. für Chem. iii. 98,) Phosphoric Acid 41·47, Protoxyd of Iron 48·57, Protoxyd of Manganese 4·7, Lithium 3·4, Silica 0·53, Water 0·68=99·35. It fuses easily before the blowpipe, and loses 0·68 per cent. of water at a red heat. It dissolves readily in borax, and affords a green glass. It is soluble in the acids.

OBS. It occurs in large quantities at Bodenmais. It was first described by Fuchs, and named from τρις *three*, and φυλη, *family*, in allusion to its containing three phosphates.

A similar compound from Keiti, in Finland, has been analyzed by Nordenskiold, and named *Tetraphyline*. It differs in physical characters from the preceding, in presenting a yellow color on its surface of fresh fracture, which by degrees becomes black. The following analysis exhibits its peculiarities in composition: Phosphoric Acid 42·6, Protoxyd of Iron 38·6, Protoxyd of Manganese 12·1, Magnesia 1·7, Lithia 8·2=103·2; the excess is supposed to be owing to an incorrect determination of the quantity of lithia.

CACOXENITE. AREALUS RADIATUS.

Kakoxene, *Steinmann.*

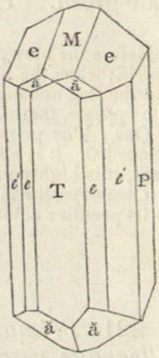
222. Occurs in minute fibres, diverging from a point.

H.=3—4. G.=3·38. *Lustre* silky. *Streak* yellowish. *Color* yellowish-brown.

Obs. It is found at Hrbeck, near Zbirow, in Bohemia, disposed on brown iron ore. It might readily be mistaken for Carpholite, which is found in similar situations, from which it differs in its deeper color. The word Cacoxenite is derived from κακος, *bad*, ξενος, *guest*, in allusion to the injurious effects of the phosphoric acid it contains on the iron extracted from the ore.

VIVIANITE. Arealus rhomboideus.

Prismatic-Iron, Mica, *M.* Dichromatic Euclas-Mica, *Haid.* Phosphate of Iron. Blue Iron Earth. Blaue Eisenerde, *Wern.* Fer Phosphaté, *H.*



223. *Primary form* :a right rhomboidal prism; M : T = 125° 18′. *Secondary form :* P : *e*′ = 125° 56′, T : *e*=165° 25′, M : e=150° 30′, M : *e*= 117° 40′, T : ă=125° 25′, Phillips. Surface P smooth, others striated. *Cleavage* highly perfect parallel with P, traces in other directions. *Imperfect crystallizations :* reniform and globular; also in light particles, forming superficial coatings.

H.=1·5—2. G=2·661. *Lustre* pearly, metallic-pearly on P. The other faces exhibit a vitreous lustre. *Streak* bluish-white, soon changing to indigo blue. The color of the powder, obtained by pulverizing the dry mineral, is liver-brown. *Color* various shades of blue and green; deepens by exposure. It is usually green at right angles with the vertical axes, and blue parallel to it. The two colors mingled, produce the dirty-blue color which the mineral ordinarily presents. Transparent—translucent; opaque on exposure. *Fracture* not observable. Thin laminæ perfectly flexible. Sectile.

It contains, according to Vögel and Stromeyer, (Untersuchungen, p. 274,)

	Bodenmais.	Cornwall.
Protoxyd of Iron	41·0	42·38
Phosphoric Acid	26·4	28·69
Water	31·0=98·4, V.	28·93=100, S.

It decrepitates in the blowpipe flame, and immediately loses its color and becomes opaque; if pulverized, it fuses into a dark brown or black scoria, which affects the magnetic needle. Heated in a glass tube, it yields a considerable quantity of pure water. It dissolves in dilute nitric and sulphuric acids.

Obs. It occurs associated with magnetic and common iron pyrites in copper and tin veins; also in narrow veins with gold, traversing gray-wacke; occasionally, it is met with in trap rocks. The friable varieties occur in clay, and are sometimes associated with bog iron ore.

Near St. Agnes, in Cornwall, transparent crystals of an indigo color, have been found an inch in diameter and two in length, disposed on magnetic pyrites. Bodenmais, and the gold mines of Vöröspatak, in Transylvania, afford crystalline specimens. On the promontory of Kertz, in the Black Sea, it has been found in large indistinct crystals, occupying the interior of shells. The earthy variety, which is sometimes known under the name of *blue iron* or *native Prussian blue*, occurs in Greenland, Stiria, Carinthia, Cornwall, &c. The friable varieties have been discovered in bog iron ore in several peat swamps, in the Shetland Isles; at Ballagh, in the Isle of Man, accompanied with animal matter, particularly the horns of elk and deer. It has also been met with in a soft friable clay near an old slaughter house, which was removed for the foundation of the west bridge at the foot of the Castle rock, Edinburgh, indicating no very remote origin.

Fine translucent crystals of Vivianite, presenting a dark blue color, are met with at Imleytown, New Jersey.

At Allentown, Monmouth Co., N. J., it occurs in considerable abundance, both crystallized in nodules and earthy, imbedded in bog iron ore, and associated with clays. It often fills the interior of belemnites and gryphites, in the ferruginous sand formation.

The *blue iron earth*, or earthy variety of this species, contains

	Klaproth, (Beit. iv. 120.)	Brandes, (Schweig. Jahrb. i. 97.)
Phosphoric Acid	32·0	30·320
Protoxyd of Iron	47·5	43·775
Water	20·0	25·000
Alumina	——	0·700
Silica	——=99·5.	0·025=99·820.

Its color is at first grayish-white, but becomes blue on exposure to the air: it soils slightly, and has a somewhat harsh feel.

ANGLARITE. Arealus divergens.

Ann. des Mines, XII. 303. Mullicite, *Thomson*, Min. I. 453. Diphosphate of Iron.

224. In fibrous masses and radiating needles; also in cylindrical masses, consisting of a congeries of small needle-form crystals, radiating from the centre of the cylinder.

G.=1·787, Thomson; the variety from Gloucester Co., N. J. *Lustre* vitreous. *Streak* lighter than the color. *Color*, gray, bluish, bluish-black, brown. Translucent—opaque.

It contains, according to Thomson, Vauquelin, and Berthier,

	Mullica Hill.	Haute Vienne.	Anglar.
Phosphoric Acid	24·00	24·8	28·82
Protoxyd of Iron	42·65	51·0	56·67
Water	25·00	15·0	14.51
Protoxyd of Manganese	——	9·0	——
Grains of sand	7·90=99·55, T.	——=99·8, V.	——=100, B.

It fuses before the blowpipe into a black globule. In the matrass, it yields water.

Obs. This species occurs at Anglar, in the Haute Vienne; also at Mullica Hill, Gloucester Co., N. J., in bluish-black cylindrical masses, composed of divergent fibres or acicular crystals.

CARPHOSIDERITE.

Karphosiderite, *Breithaupt*. Brewster's Journal. VIII. 181.

225. In reniform masses.

H.=4—4·5. G.=2·5. *Lustre* resinous. *Streak* unchanged, glimmering. *Color* pale and deep straw-yellow. *Feel* greasy.

It contains Oxyd of Iron, Phosphoric Acid, and Water, with small quantities of Manganese and Zinc. It dissolves readily in borax, and fuses with biphosphate of soda into a black scoria.

Obs. This species was first distinguished by Breithaupt, among some Greenland specimens. It resembles oxalate of iron. Its name alludes to its straw-yellow color.

PYROSMALITE. AREALUS RHOMBOHEDRUS.

Pyrodmalit, *L.* Fer muriatè, *H.* Hexagonal Pyrosmalite-Mica, *Breit.*

226. *Primary form:* a rhombohedron. *Secondary form:* a hexagonal prism, fig. 114, Pl. II., also the same solid with the alternate terminal edges replaced. *Cleavage* perfect, perpendicular to the vertical axis. It also occurs massive.

H.=4—4·5. G.=3·81, Hisinger. *Lustre* of a, the terminal face of the hexagonal prism, pearly; of other planes, less so. *Streak* paler than the color. *Color* pale liver-brown, passing into gray and pistachio-green; usually brown externally, and light-greenish-yellow internally. *Fracture* uneven, rather splintery. Somewhat brittle.

According to Hisinger and Berzelius, (Afhand. iv. 317,) it consists of

Silica	35·850
Peroxyd of Iron	35·480
Sesquoxyd of Iron	23·444
Chlorine	3·760
Water	3.600
Lime	1·210=103·344.

It becomes reddish-brown in the blowpipe flame, and emits copious fumes of muriatic acid. In a strong heat it fuses into a black slag, which at last becomes a round globule, attractable by the magnet. With borax it fuses readily, and presents the appearances characteristic of iron and manganese. It dissolves in muriatic acid, leaving a small residuum of silica.

OBS. Pyrosmalite has been found only at Bjelkegruvan, one of the iron mines of Nordmark, in Wermeland, Sweden, where it is associated with calc spar, pyroxene, apophyllite, and magnetic iron. A crystal from this locality, in the museum at Stockholm, is nearly an inch in diameter and one and a quarter inches long, and weighs five and a half ounces; its form is a six-sided prism. The other secondary form given above, is presented by a crystal in the cabinet of Mr. Heyer, of Dresden.

CRONSTEDTITE. AREALUS FOLIACEUS.

Rhombohedral Melane-Mica, *M.* Cronstedtite, *Steinmann.* Hydrous Silicate of Iron, *Thom.*

227. *Primary form:* a rhombohedron. Occurs in hexagonal prisms, tapering towards their summit, or adhering laterally; also in diverging groups, reniform, and amorphous. *Cleavage* highly perfect, parallel to a, or the base of the prism.

H.=2·5. G.=3·348. *Lustre* brilliantly vitreous. *Streak* dark leek-green. *Color* brownish-black. Opaque. Not brittle. Thin laminæ elastic.

Steinmann, (Schweigger's Jahrbuch, ii. 69,) obtained for its composition,

	Var. Cronstedtite.	
Silica	22·452	22·83
Protoxyd of Iron	58·853	57·61
Water	10·700	10·70
Protoxyd of Mang.	2·885	3·82
Magnesia	5·078=99·968, S.	3·25=98·21, S.

Before the blowpipe it froths a little, but does not melt. With borax it affords a hard black opaque bead. When in the state of powder, it gelatinizes in concentrated muriatic acid.

Obs. It accompanies hydrate of iron and calc spar, in veins containing silver ores, at Przibram, in Bohemia. It occurs also at Wheal Maudlin, in Cornwall, in diverging groups; also with quartz and magnetic pyrites, at the mines of Conghonas do Campo, in Brazil.

CHLOROPAL.

Bernhardi and *Brandes*, Schweigger's Jahrbuch, V. 29.

228. Massive; structure impalpably granular; earthy.

H.=3—4. G.=1·727—1·870; earthy varieties, the second a conchoidal specimen; 2·105, Thomson, a Ceylon chloropal. *Color* greenish-yellow and pistachio-green. Opaque—subtransparent. Fragile. *Fracture* conchoidal and splintery.

It contains, according to Bernhardi, Brandes, and Thomson, (Min. i. 464.)

	Hungary.	Hungary.	Ceylon.
Silica	46	45·00	53·00
Protoxyd of Iron	33	32·00	Peroxyd 26·04
Magnesia	2	2·00	1·40
Alumina	1	0·75	1·80
Water	18=100, B. & B.	20·00=99·75, B. & B.	18·00=100·24, T.

Infusible before the blowpipe, but blackened and rendered opaque. With carbonate of soda it forms a clear glass, exhibiting some red points. With borax it fuses into a clear glass, having no red points.

Obs. The mineral analyzed by Thomson, differs essentially from the specimens from Unghwarin, Hungary. The latter are described as breaking readily into a kind of parallelopiped, the upper end and two adjoining lateral edges of which, have the opposite magnetic pole from the lower end and the other two edges. The Ceylon variety appeared to Thomson to be destitute of this peculiarity.

Closely allied to this species is the *green iron earth*, Grune Eisenerde, of Werner. It occurs in reniform, botryoidal, and globular masses, presenting an impalpably granular structure. *Lustre* resinous. *Streak* yellowish-gray. *Color* siskin-green, passing into black and yellow. Brittle. It becomes brown and black before the blowpipe, but does not melt: it is not dissolved in nitric acid. It has been observed at Schneeberg, in Saxony, and in the Hollerterzing, in the county of Sayn.

SIDEROSCHISOLITE.

Wernekingk. Poggendorf's Annalen, I. 387. Chamoisite, *Berthier*, Ann. des Mines, V. 393. Hydrous Disilicate of Iron, *Thomson.*

229. In very minute crystals; also massive.

H.=2—3. G.=3—3·4. *Lustre* splendent; sometimes earthy, when massive. *Streak* leek-green, greenish-gray. *Color* pure velvet-black when crystallized; dark-greenish-gray. Opaque.

According to Wernekingk and Berthier, the crystallized and massive varieties contain,

	Sideroschisolite.	Chamoisite.
Silica	16·3	12·0
Protoxyd of Iron	75·5	50·5
Alumina	4·1	6·6
Water	7·3	14·7
Carbonate of Lime	——	14·4
Carbonate of Magnesia	—— =103·2, W.	1·2 =99·4, B.

These varieties are therefore each a *hydrous disilicate of iron*, and differ only in the proportion of water. Heated, it at first becomes black and magnetic; afterwards it changes to an ochre-red. In a glass tube, water is evolved. It forms a jelly with muriatic acid. The massive variety, Chamoisite, effervesces with acids, on account of the carbonate of lime with which it is mixed. The solution obtained with the crystalline variety, sideroschisolite, is greenish-yellow.

Obs. Crystallized specimens occur in cavities of magnetic pyrites and sparry iron ore in small crystals, at Conghonas do Campo, in Brazil. Chamoisite occurs in beds of small extent, in a limestone mountain, abounding in ammonites, at Chamoisin, in the Valais.

NONTRONITE.

Ann. de Ch. XXXVI. *Berthier.*

230. Structure like clay. *Color* pale-straw or canary-yellow, greenish. Opaque. *Feel* unctuous; tender. Affords an odor, when breathed on. Flattens and grows lumpy under the pestle. Polished by friction.

It contains Silica 44, Peroxyd of Iron 29, Alumina 3·6, Magnesia 2·1, Water 18·7, Clay 1·2. Immersed in water, it disengages air, becomes subtranslucent, and increases in weight. Slightly heated, it loses its water, and assumes the color of red oxyd of iron. It is readily acted on by muriatic acid, and, in part, is gelatinized. Calcined, it becomes sensibly magnetic.

Obs. Occurs in reniform masses, seldom larger than the fist, among the manganese, in the arrondissement of Nontron, in France.

Closely allied to this species, is the *Pinguite* of Leonhard, of which the following is a description:

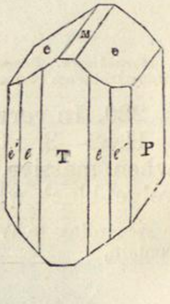
Massive. *Lustre* slightly resinous. *Streak* lighter than the color. *Color* siskin and oil-green. Does not adhere to the tongue, and emits a feeble argillaceous odor when struck. Extremely soft, resembling new made soap.

It contains, according to Kersten, Silica 36·9, Oxyd of Iron 35·6, Alumina 1·8, Magnesia 0·45, Oxyd of Manganese 0·14, Water 25·10.

COBALT BLOOM. Cobaltalus rubellus.

Prismatic Cobalt-Mica, *M.* Diatomous Euclas-Haloide, *Haid.* Prismatic Red Cobalt, *J.* Red Cobalt Ochre. Arseniate of Cobalt. Cobalt Mica. Diarseniate of Cobalt, *Thom.* Cobalt bluthe, *Haus.* Cobalt Arseniaté, *H.*

231. *Primary form:* a right rhomboidal prism; M : T=124° 51′. *Secondary form:* a crystal from Schneeberg; M : e=149° 12′, e : e=118° 23, T : *e*=155° 5′, T : *e′*=127° 6′, *e* : *e*=130° 10′, *e′* : *e′*=94° 12′. Surface P and T vertically striated. *Cleavage* parallel to P highly perfect, scarcely visible parallel to M and T. Perfect crystals of this mineral are always very minute. The imperfectly crystalline varieties present globular and reniform shapes, having a drusy surface, and a columnar structure; the columnar particles are sometimes stellularly divergent, and thus compose a granu-



lar variety. It also occurs as a powder coating other minerals, and then constitutes what is sometimes called *cobalt crust*.

H.=1·5—2; the lowest degree upon P. G.=2·948. *Lustre* of P pearly, especially of the cleavage face; of other faces, adamantine, inclining to vitreous. When it is an incrustation on other substances, its lustre is commonly dull and earthy. *Streak* a little paler than the color. *Color* crimson, and peach-blossom-red, sometimes pearl-gray, or greenish-gray. The red tints incline to blue, if seen in a direction perpendicular to P. The powder of the dry pulverized mineral has a deep lavender-blue tinge, which is not the case when crushed in water. Transparent—subtranslucent. *Fracture* not observable. Thin laminæ flexible in one direction Sectile.

According to Bucholz, (Gehlen's Journ. 2d ser. ix. 314,) cobalt bloom contains Arsenic Acid 37·9, Oxyd of Cobalt 39·2, Water 22·9. Darkens *per se* in the blowpipe flame, and emits copious arsenical fumes; in the reducing flame, it fuses into a globule of arsenid of cobalt. With borax, and other fluxes, it yields a fine blue glass.

Obs. It occurs at Schneeberg, in Saxony, in micaceous scales, stellularly aggregated. Brilliant specimens, consisting of minute aggregated crystals, are met with at Saalfield, in Thuringia; and at Riegelsdorf, in Hessia. The earthy peach-blossom varieties have been observed in Dauphiny; in Cornwall; at the lead mine of Tyne Bottom, near Alston, in Cumberland. A perfectly green variety occurs at Platten, in Bohemia, and sometimes red and green tinges have been observed on the same crystal.

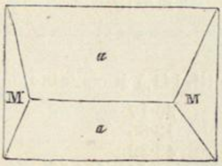
Cobalt bloom, when abundant, is valuable for the manufacture of smalt. This species resembles red antimony, and capillary red copper ore. From both of these minerals, however, the effects under the blowpipe readily distinguish it. Moreover, the color of the former is more sombre, of the latter, more brilliant than cobalt bloom.

WHITE LEAD. Cronalus rhombicus.

Diprismatic Lead-Baryte, *M.* White Lead Ore. Blei Erde, *Wern.*

232. *Primary form:* a right rhombic prism; M : M=117° 13′, and 62° 47′. *Secondary forms:* both from Johangeorgenstadt.

1



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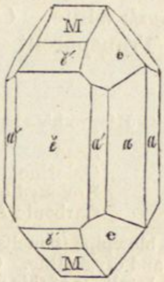


M : $\breve{e}$=120° 24′. M : $\breve{e}'$=150°, $a : a$=140° 15′, and 39° 45′, $\breve{e} : a'$=

145° 20′, ĕ : a=109° 53′. *Cleavage* parallel to M often perfect. *Compound crystals:* several of these forms are figured in Pl. IV., and have already been fully described in § 76. *Imperfect crystallizations:* rarely fibrous; frequently granularly massive and impalpable.

H.=3—3·5. G.=6·465—6·480. *Lustre* adamantine, inclining to vitreous or resinous; sometimes pearly. The former is sometimes metallic, if the colors are dark. *Streak* white. *Color* white, gray, grayish-black, sometimes tinged blue or green by some of the salts of copper. Transparent—subtranslucent. *Fracture* conchoidal. Very brittle.

Its composition is as follows:

	Leadhills.
Carbonic Acid	16·00
Protoxyd of Lead	82·00
Water	2·00=100, Klaproth.

Before the blowpipe, it decrepitates, becomes yellow, then red, and finally, with care, a globule of lead may be obtained. It dissolves readily, and with effervescence in dilute nitric acid.

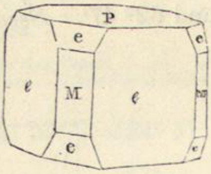
Obs. Leadhills and Wanlockhead are among the finest localities of this mineral. At these places it occurs with other ores of lead in transition slate. Beautiful crystals are met with at Johangeorgenstadt; at Nertchinsk and Beresof, in Siberia; near Bonn, on the Rhine; at Clausthal, in the Hartz; at Bleiberg, in Carinthia; and at Mies and Przibram, in Bohemia. In England, it has been observed at Alston Moor, Keswick, and particularly in Cornwall, where, in the mine of St. Minvers, it occurs in exceedingly delicate crystals. Opaque pseudonomorphs, imitative of crystals of Anglesite have been met with at Leadhills.

Fine crystals have been obtained at the Perkiomen lead mines, near Philadelphia. It also occurs at Valle's Diggings, Jefferson Co., Missouri, and in small quantities, principally as an incrustation, at Southampton, Mass. The lead mines of St. Lawrence Co., N. Y., contain much of this ore, where it has been formed by a decomposition of the galena; it has not been observed there in a crystalline state.

CORNEOUS LEAD. Cronalus quadratus.

Brachytypous Lead-Baryte, *M.* Murio-Carbonate of Lead. Chloro-Carbonate of Lead, *Themson.*

233. *Primary form*: a right square prism. *Secondary forms:* similar to figs. 53 and 61, Pl. I.; and also combinations of the two. M : e=135°; also the annexed figure. *Cleavage* parallel to M.



H.=2·75—3. G.=6—6·1. *Lustre* adamantine. *Streak* white. *Color* white, gray, and yellow. Transparent—translucent. Rather sectile.

According to Klaproth's analysis, (Beitrage iii. 141,) it contains

Lead	39·17
Chlorine	13·56
Protoxyd of Lead	43·32
Carbonic Acid	8·51=104·56

Before the blowpipe it melts readily into a yellow globule, which on cooling becomes white and crystalline. On charcoal, lead is obtained.

Obs. The localities of this rare mineral are Matlock, in Derbyshire; Hausbaden, near Badenweiller, in Germany; also Southampton, Mass., in the United States. At each of these localities, it accompanies other ores of lead.

COTUNNITE. CRONALUS VESUVIANUS.

Cotunnia, *Monticelli*. Cotunnite, *Von Kobell*. Chlorid of Lead, *Thomson*.

234. In acicular crystals.

May be scratched by the nail. *Lustre* adamantine; inclining to silky or pearly. *Streak* white. *Color* white.

According to Berzelius, it contains Chlorine 25·48, and Lead 74·52, and is, therefore, a simple Chlorid of Lead.

It fuses readily in the flame of the blowpipe and colors the flame blue, giving off white vapors, which condense on the charcoal. With carbonate of soda it yields a globule of lead. It dissolves in about 27 times its weight of cold water.

OBS. This mineral was observed by Monticelli and Covelli, in the crater of Mount Vesuvius, after the eruption of 1822. It was accompanied with chlorid of sodium, and chlorid and sulphate of copper. It was named in honor of a distinguished medical man at Naples.

CERASITE. CRONALUS PERITOMUS.

Peritomous Lead-Baryte, *M*. Muriate of Lead. Dichlorid of Lead. Berzelite, *Levy*. Kerasite.

235. *Primary form:* a right rhombic prism; M : M=102° 27′. It occurs in masses, having a columnar structure, often radiated, and admitting of a highly perfect cleavage parallel to M.

H.=2·5—3. G.=7—7·1. *Lustre* pearly upon cleavage faces. *Streak* white. *Color* white, with a tinge of yellow or red. Feebly translucent—opaque.

It is composed, according to Berzelius, of

Lead	83·2
Chlorine	13·77
Carbonic Acid	1·03
Silica	1·46
Water	0·54=100,

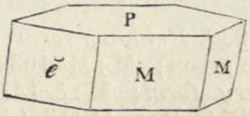
and, therefore, consists of 2 atoms of lead and 1 atom of chlorine.

It decrepitates slightly under the heat of the blowpipe, and readily fuses, producing a globule of a deeper yellow color than the original specimen. On charcoal, lead may be obtained. Treated with peroxyd of copper and salt of phosphorus, the flame assumes an intensely blue color.

OBS. This rare mineral occurs at the Mendip Hills, in Somersetshire, on earthy black manganese. Its name is derived from κεϱας, *horn*.

LEADHILLITE. CRONALUS ACROTOMUS.

Axotomous Lead-Baryte, *M*. Sulphato-Tricarbonate of Lead. Rhomboidal Carbonate of Lead.



236. *Primary form:* an acute oblique rhombic prism; P : M=89° 36′, or its supplement 90° 24′, and M : M=59° 40′, or its supplement 120° 20′. *Secondary forms:* the annexed figure is placed with a side lateral edge towards the observer. The plane ĕ truncates the front lateral edge. The lettering of the planes will show their respective situations. A few of their interfacial angles are as follows; M : M=120° 20′, P : M (the front plane M) =90° 24′, P : M

(M to the right) =89° 36′, M : ĕ=119° 50′. *Cleavage* perfect parallel to P, in traces in the direction of M and ĕ.

H.=2·5. G.=6·2—6·5. *Lustre* pearly on the basal plane; in other parts resinous, somewhat adamantine. *Streak* white. *Color* white, passing into yellow, green or gray. Transparent—translucent. Conchoidal *fracture* scarcely observable. Rather sectile.

Its constituents, as determined by Berzelius, are

Carbonate of Lead	71·1
Sulphate of Lead	30·0=101·1.

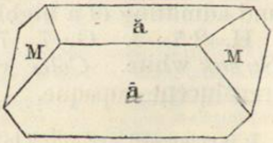
It therefore contains three atoms of the former to one of the latter.

Before the blowpipe, it intumesces at first, and then turns yellow; but returns to a white color on cooling. It effervesces briskly in nitric acid, and leaves a white precipitate.

Obs. This ore has been principally found at Leadhills, associated with other ores of lead, in a vein traversing gray-wacke; Grenada is also stated to be a locality of it. The crystals seldom exceed an inch in length, and are commonly smaller. The compound forms are very complex.

DYOXYLITE. Cronalus flexilis.

Prismatoidal Lead-Baryte, *M.* Suphato-Carbonate of Lead.



237. *Primary form:* an oblique rhombic prism; M : M= *Secondary form:* Plane M is usually rounded, and the crystals aggregated lengthwise and seldom distinct. *Cleavage* parallel to the shorter diagonal; Laminæ flexible like gypsum.

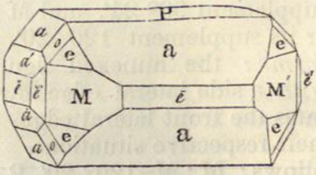
H.=2—2·5. G.=6·8—7. *Lustre* pearly upon the perfect face of cleavage; on other parts adamantine, inclining to resinous. *Streak* white. *Color* greenish-white, pale-yellow or gray. Transparent—translucent.

Its constituents, according to Brooke, are Carbonate of Lead 46·9, and Sulphate of Lead 53·1. It fuses before the blowpipe into a globule, which is white on cooling. It dissolves in nitric acid, but without a perceptible effervescence.

Obs. It occurs at Leadhills, with other ores of lead. A massive variety has of late been observed in Siberia.

ANGLESITE. Cronalus Angleseanus.

Prismatic Lead-Baryte, *M.* Sulphate of Lead. Lead Vitriol.



238. *Primary form:* a right rhombic prism; M : M=103° 49′. *Secondary form:* M : ē=141° 54′, M : ĕ=128° 6′, P : a=140° 36′, P : e=115° 40′, P : ē or ĕ=90°. *Cleavage* parallel to M and P, but interrupted. The planes M and ē are often vertically striated, and a, horizontally. *Imperfect crys-*

tallizations: Lamellar and granular varieties of various sizes of individuals, are of frequent occurrence.

H.=2·75—3. G.=6·259—6·298. *Lustre* highly adamantine in some specimens, in others, inclining to resinous and vitreous. *Streak* white. *Color* white, tinged yellow-gray, green and sometimes blue. Transparent—opaque. *Fracture* conchoidal. Very brittle.

It contains, according to Klaproth, (Beitrage, iii. 162,) Stromeyer, (Hoffman's Handbuch, iv. 43,) and Thomson, (Min. i. 559,)

			Leadhills.
Sulphuric Acid	25·75	26·0191	25·655
Protoxyd of Lead	70·50	72·9146	74·045
Protoxyd of Iron	——	0·1151	——
Protoxyd of Manganese	——	0·1654	——
Water	2·25=98·5, K.	0·1242=99·3384, S.	0·300=100, T.

It is, therefore, a simple sulphate of lead.

In the flame of a candle it decrepitates, and frequently assumes a slightly reddish tinge on the surface. In powder, it melts in the blowpipe flame into a white slag, which yields metallic lead by the addition of carbonate of soda.

Obs. This ore of lead results, in many instances, from the decomposition of galena. At Leadhills it frequently occurs, occupying the cubical cavities of galena, or is disposed on the surface of this ore. This locality, and also Wanlockhead, afford large and beautiful crystals of this mineral, some of which are transparent, of a tabular form, and are several inches in diameter. Pary's mine, in Anglesea; Mellanoweth, in Cornwall; Clausthal and Zellerfeld, in the Hartz; Badenweiler, in the Brisgau, are other localities. Small, but extremely perfect transparent crystals have been brought from Fondon, in Grenada. The massive varieties are met with in Siberia, Andalusia, and Alston Moor.

In the United States, no very beautiful crystallizations have been obtained. It, however, occurs in the Missouri lead mines, and also in the lead mine at Southampton, Mass., and at the Walton gold mine, Luzerne Co., Va.

HEDYPHANE. Cronalus amorphus.

239. Occurs in amorphous masses traversed by numerous fissures; also, according to Breithaupt, in short hexagonal prisms.

H.=3·5—4. G.=5·46—5·493. *Lustre* adamantine; sometimes subresinous. *Streak* and *Color* white, or grayish-white. Translucent.

Its composition, according to Kersten's analysis, (Ann. de Ch. et de Ph. xlviii. 178,) is as follows,

Protoxyd of Lead	52·950
Lime	14·034
Chlorine	2·029
Arsenic Acid	22·780
Phosphoric Acid	8·207=100.

It fuses before the blowpipe into an opaque globule, which does not crystallize on cooling. It tinges the flame greenish-blue, without producing any odor. With salt of phosphorus it froths and gives out the odor of muriatic acid. Globules of lead are obtained when fused on charcoal, and white arsenical fumes are given off. A scoria remains, which is not reducible in the interior flame, but crystallizes on cooling.

Obs. It occurs at Longbanshyttan, in Sweden, associated with brown garnet and manganese spar. Its name is derived ἡδὺς, *sweet*, and φαινειν, *to appear*.

PLUMBO-RESINITE. Cronalus resiniformis.

Sexaluminate of Lead, *Thomson*. Plombgomme. Bleigummi, *of the Germans*. Plumbo-gummite.

240. Aggregations of columnar particles presenting externally reniform or globular shapes; also impalpable.

H.=4—4·5. G.=6·3—6·4. *Lustre* resinous. *Streak* white. *Color* yellowish and reddish-brown; also yellowish-white. Translucent. Resembles in color and appearance gum-arabic. *Fracture* conchoidal.

Berzelius and Dufrénoy obtained the following as its constituents:

Protoxyd of Lead	40·14		37·51
Alumina	37·00		34·23
Water	18·80		16·14
Sulphurous Acid	0·20		——
Lime, Ox. of Iron, and Mang.	1·80	Phos. Lead	7·80 (from the gangue.)
Silica	0·60=98·54, B.		2·11=97·79, D.

A quick application of the heat of the blowpipe produces decrepitation, and it soon parts with the water it contains, but does not fuse. On charcoal it forms an enamel, like some of the zeolites, without fusing. With borax a colorless glass is obtained; a reduction of the ore is not effected. Concentrated hydrochloric acid decomposes the powdered plumbo-resinite.

Obs. It occurs in clay slate, at Huelgoet, near Poullaouen, in Brittany, associated with galena, blende, iron pyrites, and pyromorphite; also in a lead mine near Beaujeu. It resembles some varieties of mammillated blende.

PYROMORPHITE. Cronalus hexagonus.

Rhombohedral Lead-Baryte. Phosphate of Lead. Braunbleierz, Grunbleierz, *Wern.* and *Hoff.* Traublenblei, *Haus.* Arseniate of Lead. Mimetene.

241. *Primary form:* the regular hexagonal prism. *Secondary form:* fig. 125, Pl. II. M : *e*=150°, M : e=131° 45′, P : e=138° 15′. *Cleavage* in traces parallel to M. M commonly horizontally striated. *Imperfect crystallizations:* globular, reniform, and botryoidal forms, having an internal columnar structure; also fibrous and granularly massive grains strongly coherent.

The identity in the crystallization of the phosphate and arsenate of lead, requires their union in the same species. In the farther description of them, however, it is preferred to treat of them separately. They may be distinguished as variety 1, speciosus; and variety 2, alliaceus.

PYROMORPHITE. Cronalus hexagonus. Var. speciosus.

H.=3·5—4. G.=6·5871—6·915, according to Thomson. *Lustre* resinous. *Streak* white, sometimes yellowish. *Color* green, yellow-brown, of different shades; sometimes fine orange-yellow, owing to an intermixture with chromate of lead. Subtransparent—subtranslucent. *Fracture* subconchoidal, uneven. Brittle.

Its compositon is, according to Kersten, (Ann. de Ch. et de Ph. xlviii. 157,)

Protox. Lead	72·17	75·830
Lime	6·47	3·711
Chlorine	2·00	2·110
Phosphoric Acid	19·36=100.	18·349=100.

Klaproth, (Beit. iii. 146,)

Protox. of Lead	78·58	78·40
Muriatic Acid	1·65	1·70
Peroxyd of Iron	——	0·10
Phosphoric Acid	19·73=99·96.	18·37=98·57.

The first analysis by Kersten, was of a specimen belonging to the variety polysphœrite, being in small spheres of a brown color, and was obtained in the mine Sonnenwirbel, near Freiberg. Sp. gr.=6·092. The second was a similar specimen from Mies, in Bohemia. Klaproth's first of the above analyses, was performed on a brown phosphate from Huel Goet: the second was a siskin-green phosphate from Zschopau. Before the blowpipe, on charcoal, it melts without addition, and the globule on cooling, assumes a polyhedral form, and a dark color. In the reducing flame, the globule becomes bluish. It dissolves readily in heated nitric acid.

Obs. Pyromorphite occurs principally in veins, and accompanies other ores of lead. Fine specimens occur at Leadhills and Wanlockhead; at Poullaouen and Huel Goet, in Brittany; at Zschopau, and other places, in Saxony; in the Hartz, Bohemia, and Hungary.

The green variety has been found in fine specimens at the Perkiomen lead mine, near Philadelphia, and at the lead mine in Lenox, Maine.

MIMETENE. Cronalus hexagonus. Var. alliaceus.

H.=2·75—3·5. G.=6·41, Gregor. *Lustre* resinous. *Streak* white. *Color* pale-yellow, passing into brown. Subtransparent—translucent. Sectile.

It is composed, according to Wöler, (Pogg. Ann. iv. 167,) who analyzed a specimen from Johangeorgenstadt, of

Protoxyd of Lead	67·64
Arsenic Acid	21·09
Lead	7·39
Chlorine	2·56
Phosphoric Acid	1·32=100.

It dissolves easily in nitric acid, especially if heated. Before the blowpipe, in a gold spoon, it fuses into a brownish-yellow mass, which does not crystalline externally on cooling. On charcoal, it gives out copious arsenical fumes, and affords a globule of lead.

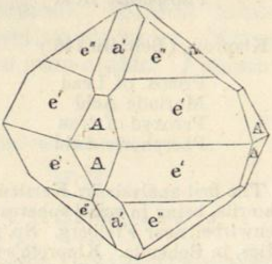
Obs. Fine specimens of this mineral occur at Huel Unity, near Redruth, in Cornwall, and in several other of the Cornish mines; also at Beeralston, in Devonshire. At St. Prix, in the department of the Saone, in France, it occurs in capillary crystals; at Johangeorgenstadt, in fine crystals of a yellow color; at Nertschinsk, Siberia, in reniform masses of a brownish-red color.

MOLYBDATE OF LEAD. CRONALUS PYRAMIDALIS.

Pyramidal Lead-Baryte, *M.* Gelb-bleierz, *Wern.* Yellow Lead Ore. Bleigelb, *Haus.*

242. *Primary form:* a square octahedron; A : A (over a terminal edge)=99° 40′; A : A (over a basal edge)=131° 35′. *Secondary forms:* similar to fig. 54, Pl. I.; also the annexed fig., e′ : e′ (over basal edge)=115° 7′, A : a′=150° 46′, e′ : e″=168° 49′. *Cleavage* very smooth parallel to A. It occurs also granularly massive; grains of various sizes, and firmly coherent.

H.=2·75—3. G.=5·706, Hatchett; 6·76, Haidinger. *Lustre* resinous. *Streak* white. *Color* wax-yellow, passing into orange-yellow; also siskin- and olive-green, yellowish-gray, grayish-white. Subtransparent—subtranslucent. *Fracture* subconchoidal. Brittle.



Its constituents are, according to Klaproth, (Beit. ii. 275,) Hatchett, (Phil. Trans. 1796, p. 233,) and Göbel, (Schweigger's Jahrbuch, vii. 71.)

Molybdic Acid	34·25	37·00	40·5
Protoxyd of Lead	64·42	58·40	58·0
Oxyd of Iron	——	3·08	——
Silica	—— =98·67, K.	0·28 =98·76, H.	—— =98·5, G.

In the blowpipe flame it decrepitates briskly, and becomes of a darker color, which again disappears. On charcoal it fuses and is absorbed by it, leaving behind some globules of metallic lead. With borax in the exterior flame, it fuses readily into a colorless glass. In the interior flame, the glass is transparent, but on cooling, becomes all at once dark and opaque. Melts readily with salt of phosphorus, producing a green glass, when the proportion of the mineral is small, but black and opaque, if large.

Obs. This species occurs in veins of limestone with other ores of lead, at Schwarzenbach, Bleiberg, and Windish-Kappel, in Carinthia. It is also met with at Rezbanya, in Hungary, and at Moldawa, in the Bannat, where its crystals have considerable resemblance to chromate of lead. It is found in small quantities at the Southampton lead mines, Mass., and at the Perkiomen mine, near Philadelphia.

VANADATE OF LEAD. CRONALUS VANADICUS.

243. Occurs in irregular crystallizations, globular masses, or incrustations. The larger globules exhibit traces of six-sided prisms.

H.=2·75. G.=6·6623—7·23. *Lustre* fracture of surface resinous. *Streak* white. *Color* light brownish-yellow, straw-yellow, reddish-brown. Subtranslucent—opaque. *Fracture* even, or flat conchoidal. Brittle.

According to Berzelius, the Mexican variety consists of Chlorid of Lead 25·33, Vanadate of Lead 74·00, Hydrous Oxyd of Lead 0·67. Dr. R. D. Thomson obtained

Chlorine	2·446
Lead	7·063
Protoxyd of Lead	66·326
Vanadic Acid	23·436
Peroxyd of Iron and Silica	0·163=99·434.

This is equivalent to 1 part of Chlorid of Lead, to 9 of Sesquivanadate of Lead. Before the blowpipe, in a pair of forceps, it fuses, and retains its yellow color on cooling: if kept some time in fusion, however, it changes into a steel-gray porous mass, which, upon charcoal, yields globules of metallic lead. On charcoal it fuses with much frothing into a bead, resembling the original assay. It forms green solutions with the sulphuric and muriatic acids, and a beautiful yellow solution with nitric acid.

Obs. This mineral was first discovered at Zimapan, in Mexico, by Del Rio. It has since been obtained among some of the old workings at Wanlockhead, in Dumfriesshire, where it occurs in small globular masses, sprinkled over calamine, or in thin coatings on the surface of that mineral.

TUNGSTATE OF LEAD. Cronalus ponderosus.

Tungstate of Lead. Scheelsaures Blei.

244. *Primary form:* a square octahedron or prism. Occurs in modified square octahedrons or prisms; often indistinctly aggregated. *Cleavage* parallel to the base of the prism.

H.=2·75.—3. G.=7·904—8·088. *Lustre* resinous. *Streak* white. *Color* green, gray, brown, and red. Faintly translucent.

It is composed of Tungstic Acid 52, and Oxyd of Lead 48.

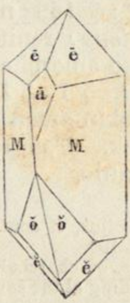
It melts before the blowpipe, and gives off vapors of lead, leaving a dark-colored, sub-metallic crystalline globule, whose streak is pale-gray.

Obs. Tungstate of lead occurs at Zinnwald, in Bohemia, associated with quartz and mica; also at Bleiberg, in Carinthia, accompanying the molybdate of lead.

CHROMATE OF LEAD. Cronalus hyacinthus.

Hemi-prismatic Lead-Baryte, *M.* Red Lead Ore.

1.



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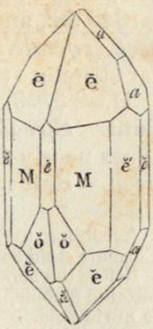


245. *Primary form:* an oblique rhombic prism; M : M=93° 40′, P : M=99° 11′. *Secondary forms:* P : ē=102° 30′, M : ē=136° 50′, M : ĕ= 133° 10′, ē . ē=119°, ĕ : ĕ=107° 30′. *Cleavage* tolerably distinct parallel to M, less so parallel to P. Surface M streaked longitudinally. The faces mostly smooth and shining. *Imperfect crystallizations:* imperfectly columnar; granularly massive.

H.=2·5—3. G.=6—6·004. *Lustre* adamantine–vitreous. *Streak* orange-yellow. *Color* various shades of hyacinth-red. Translucent. sectile.

The constituents of the pure chromate of lead are Chromic Acid 31·71, Protoxyd of Lead 68·29.

It blackens in the blowpipe flame, and decrepitates if quickly heated. It may be fused into a shining slag containing globules of lead. It undergoes a partial reduction in glass of borax, coloring at it the same time green. It dissolves without effervescence in nitric acid, and produces a yellow solution.

Obs. Siberia is the principal locality of the chromate of lead. It occurs also at Beresof, in narrow veins, traversing decomposed gneiss, and associated with gold, pyrites, galena, quartz, and Vauquelinite. In Brazil, at Conconhas do Campo, fine crystallized specimens are met with, where it occurs in decomposed granite.

MELANOCHROITE. Cronalus rubeus.

Subsesquichromate of Lead, *Thom.*

246. *Primary form:* a rhombic prism. Crystals usually tabular, and reticularly interwoven. Occurs also massive.

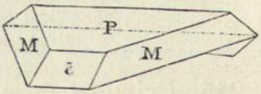
Very soft. G.=5·75. *Lustre* resinous, glimmering. *Streak* brick-red. *Color* between cochineal and hyacinth-red; becomes lemon-yellow on exposure. Subtranslucent—opaque.

It contains, according to Hermann, (Poggendorf's Annalen, xxviii. 162,) Chromic Acid 23·64, Protoxyd of Lead 76·36=100. On charcoal, before the blowpipe, it fuses readily into a dark mass, which is crystalline when cold. In the reducing flame, lead is sublimed. It gives a green bead with the fluxes.

Obs. It occurs in a limestone rock at Beresofsk, in the Ural, associated with chromate of lead, Vauquelinite, pyromorphite, and galena. It was first analyzed and described by Hermann.

VAUQUELINITE. Cronalus Vauquelini.

247. *Primary form:* an oblique rhombic prism. Occurs usually in minute irregularly aggregated crystals, of a dark green or black color. *Compound crystals:* similar to the annexed figure; composition of *the third kind*, parallel to a plane on the acute solid angles, P : P (of the two individuals,) =134° 30′, and P : ē=149° nearly. *Imperfect crystallizations:* reniform and botryoidal shapes, and granular structure; also amorphous.



H.=2·5—3. G.=5·5—5·78. External *lustre* adamantine, often faint. *Streak* siskin-green or brownish. *Color* dark-green, sometimes nearly black. Faintly translucent—opaque. *Fracture* uneven. Rather brittle.

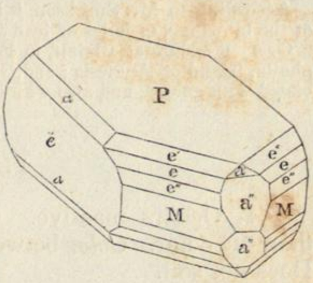
According to Berzelius, it contains Oxyd of Lead 60·87, Oxyd of Copper 10·80, Chromic Acid 28·33=100.

Before the blowpipe, on charcoal, it slightly intumesces and fuses into a gray submetallic globule, yielding at the same time, small beads of lead. It is partly soluble in nitric acid.

Obs. Vauquelinite occurs with chromate of lead at Beresof, in Siberia, generally in mammillated or amorphous masses, or thin crusts. It has also been observed at Port Gibaud, in the Puy de Dome; it is stated to occur along with the chromate of lead of Brazil. Levy gives its specific gravity at 6·8—7·2, and hardness above 4·0.

CALEDONITE. CRONALUS DIATOMUS.

Paratomous Lead-Baryte, *Haid.* Cupreous Sulphato-Carbonate of Lead.



248. *Primary form:* a right rhombic prism; M : M=95°. *Secondary form:* e′ : e′=108°, M : ĕ=132° 30′, P : *a*=126°, P : e′=126°, P : e=115° 30′, a″ : a″=143° 42′, Brooke. *Cleavage* parallel to M and P indistinct, more obvious parallel to ĕ. The crystals are sometimes large and well defined, but usually very minute, and occasionally appear in bunches diverging from a common point.

H.=2·5—3. G.=6·4. *Lustre* resinous. *Streak* greenish-white. *Color* deep verdigris or bluish-green; inclining to mountain green if the crystals are delicate. Translucent. *Fracture* uneven. Rather brittle.

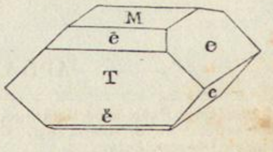
Brooke's analysis, (Edin. Phil. Jour. iii. 119,) determined its constituents to be

Sulphate of Lead	55·8
Carbonate of Lead	32·8
Carbonate of Copper	11·4=100.

OBS. It occurs only at Leadhills, in Scotland, accompanying the other ores of lead of that locality. It was first examined and described by Mr. Brooke.

CUPREOUS ANGLESITE. CRONALUS RHOMBOIDEUS.

Diplogenic Lead-Baryte, *Haid.* Cupreous Sulphate of Lead.



249. *Primary form:* a right rhomboidal prism; M : T=95° 45′, as determined by Haidinger. *Secondary form:* the annexed figure, e : e=119°, Haidinger. *Cleavage* very perfect parallel to M and T.

H.=2·5—3. G.=5·3—5·5. *Lustre* vitreous or adamantine. *Streak* pale-blue. *Color* deep azure-blue. Translucent.

According to Brooke, (Ann. of Phil. 2d ser. iv. 117,) it consists of Sulphate of Lead 74·4, Oxyd of Copper 18·0, and Water 4·7=97·1. In the blowpipe flame, it affords indications of copper and lead.

OBS. This mineral occurs only at Leadhills, but is even there an exceedingly rare mineral. Linares, in Spain, has been reported as another locality.

MINIUM.

250. Pulverulent, exhibiting, under the microscope, occasionally

crystalline scales. The crystal, according to M. Kapper, is a right rhombic prism of 93° 44′.

G.=4·6. *Color* vivid red, mixed with yellow.

According to Mr. Smithson, it is a Sesquoxyd of Lead. In the reduction flame of the blowpipe, globules of lead are obtained.

Obs. It occurs at Bleialf, in Eifeld; Badenweiler, in Baden; Brillon in Westphalia, island of Anglesia; and Grass-hill chapel, in Yorkshire. It is usually associated with galena, and also with calamine.

PLUMBIC OCHRE.

251. Occurs massive. G.=8·0. *Lustre* dull. *Streak* lighter than the color. *Color* between sulphur and lemon-yellow. Opaque. Does not soil.

Dr. John determined the following as its constituents: Protoxyd of Lead 87·382, Carbonic Acid 3·846, Oxyd of Iron and Lime 0·481, Ferruginous Silica 2·404=94·113. Melts easily before the blowpipe, and is easily reduced.

Obs. It is said to occur at Badenweiler, in Baden, in quartz. Geralt states that it has been ejected from the volcanoes of Popocatapetl and Jztaccituall, in Mexico.

POLYSPHÆRITE.

Breithaupt, Jahresbericht, 1832, p. 202.

252. In roundish masses; structure internally radiated.

H.=3—4. G.=5·83—5·89. *Lustre* greasy. *Fracture* conchoidal.

Contains Oxyd of Lead, Phosphoric Acid, and Magnesia.

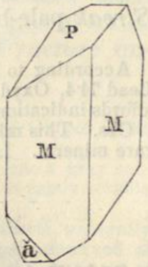
Obs. Occurs at the mines of Freiberg, in Saxony, associated with blende, galena, quartz, and iron pyrites.

APHANESITE. CYPRALUS ACROTOMUS.

Diatomous Habroneme-Malachite, *M.* Axotomous Habroneme-Malachite, *Haid.* Radiated Acicular Olivenite, *Jam.* Strahlerz, *Hoff.* Cuivre Arseniaté Ferrifère, *H.* Cuivre Arseniaté en Prism Rhomboidale Oblique, *Levy.*

253. *Primary form:* an acute oblique rhombic prism; M : M=56° and 124°, P : M=85° and 95°. *Secondary form:* M : M=124°, P : ă=99° 30′. *Cleavage* highly perfect parallel with P.

H.=2·5—3·0. G.=4·192. *Lustre* of face P pearly. *Streak* verdigris-green. *Color* dark verdigris-green, inclining to blue; also dark-blue. Subtranslucent. Not very brittle.



According to Chenevix and Richardson, it contains

Oxyd of Copper	54·00	56·65
Arsenic Acid	30·00	39·80
Water	16·00=100, C.	3·55=100, R.

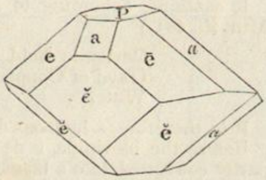
It deflagrates before the blowpipe, fuses readily, and emits arsenical fumes.

Obs. It occurs only at Cornwall, with other salts of copper. The crystals usually present a very dark-blue color and brilliant lustre, but are rarely recognizable, being aggregated in diverging groups, or disposed in extremely minute individuals, in cavities of quartz. Hence the name *Aphanesite*, from αφανης, *unmanifest*.

BLUE MALACHITE. Cypralus cœruleus.

Prismatic Azure-Malachite, *M.* Blue Copper Ore. Blue Carbonate of Copper. Hydro-Carbonate of Copper, *Thomson.* Chessy Copper.

254. *Primary form:* an oblique rhombic prism; M : M=98° 50′. *Secondary form:* P : *ē*=92° 21′. a : *ē*= 132° 43′, *a* : *a* (over P) =99° 32′. It occurs also massive, and presenting several imitative shapes, having a columnar composition; also of a dull and earthy appearance.



H.=3·5—4·25. G.=3·831. *Lustre* vitreous, almost adamantine. *Streak* blue, lighter than the color. *Color* various shades of azure-blue, passing into azure and Berlin-blue. Transparent—subtranslucent. *Fracture* conchoidal. Brittle.

It contains, according to Klaproth, (Beitrage iv. 31,) Vauquelin, (Ann. de Museum, xx. 1,) and Phillips, (Journ. Royal Institution iv. 276,)

Carbonic Acid	24·00	21·25	25·46
Oxyd of Copper	70·00	70·00	69·08
Water	6·00=100, K.	8·75=100, V.	5·46=100, P.

It blackens, when strongly heated, and, on charcoal, fuses; borax is colored green. It dissolves with effervescence in nitric acid.

Obs. Blue malachite occurs abundantly in splendid crystallizations, presenting a great variety of forms and brilliant colors, at Chessy, near Lyons, whence it has derived its name of *Chessy Copper.* It also occurs in fine crystals in Siberia; at Moldawa, in the Bannat; at Wheal Buller, near Redruth, in Cornwall; also in small quantities at Alston Moor and Wanlockhead.

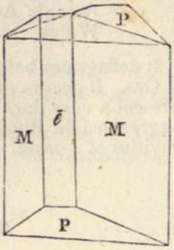
This mineral occurs at the Perkiomen lead mine, associated with galena, blende, and white lead ore; the specimens, however, are rather indifferent.

If abundant, blue malachite is a valuable ore of copper. It forms a blue paint of a bright tint, when ground to an impalpable powder; but is of little value as a pigment, on account of its liability to turn green.

GREEN MALACHITE. Cypralus vulgaris.

Hemi-Prismatic Habroneme-Malachite, *M.* Diprismatic Green Malachite, *Jameson.* Green Carbonate of Copper. Mountain Green. Atlaserz.

255. *Primary form:* an oblique rhombic prism; M : M=130° P : *ē* (plane truncating the first lateral edge) =118° 11′. *Cleavage* highly perfect parallel to P; less distinct parallel to *ē*, or the longer



diagonal. *Compound crystals:* composition of the second kind; parallel with the obtuse lateral edge of the prism. *Imperfect crystallizations:* in fascicular groups; tuberose, botryoidal, and stalactitic shapes, composed of diverging fibres; also fibrous; and frequently granularly massive, of an earthy appearance.

H.=3·5—4. G.=4·008, Haidinger. *Lustre* adamantine, inclining to vitreous; fibrous varieties have often a silky, and others an earthy lustre. *Streak* green, rather paler than the color. Translucent—subtranslucent—opaque. *Fracture* subconchoidal, uneven. Seldom observed in crystallized forms.

It contains, according to Klaproth, (Beitrage ii. 287,) and Vauquelin, (Haüy's Min. iii. 491,)

Carbonic Acid	18·0	21·25
Oxyd of Copper	70·5	70·00
Water	11·5=100, K.	8·75=100, V.

It is, therefore, a hydrous dicarbonate of copper.

Before the blowpipe, it decrepitates, becomes black, and is partly infusible, and partly converted into a black scoria. With borax, it fuses easily into a deep green globule, and ultimately affords a bead of copper. It dissolves with effervescence in nitric acid.

Green malachite usually accompanies the other ores of copper. Perfect crystals are quite rare. The fibrous variety occurs abundantly in Siberia; at Chessy, in France; and in the old mine at Sandlodge, in Shetland; the compact occurs at Schwatz, in the Tyrol. It also occurs at Cornwall.

In the United States, it occurs in connection with the vitreous copper of Cheshire, Conn.; at Schuyler's mines, New Jersey, where it is accompanied also with red copper ore; in the Blue Ridge, in Pennsylvania, near Nicholson's Gap; at the Perkiomen lead mine; but it has not been obtained at either of these and other localities in fine specimens.

Green malachite admits of a high polish, and when in large masses, is cut into tables, snuff-boxes, vases, &c.

CHRYSOCOLLA. CYPRALUS AMORPHUS.

Uncleavable Staphyline-Malachite, *M.* Copper-green. Silico-Carbonate of Copper, *Thomson.*

256. Botryoidal and massive.

H.=2—3. G.=2—2·238. *Lustre* vitreous, shining, earthy. *Streak* white. *Color* emerald- and pistachio-green, passing into sky-blue; often brown when impure. Translucent—translucent-opaque. *Fracture* conchoidal. Rather sectile; translucent varieties brittle.

It contains, according to Klaproth, (Beit. iv. 34,) John, and Thomson,

Silica	26	28·37	25·31
Oxyd of Copper	50	49·63	54·46
Carbonic Acid	07	3·00	14·98
Water	17	17·50	5·25
Sulphate of Lime	—=100, K.	1·50=100, J.	——100, T.

" The great difference in the proportion of carbonic acid in these analyses, renders it probable that the carbonate and silicate of copper are not chemically combined." Thomson.

It blackens in the interior flame of the blowpipe on charcoal, without melting. With borax it melts into a green glassy globule, and is partly reduced.

Obs. The same specimen of this mineral often presents very different appearances at its opposite parts; being sometimes of an earthy appearance, like decomposed feldspar, in one part, and translucent and brittle on the opposite. The differences of the several varieties are owing, more or less, to impurities.

It accompanies other copper ores, in Cornwall; at Libethen, in Hungary; at Falkenstein and Schwatz, in the Tyrol; in Siberia, the Bannat, Thuringia, &c.

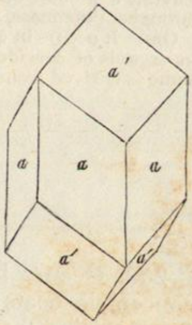
In Sommerville, New Jersey, chrysocolla occurs, associated with red copper ore, native copper, and green malachite; also with similar associated minerals and with brown iron ore in Nova Scotia, at the basin of mines.

DIOPTASE. Cypralus rhombohedrus.

Rhombohedral Emerald-Malachite, *M.* Emerald Copper. Achirite.

257. *Primary form:* an obtuse rhombohedron; R : R=126° 17′. *Secondary form:* fig. 118, $a' : a'$=95° 48′, $a' : a$=132° 6′, $a : a$=120°. *Cleavage* perfect, parallel with R.

H.=5. G.=3·278. *Lustre* vitreous—inclining to resinous. *Streak* green. *Color* emerald-green; also blackish-green, and verdigris-green. Transparent—subtranslucent. *Fracture* conchoidal, uneven. Brittle.



Its constituents have been determined very differently by different chemists. It contains, according to Lowitz, Vauquelin, and Hess,

Oxyd of Copper	55	25·57	45·10
Silica	33	28·57	36·85
Water	12	——	11·52
Carbonate of Lime	—	42·85	Lime 3·39
Alumina	—	——	2·36
Magnesia	— =100, L.	—— =96·99, V.	0·22=99·44, H.

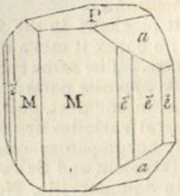
It decrepitates in the blowpipe flame, tinging it yellowish-green; in the exterior flame it becomes black, and in the interior red, but does not melt. It fuses with borax, giving it a green color, and finally is reduced. Insoluble in nitric, but soluble without effervescence in muriatic acid. It acquires negative electricity by friction when insulated.

Obs. Dioptase occurs disposed in well defined crystals on quartz, in the Kirghese Steppes of Siberia, whence it was first brought by a Bucharian merchant, Achir Mamed. It was named Achirite, after this merchant. It is said to occur at Rezbanya, in Hungary, associated with electric calamine.

EUCHROITE. Cypralus speciosus.

Prismatic Emerald-Malachite, *M.* Euchroite, *Breithaupt.*

258. *Primary form:* a right rhombic prism; M : M=117° 20′.



Secondary form : P : *a*=133° 56′, ĕ : *a*=136° 4′, M : ĕ=121° 20′. *Cleavage* parallel to M, distinct. Faces M vertically striated.

H.=3·75. G.=3·389. *Lustre* vitreous. *Streak* pale apple-green. *Color* bright emerald-green. Transparent—translucent. Doubly refracts distinctly. *Fracture* small conchoidal, uneven. Rather brittle.

According to Dr. Turner's analysis, (Schweigger's Jahrbuch, xv. 233,) it contains,

Peroxyd of Copper	47·85
Arsenic Acid	33·02
Water	18·80=99·67.

In the matrass, it loses its water, and becomes yellowish-green and friable. Heated on charcoal to a certain point, it is reduced in an instant with a kind of deflagration, leaving a globule of malleable copper, with white metallic particles disseminated throughout the mass, which volatilize with the continuance of the heat.

Obs. It occurs in quartzose mica slate at Libethen, in Hungary, where it is found in crystals of considerable size, having much resemblance to dioptase. Its trivial name is derived from ευχροια, *beautiful color.*

ERINITE. Cypralus concentricus.

Dystomic Habroneme-Malachite, *Haid.* Hydrous Sub-bisesquarsenate of Copper, *Thomson.*

259. Occurs in mammillated crystalline groups, consisting of concentric coats of a fibrous structure, and presenting rough surfaces, arising from the terminations of very minute crystals. The layers, which are themselves very compact, are often easily separable. They sometimes present indistinct traces of what appears to be a rectangular cleavage.

H.=4·5—5. G.=4·043. *Lustre* almost dull, slightly resinous. *Streak* green, paler than the color. *Color* a fine emerald-green, slightly inclining to grass-green. Subtranslucent—nearly opaque. Brittle.

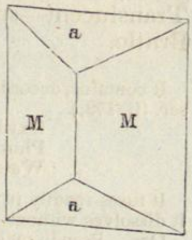
It is composed, according to Dr. Turner, (Phil. Mag. 2d ser. iv. 154,) of

Oxyd of Copper	59·44
Arsenic Acid	33·78
Alumina	1·77
Water	5·01=100, Turner.

Obs. Erinite occurs associated with other cupric arsenates, in the county of Limerick, Ireland. It was first described by Haidinger.

LIROCONITE. CYPRALUS RECTANGULUS.

Prismatic Lirocone-Malachite, *M.* Prismatic Olivenite, or Lenticular Copper, *Jam.* Octahedral Arseniate of Copper. Linsenerz, *Wern.* Linsenkupfer, *Haus.* Cuivre Arseniaté Octaèdre obtus, *H.*



260. *Primary form:* a rectangular octahedron or prism; M : M=60° 15′, and 119° 45′. *Secondary form:* a : a=71° 59′. *Cleavage* parallel with M, but with difficulty obtained. Massive granular varieties occur, but are rare.

H.=2—2·5. G.=2·882, Bournon; 2·926, Haidinger. *Lustre* vitreous, inclining to resinous. *Streak* and *Color* sky-blue—verdigris-green. *Fracture* imperfectly conchoidal, uneven. Nearly sectile.

According to Chenevix, this mineral contains Oxyd of Copper 49, Arsenic Acid 14, Water 35=98.

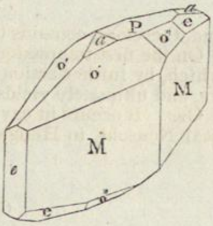
An analysis by Thomson of some pure crystals, though unsatisfactory, as he states, on account of the small quantity employed, gives a very different composition; according to him, it consists of Oxyd of Copper 30·10, Arsenic Acid 43·39, Water 26·69=100·18.

Before the blowpipe it loses its color and transparency, emits arsenical fumes, and becomes a black, friable scoria, containing some white metallic globules. With borax, it affords a green globule, and undergoes a partial reduction. It dissolves in nitric acid without effervescence.

Obs. Crystals of this mineral have rarely been observed an inch in diameter; usually they are quite small. It occurs, associated with various ores of copper, pyrites, and quartz, at Huel Gorland and Huel Unity, in Cornwall; also in minute crystals at Herrengrund, in Hungary.

PSEUDO-MALACHITE. CYPRALUS HEMIHEDRUS.

Prismatic Habroneme-Malachite, *M.* Prismatic Olivenite. Phosphate of Copper. Hydrous Phosphate of Copper.



261. *Primary form:* a right rhombic prism; M : M=38° 56′. *Secondary form:* This crystal is hemihedrally modified, and consequently, it has the aspect of an *oblique* rhombic prism; P : ĕ=90°, M : M=141° 4′, the supplement of 38° 56′, M : ĕ=109° 28′. M and M being considered the primary lateral planes, o′ and o″ are intermediary planes on the obtuse solid angles; but if viewed as beveling planes of the obtuse lateral edge, and the plane o′ as replacing a basal edge P : M, o″ will replace the obtuse solid angle. In lettering the crystal according to this view of it, we should substitute ĕ′ for M, e′ for o′, a for o″, and *o′* for e, which then becomes an intermediary. *Cleavage* appears merely in indistinct traces parallel to ĕ or the shorter diagonal; also it is stated parallel to *a.* *Imperfect crystallizations:* reni-

form shapes and massive, with an indistinctly columnar composition and drusy surface.

H.=4·75—5. G.=4·205. *Lustre* adamantine, inclining to vitreous. *Streak* green, a little paler than the color. *Color* emerald-green, verdigris-green, blackish-green, often darker at the surface. Translucent—subtranslucent. *Fracture* small conchoidal, uneven. Brittle.

It contains, according to Klaproth, (Beitrage, iii. 201,) and Lunn, (Ann. Phil. 2d ser. iii. 179,)

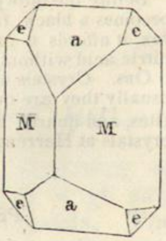
Oxyd of Copper	68·13	62·847
Phosphoric Acid	30·95	21·687
Water	——=99·08.	15·454=99·988.

It fuses readily in the blowpipe flame, into a small vesicular metalloidal globule. It dissolves without effervescence in nitric acid; more readily if heated.

Obs. Pseudo-malachite occurs in veins traversing gray-wacke slate at Rheinbreitenbach, near Bonn, on the Rhine, and is associated with quartz, and other ores of copper. The massive variety is met with at Libethen, in Hungary.

LIBETHENITE. Cypralus dystomus.

Diprismatic Olive-Malachite, *M.* Prismatic Olivenite. Phosphate of Copper. Hydrous Diphosphate of Copper, *Thom.* Cuivre Phosphaté, *H.*



262. *Primary form:* a right rhombic prism; M : M=95° 2′. *Secondary form:* a : a over the apex =111° 58′. *Cleavage* very indistinct parallel to M and a.

H.=4. G.=3·6—3·8. *Lustre* resinous. *Streak* olive-green. *Color* olive-green, generally dark. Subtranslucent. *Fracture* conchoidal, uneven. Brittle.

According to Berthier, (Ann. des Mines, viii. 334,) it consists of

Phosphoric Acid	28·7
Oxyd of Copper	63·9
Water	7·4=100,

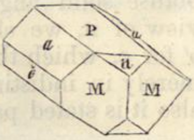
and, therefore, contains two parts of oxyd of copper to one of acid.

On the first impression of the heat of the blowpipe, it fuses into a brownish globule, which, by further action of the heat, acquires a reddish-gray color and metallic lustre, and ultimately yields at its centre, a globule of metallic copper.

Obs. It occurs in cavities in quartz, associated with copper pyrites at Libethen, near Neusohl, in Hungary; also in small quantities near Gunnislake, in Cornwall.

OLIVENITE. Cypralus acicularis.

Prismatic Olive-Malachite, *M.* Acicular Olivenite. Prismatic Arseniate of Copper, *Bournon.* Prismatic Oliven Ore. Olivenit, *L.*



263. *Primary form:* a right rhombic prism; M : M=110° 50′. *Secondary form:* P : *a*= 136° 15′, M : ĕ=124° 35′. *Cleavage* in traces parallel to M and *a*, the former a little the most distinct. *Imperfect crystallizations:* globular and reniform shapes, with indistinctly columnar

structure; individual columns straight and divergent, rarely promiscuous. Also fibrous, curved lamellar and granularly massive varieties occur.

H.=3. G.=4·2809, Bournon; 4·166, Richardson. *Lustre* adamantine—vitreous; of some fibrous varieties pearly. *Streak* olive-green—brown. *Color* various shades of olive-green, passing into leek-, siskin-, pistachio-, and blackish-green; also liver-, and wood-brown. Subtransparent—opaque. *Fracture* when visible, conchoidal, uneven. Brittle.

It contains, according to Kobell, (Poggendorf's Annalen, xviii. 249,) and Richardson, (Thomson's Min. i. 614.)

Arsenic Acid	36·71	36·9
Oxyd of Copper	56·43	56·2
Water	3·50	3·9
Phosphoric Acid	3·36=100, K.	——=100, R.

It, therefore, consists of two parts of oxyd of copper to one of acid.

Remains unaltered before the blowpipe alone, but on charcoal it fuses with a kind of deflagration, and yields a white metallic globule, which, as it cools, becomes covered with a red scoria. It dissolves in nitric acid.

Obs. The crystallized varieties occur disposed on, or coating cavities of quartz, at the Cornwall mines; also in inferior specimens at Alston Moor. The *wood arsenate*, is a term which has been applied to a variety presenting a soft velvet-like surface, and a light siskin or greenish-gray color, having an earthy texture, and a radiated or fibrous structure. It is peculiar to Cornwall.

ATACAMITE. Cypralus exhalans.

Prismatoidal Habroneme-Malachite, *M.* Hexmuriate of Copper, *Thomson.*

264. *Primary form:* a right rhombic prism; M : M=97° 20′. *Secondary forms:* a rectangular octahedron; this form is most commonly presented by its minute crystals. It also presents highly modified rectangular prisms. *Cleavage* parallel to P perfect; less indistinct parallel to M.

H.=2·5—3. G.=4·43. *Lustre* adamantine—vitreous. *Streak* apple-green. *Color* various shades of green, sometimes blackish-green. Translucent—subtranslucent.

It is composed, according to Proust, (Ann. de Chim. xxxii. 49,) and Klaproth, (Beitrage, iii. 200,) of

Oxyd of Copper	76·6	73·0
Muriatic Acid	10·6	10·1
Water	12·8=100, P.	16·9=100, K.

It is, therefore, a chlorid of copper; and is composed of 1 part of chlorine to 6 of copper and 6 of water.

It tinges the blowpipe flame a bright green or blue, and gives off fumes of muriatic acid; on charcoal, the copper is reduced to the metallic state.

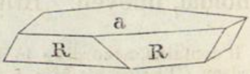
Obs. This species was originally found in the state of sand in the Atacama desert, between Chili and Peru. It is said to occur also at Remolinos, in Chili, and in veins in the district of Tarcpaca. It also invests some of the lavas of Vesuvius, being formed by the action of the volcano; Schwarzenberg, in Saxony, is another reported locality.

It is ground up in Chili, and sold under the name of Arsenillo, as a powder for letters.

COPPER MICA. CYPRALUS FOLIACEUS.

Rhombohedral Euchlore-Mica, *M.* Prismatic Copper Mica, *J.* Rhomboidal Arsenate of Copper, *P.* Kupfer Glimmer, *W.* and *L.* Terhydrous Diarsenate of Copper, *Thom.*

265. *Primary form:* an acute rhombohedron; R : R=69° 30′. *Secondary form:* R : a=108° 40′. *Cleavage* highly perfect parallel to the plane a, whose surface is sometimes striated in triangular directions. It is said also to occur massive.



H.=2. G.=2·5488, Bournon. *Lustre* of a, pearly, of the other faces, vitreous. *Streak* somewhat paler than the color. *Color* emerald or grass-green. *Fracture* scarcely observable. Sectile.

It contains, according to Vauquelin and Chenevix,

Oxyd of Copper	39·00	58·00
Arsenic Acid	43·00	21·00
Water	17·00=99, V.	21·00=100, C.

It decrepitates in the blowpipe flame, loses its color and transparency, emits arsenical fumes, and fuses into a black globule, after forming a black spongy scoria.

OBS. The copper mines of Tingtang, Wheal Gorland, and Wheal Unity, near Redruth, are its principal localities in Cornwall. It is stated to have been observed in minute crystals in Herrengrund, in Hungary.

COPPER FROTH. CYPRALUS DECREPITANS.

Prismatic Euchlore-Mica, *M.* Cupriferous Calamine, *P.* Zinc Hydraté Cupriferè, *Levy.* Kupferschaum. Copper Schaum, and Hydrous Subbisesquarseniate of Copper, *Thom.* Borodiglione. Pharmacosiderite. Kupaphrite.

266. *Primary form:* a right rhombic prism. *Secondary form:* the primary, with the acute lateral edges truncated. *Cleavage* parallel with P perfect. Surface M with horizontal striæ.

H.=1—1·5. G.=3·098. *Lustre* of P pearly, of other faces vitreous. *Streak* a little paler than the color. *Color* pale apple-green, and verdigris-green, inclining to sky-blue. Translucent—subtranslucent. *Fracture* not observable. Very sectile. Thin laminæ are flexible.

It contains, according to Kobell's analyses, (Poggendorf's Annalen, xviii. 253,) of specimens from Falkenstein, in the Tyrol,

Arsenic Acid	25·01	25·366
Oxyd of Copper	43·88	43·660
Water	17·46	19·824
Carbonate of Lime	13·65=100.	11·150=100.

It decrepitates briskly in the blowpipe flame, throwing off fine fragments, which tinge the flame green, blackens, and fuses into a steel-gray globule, not crystalline on its suface. On charcoal, it emits moisture quietly, and after a long continuance of the blowpipe heat, swells a little from the extrication of the vapor of arsenic. With carbonate of soda, an imperfectly fluid mass is obtained, which contains a white metallic nucleus.

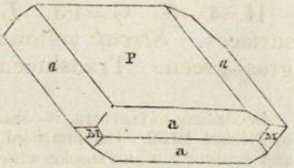
Obs. This mineral usually occurs in the cavities of calamine, calc spar, or quartz, and accompanied by other ores of copper, appearing in small aggregated and diverging fibrous groups of a pale-green color, and possessing a delicate silky lustre. It has been observed in the Bannat; at Libethen, in Hungary; Nerzschinsk, in Siberia; Schwartz, in the Tyrol; Saalfield, in Thuringia; and Matlock, in Derbyshire.

BROCHANTITE.

Levy, Ann. of Phil. VIII. 241. 1824.

267. *Primary form:* a right rhombic prism; M : M=114° 20′. *Secondary form:* the annexed figure; P : *a*=148° 30′, *a* : *a* (over P) =117°, a : a (adjacent planes) =150° 30′, P : a =104° 45′. Surface M blackish, and dull. *Cleavage* in traces parallel with M.

H.=3·5—4. G.=3·7—3·8. *Lustre* vitreous. *Color* emerald-green. Transparent.



According to Children, (Ann. of Phil., 2d ser., viii. 241,) it consists of Sulphuric Acid, Oxyd of Copper, and a little Silica, or Alumina. It dissolves in muriatic acid, and blackens before the blowpipe, without fusing.

A mineral from Rezbanya, in Hungary, analyzed by Gustav Magnus, of Berlin, appears to be closely allied to this species. He obtained for its composition Sulphuric Acid 17·426, Oxyd of Copper 66·935, Water 11·917, Oxyd of Tin 3·145, Oxyd of Lead 1·048. With this species, must also be united the *Konigine* of Levy.

Obs. It occurs in small but well defined crystals, with malachite, and native copper, at Ekatherinenburg, in Siberia. The Konigine was found at the same locality.

VELVET COPPER ORE.

Cuivre Velouté, *Levy*. Kupfersammterz.

268. Occurs in short delicate fibres, diverging from a centre, and gregagated in spherical globules. *Color* a fine smalt-blue.

Obs. It occurs sparingly at Moldawa, in the Bannat, coating the cavities of an earthy oxyd of iron. From its rarity, the characters of the species have not been accurately determined.

NICKEL GREEN. NICCALUS PRASINUS.

Diarsenate of Nickel, *Thom.*

269. In capillary crystals; also massive.

Soft. *Color* a fine apple-green. *Streak* greenish-white. *Fracture* uneven, or earthy.

According to Berthier, (Ann. de Ch. et de Ph. xiii.,) it contains

Arsenic Acid	37·29	36·8
Oxyd of Nickel	36·49	36·2
Water	26·22	25·5
Oxyd of Cobalt	——=100.	2·5=100.

Darkens in color before the blowpipe. On charcoal, it gives out the odor of arsenic, and in the inner flame of the blowpipe yields a metallic button.

Obs. It occurs on white nickel at Allemont, in Dauphiny, and is supposed to result from the decomposition of this ore.

HERRERITE. Niccalus Herreri.

270. Massive; reniform. *Cleavage* in three directions, indicating a rhombohedral primary. Surface curved.

H.=4—5. G.=4·3. *Lustre* vitreous to pearly; shining on fresh surfaces. *Streak* yellowish-gray. *Color* pistachio,- emerald-, and grass-green. Translucent.

According to Herrera, it contains Carbonic Acid 31·86, Tellurium 55·58, Peroxyd of Nickel 12·32. On charcoal, it becomes gray under the action of the blowpipe, and evolves a white smoke which adheres to the charcoal. In the reducing flame it is changed to a beautiful grass-green. Heated in an open tube, it gives an abundant smoke, which adheres to the glass, and on examination with a microscope, appears to be composed of innumerable white transparent globules.

Obs. It occurs at Albarradon, in Mexico, in transition limestones, in a metallic vein, consisting chiefly of ores of lead, native silver, horn silver, and iodic silver.

URANIC OCHRE. Uranalus ochraceus.

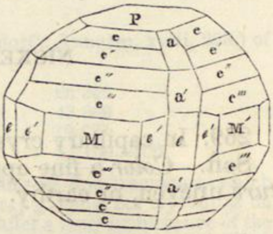
271. Earthy and pulverulent. *Color* sulphur-yellow, citron-yellow to brownish or reddish-yellow. When gently heated, it becomes orange-yellow.

It is believed to be Carbonate of Uranium. It effervesces in acid, yielding a yellow solution, which affords a brown precipitate with prussiate of potash.

Obs. It accompanies pitchblende, in Cornwall, and in Bohemia.

URANITE. Uranalus quadratus.

Pyramidal Euchlore-Mica, *M.* Pyramidal Uranite, *J.* Uran Mica. Cupreo-phosphate of Uranium, *Thom.* Chalcolite-Uranglimmer, *W.* Uranoxyd, *Haus.* Urane Oxydé, *H.*



272. *Primary form:* a right square prism. *Secondary:* similar to figs. 52 and 53. Pl. I.; also the annexed figure, P : e=145° 32′, P : e′=140° 40′, P : e″=137° 10′, P : e‴=111° 50′, P : a′=134°, Phillips. *Cleavage* parallel to P highly perfect; traces of *e*. Surface P smooth, M rough.

H.=2—2·5. G.=3·12, Champeaux. *Lustre* of P pearly, of other faces adamantine.

Streak somewhat paler than the color. *Color* emerald-green, grass-green, sometimes leek-green, apple-green or siskin-green; also gold-yellow, and lemon-yellow. Transparent—subtranslucent. *Fracture* not observable. Sectile. Laminæ brittle and not flexible. In this respect, this mineral differs from some green varieties of mica which it sometimes resembles.

It contains according to Berzelius, and R. Phillips,

	Cornwall.	Autun.	Cornwall.
Phosphoric Acid	14·62	14·96	16·0
Oxyd of Uranium	62·52	64·03	60·0
Oxyd of Copper	8·12	——	9·0
Water	14·74	15·04	14·5
Lime	——	5·97	——
Silica	——=100, B.	——=100, B.	0·5=100, P.

Specimens from Cornwall usually exhibit traces of arsenic and fluoric acids; those from Autun, of fluoric acid and ammonia.

Before the blowpipe, *per se*, it becomes yellow and opaque. It intumesces on charcoal, loses about one third by ignition, and fuses into a black globule, exhibiting traces of crystallization upon the surface. With borax, it forms a yellowish-green glass.

In nitric acid it dissolves without effervescence, forming, when the acid is saturated and the mineral is pure, a lemon-yellow solution.

Obs. Uranite is found with other ores of uranium, associated with silver, tin, and iron ores; occasionally also in beds.

Gunnis Lake formerly afforded splendid crystallizations of this mineral; and also more latterly, Tincroft, and Wheal Buller, near Redruth, in Cornwall. The siskin-green variety occurs in granite veins at St. Symphorien, near Autun, and at St. Yrieix, near Limoges, in France. It occurs also in the districts of Schneeburg and Johanngeorgenstadt.

ORDER III. CERATINEA.

HORN SILVER. CERATUS CUBICUS.

Hexahedral Pearl-Kerate, *M.* Muriate of Silver. Chlorid of Silver. Hornerz, *Wern.*, *Hoff.* Hornsilber, *Haus.* Argent Muriaté, *H.*

273. *Primary form:* the cube. *Secondary forms:* figs. 2, 3, 4, 5, 6, 7, Pl. I. *Cleavage* none. *Imperfect crystallizations:* usually a strongly coherent granular structure, rarely columnar, or bent columnar; often in crusts.

H.=1—1·5. G.=5·552. *Lustre* resinous, passing into adamantine. *Streak* shining. *Color* pearl-gray, passing into lavender-, and violet-blue; also into grayish-, yellowish-, and greenish-white, and into siskin-, asparagus-, pistachio-, and leek-green. Becomes brown on exposure. Translucent—feebly subtranslucent. *Fracture* more or less perfectly conchoidal. Sectile.

Klaproth analyzed a specimen from Saxony, and another from Peru, and obtained the following composition: (Beitrage, i. 132, and iv. 10.)

Silver	67·75	76
Chlorine	21·50	24
Oxyd of Iron	6·00	—
Alumina	1·75	—
Sulphuric Acid	0·25=97·25.	—=100.

The flame of the candle is sufficient to produce fusion, and an emission of fumes of muriatic acid. On charcoal it is easily reduced; and also if rubbed with a plate of moistened zinc or iron, the surface of zinc or iron becomes covered with a thin film of metallic silver. It is not soluble in nitric acid or water.

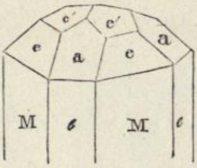
OBS. Horn silver occurs in veins in clay slate, accompanying other ores of silver, and usually only in the higher parts of these veins. It also has been observed with ochry varieties of brown iron ore; also with several copper ores, calcareous and heavy spar, &c.

The largest masses, and particularly those of a green color, are brought from Peru and Mexico, where it is associated with native silver. It was formerly obtained in the Saxon mining districts of Johanngeorgenstadt and Freiberg, but is now rare. A mass, weighing six and three-quarter pounds, from this locality, is now in the Zwinger collection, at Dresden. It also occurs in Siberia; at Kongsberg, in Norway; in Cornwall, and at Huelgoet, in Brittany: also at Andreasberg, in the Hartz, occurs an earthy variety, called by the Germans, Buttermilcherz, which, according to Klaproth, contains Silver 24·64, Muriatic Acid 8·28, Alumina 67·08.

Horn Silver, when found in large quantities, is valuable as an ore of silver.

HORN QUICKSILVER. Ceratus quadratus.

Pyramidal Pearl-Kerate, *M.* Muriate of Mercury. Dichlorid of Mercury, *Thom.* Native Calomel, *Haid.*



274. *Primary form:* a right square prism. *Secondary form:* M : *e*=135°, M : e=158°, M : e′=129° 32′, *e* : a=120° 5′. *Cleavage* parallel with M very indistinct. Occurs also in crystalline coats, and of a granularly massive structure.

H.=1—2. G.=6·482, Haidinger. *Lustre* adamantine. *Streak* white. *Color* yellowish-gray, or ash-gray, also grayish and yellowish-white. Translucent—subtranslucent. *Fracture* conchoidal. Sectile.

Klaproth found it to contain Oxyd of Mercury 76, Hydrochloric Acid 16·4, Sulphuric Acid 7·6. Artificial calomel is composed of Mercury 84·74, and Chlorine 15·26; or two parts of Mercury to one of Chlorine.

It is entirely volatilized on charcoal before the blowpipe, if pure, and is thus distinguished from the preceding species. It is insoluble in water.

Obs. This mineral is of even rarer occurrence than horn silver. Its principal locality is Moschellandsberg, in Deuxponts, where it occurs coating the cavities of a ferruginous gangue, and associated with cinnabar. The crystals are often large and well defined. It has also been observed at the quicksilver mines of Idria, in Carniola; at Almaden, in Spain; and at Harzowitz, in Bohemia.

IODIC SILVER. Ceratus foliatus.

275. Structure foliated.

Soft. *Lustre* resinous. *Streak* semi-metallic. *Color* white—yellowish-green, with some black portions of metallic silver, which have a silver-white color when polished. Translucent. Plates flexible.

Some experiments by Vauquelin, determined that it contained Silver, Lead, Iron, Iodine, and Sulphur.

Before the blowpipe, on charcoal, it fuses immediately, producing a vapor which tinges the flame of a fine violet color, and affording some globules of silver.

Obs. Iodic Silver occurs in thin veins in steatite, at Abarradon, near Mazapil, in Mexico. It was first recognized by Vauquelin, (Ann. de Ch. et de Ph. xxix. 99,) among some specimens which M. Joseph Tabary brought from that country.

ORDER IV. OSMERINEA.

HALLOYLITE. Hydrolus cerinus.

Halloysite, *Berthier*. Ann. de Chim. et de Ph. XXXII. 334, and IX. 3d ser. 500.

276. Compact, and having the aspect of steatite.

Yields to the nail, and may be polished by it. G.=1·8—2·1. *Lustre* waxy. *Streak* white. *Color* white, generally with a bluish tint. Subtranslucent. *Fracture* conchoidal, like that of wax. Adheres to the tongue. When small pieces are put in water, they become transparent, like hydrophane; air is disengaged, and they increase in weight.

It contains, according to Berthier,

	Liege.	Bayonne.
Silica	39·5	46·7
Alumina	34·0	36·9
Water	26·5=100.	16·0=99·6.

When calcined, it loses one-fourth of its weight, and becomes milk-white. It is readily dissolved by sulphuric acid, which unites with the alumina, and leaves the silica in a gelatinous state.

Obs. Occurs with ores of zinc, iron, and lead, near Liege, and Lamur. Also at Housscha, near Bayonne. It was first described by Berthier, and named in compliment to its discoverer, M. Omalius d' Halloy. According to Brongniart, it results from the decomposition of a graphic granite.

The *Lenzinite* of John, from Kall, in the Eifeld, in Prussia, the *Severite*, of Dufour, from St. Sever, in France, and the *Pholerite*, which appears in the form of soft nacreous scales of a white color, from the coal formation of Fins, in the Dep. of Alliesin, France, are similar compounds with the above, and probably mere varieties of it.

KOLLYRITE. Hydrolus argilliformis.

Alumine Hydraté Silicifère, *Levy*. Hydrous Trisilicate of Alumina, *Thom*.

277. Massive; resembling clay in its general appearance.

Light and friable; H. sometimes as high as 3. *Lustre* of the surface of fracture vitreous. *Color* snow-white. Translucent—opaque. Adheres to the tongue. Hardly soils the fingers. *Fracture* earthy.

According to Klaproth, (Beitrage, i. 257,) and Berthier, (Ann. des Mines, ii. 476,) it contains,

	Schemnitz.	Esquerre.
Silica	14	15·0
Alumina	45	44·5
Water	42=101, K.	40·5=100, B.

Before the blowpipe it remains unaltered. When calcined, it gives off much water, separates into columnar masses like starch, and loses weight; it then will absorb water with a slight noise, and become partly transparent. Dissolves without effervescence in nitric acid, forming a saline magma without crystals.

Obs. This species was discovered by M. Lelievre, on the mountain Esquerre, in the French Pyrenees. It was afterwards found in the Shaft of Stephanus, at Schemnitz, in Hungary.

SCARBROITE. Hydrolus adhærens.

278. Massive. G.=1·48. Without *lustre*. *Color* pure white. *Fracture* conchoidal. *Odor* argillaceous when breathed on. Highly adhesive to moist surfaces; admits of being polished by the nail. When immersed in water, it does not become translucent or subtranslucent, neither does it fall to pieces; but it increases in weight.

It contains, according to Vernon, Alumina 42·75, Silica 7·90, Water 48·55, Peroxyd of Iron 0·80=100.

Obs. It occurs between laminæ of oxyd of iron, in a calcareous rock on the coast of Scarbro.

PYRARGILLITE. Hydrolus pyrosmicus.

Nordenskiold, Jahresbericht, 1833, p. 174.

279. Massive; occasionally presenting the form of a four sided prism, with truncated angles or beveled edges; frequently traversed with minute chlorite particles. *Color* partly black and shining, or bluish and dull. Emits an argillaceous odor.

Consists of Silica 43·93, Alumina 28·93, Oxyd of Iron 5·30, Magnesia, with a little Oxyd of Manganese 2·9, Potash 1·05, Soda 1·85, Water 15·47=99·43. It is entirely soluble in nitric acid.

Obs. Occurs in granite, near Helsingsfors, in Finland. It was named as above by Nordenskiöld, on account of its argillaceous odor when heated, from πῦρ, *fire*, and ἄργιλλος, *clay*.

GIBBSITE. Hydrolus Gibbsianus.

280. Occurs in stalactitic forms, often irregular and small, forming a tuberose surface. Structure fibrous, the fibres radiating from the central column.

H.=3—3·5. G.=2·091, Thomson; 2·4, Torrey. *Lustre* faint. *Streak* white. *Color* grayish, or greenish-white. Translucent.

According to Dr. Torrey, (New York Med. and Phys. Journ. i. 68,) it is composed of Alumina 64·8, Water 34·7. Dr. Thomson gives the following composition as the result of his analysis, which may have been obtained from a less pure specimen: Alumina 54·91, Water 33·60, Silica 8·73, Peroxyd of Iron 3·93=101·17.

Obs. It has been found in small quantities in a bed of brown iron ore at Richmond, Mass., where it was first discovered by Dr. Emmons.

ALLOPHANE. Hydrolus tinctus.

Riemannite.

281. Reniform and massive; sometimes presenting traces of crystallization on the surface; occasionally almost pulverulent.

H.=3. G.=1·852—1·889. *Lustre* vitreous, or resinous; splendent and waxy internally. *Streak* white. *Color* pale-blue; sometimes green, brown, or yellow. Translucent. *Fracture* conchoidal, and shining. Very brittle.

The following is its composition, according to Stromeyer (Gilbert's Annalen, liv. 120,) Walchner, and Berthier, (Ann. des Mines, 1836, ix. 499.)

					Transparent variety.	Pulverulent variety.
Alumina	32·202		38·76		29·2	34·2
Silica	21·922		24·11		21·9	26·3
Water	41·301		35·75		44·2	38·0
Carb. of Copper	3·058	Ox. Cop.	2·33	Mixed clay,	4·7	1·5
Lime	0·730		——		——	——
Sulph. of Lime	0·517		——		——	——
Hyd. Perox. Iron	0·270=100, S.		——=100·95, W.		——=100, B.	——=100, B.

The heat of the blowpipe speedily deprives it of its color, and renders it opaque and pulverulent, producing at the same time some intumescence, and tinging the flame green. It does not fuse *per se*, but with borax melts readily into a transparent and nearly colorless glass. It forms a jelly with acids.

Obs. It occurs, lining irregular cavities in a kind of marl, at Saalfield, in Thuringia; at Schneeberg, in Saxony; and elsewhere. The specimens analyzed by Berthier, occur abundantly in the chalk of Beauvais, France; they presented a honey-yellow color. It was first observed by Messrs. Riemann and Roepert, and hence has been called *Riemannite*, The first analysis and description were made by Hofiman and Stromeyer, in 1816.

The name of this species is derived from αλλος, *other*, and φαινω, *to appear;* in allusion to its change of appearance under the blowpipe.

BOLE.

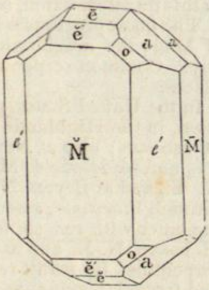
282. Massive; structure impalpably granular.

G.=1·6—1·97. Soft, or very soft. *Lustre* dull, or faintly glimmering. *Streak* shining, or resinous. *Color* brown, yellow, or red. Subtranslucent—opaque. *Fracture* perfectly conchoidal. *Feel* greasy. Adheres to the tongue. Thrown into water, it emits a crackling noise, and falls to a powder.

Obs. Bole occurs in irregular beds, or disseminated nodules in wacke and trap tufa, in Habitschwald, in Hessia; at Striegau, in Silesia; and at Sheibenberg, in Saxony.

SERPENTINE. Ophitis communis.

Hydrous Sesquisilicate of Magnesia, *Thom.* Marmolite* of *Nuttall.* Deweylite, *Emmons.* Οφιτης, Ophitis, *Vetruvius.* Talcum Serpentinum, *Linn.*, *Wern.*



283. *Primary form:* a right rectangular prism. *Secondary form:* $\bar{M} : e'$=131° 14½′, $e' : e'$=82° 27′, $\breve{M} : \breve{e}$=115° 44′, M : $\breve{e}'$=133° 58′, a : a=105° 26′. *Cleavage* indistinct parallel to $\breve{M}$ and e', apparent only in a strong light. Occurs usually massive; composition granular and impalpable. Some varieties have a lamellar structure.

H.=3—4. G.=2·507; 2·591, Thomson. *Lustre* resinous—greasy; low degrees of intensity. *Streak* white, slightly shining. *Color* leek-green and blackish-green; occasionally, lighter shades of oil and siskin-green colors; none bright. On exposure, it often becomes yellowish-gray. Translucent—-opaque. *Fracture* conchoidal or splintery. Sectile.

It contains, according to Lychnell, Hisinger, Mosander, Vanuxem and Shepard,

Silica	41·58	41·95	43·07
Magnesia	42·41	40·64	40·37
Water	11·29	11·68	12·45
Lime	——	——	0·50
Alumina	trace	0·37	0·25
Protoxyd of Iron	2·17	2·22	1·17
Carbonic Acid	2·38=99·83, L.	3·42=100·28, L.	——=97·81, H.

Silica	42·34	42·69	40·08
Magnesia	44·20	40·00	41·40
Water	12·38	16·45	15·67
Protoxyd of Iron	0·18	1·00	2·70
Carbonic Acid	0·87=99·97, M.	——=100·14, V.	——=99·85, S.

The first is an analysis of a yellow translucent serpentine from Sjögruvan, in Svärdsjo. The second, of a precious serpentine from Skyttgruvan, at Fahlun; the third, from the same locality; the fourth, of an almost colorless variety from the limestone quarry of Gullsjo, in Wermeland; the two following, of marmolite, from Hoboken; the last of the same variety from Blanford.

On exposure to heat it gives off water, assumes a brownish red-color, but fuses with difficulty and only on the edges. With borax it forms a green-glass, which becomes nearly white on cooling. With carbonate of soda, it fuses into a yellowish-brown enamel

Obs. The translucent varieties of serpentine have been distinguished by the epithet *precious* or *noble serpentine.* *Common* serpentine has a more earthy aspect, and is only subtranslucent or opaque. The marmolite variety has a lamellar structure,

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* Silliman's Am. Journal, iv. 18.

and presents a dark or light-green, and greenish or bluish-white color. Its hardness is 2·5—3. Serpentine frequently forms mountain masses in primitive regions.

Dark-green opaque crystals of serpentine have been observed in the Fassa valley, Tyrol; their form is, however, usually so imperfect, that but a few of the faces in the above figure are presented in the same individual. They have been considered pseudomorphs, and quite lately, M. A. Quernstedt, (Annalen der Physik, etc., 1835, No. 11,) has advanced the hypothesis, and supported it by very plausible arguments, that they are pseudo-crystals of chrysolite. For an explanation of the probable process in this transformation, see § 55.

The finest precious serpentines come from Fahlun and Gulsjo, in Sweden; the Isle of Man; the neighborhood of Portsoy, in Aberdeenshire; Corsica; Siberia; Saxony. Common serpentine occurs at Lizzard's Point, in Cornwall, and many other places.

In the United States, precious serpentine, of a light-green color, occurs at Phillipstown, in the Highlands, N. Y., where it is frequently intersected with narrow seams of asbestus; also at Newburyport, Mass., and at Newport, R. I. Near New Fane, Vt., and Middlefield, Mass., there are extensive formations of serpentine. At Amity, N. Y., and at Bryan, N. J., crystallized varieties have been observed disseminated through limestone, associated at the former place with black spinel and Ilmenite; at the latter with red spinel. The marmolite variety occurs with native magnesia, at Hoboken, N. J., and at Blandford, Mass., with schiller spar. A compact variety of serpentine, in many respects resembling the marmolite, has been found in seams and irregular veins, at Middlefield, Mass., at Cooptown, Hartford Co., Md., and at Amity, N. Y. Specimens of precious serpentine are also obtained at the New Haven marble quarry, where it occurs in the verd antique marble of that region.

A mineral has been described by Hausmann under the name of *picrolite*, whose composition is very similar to that of serpentine. We would, therefore, connect it with this species, till farther crystallographic observations show an identity to be impossible. Its description is as follows: structure massive or fibrous. H.=3·5—4; color leek-green, passing into yellow. Streak a little shining—subtranslucent to opaque. The following are a few of its analyses.

	Stromeyer.	Lynchnell.	Almroth.
Silica	41·660	40·98	40·04
Magnesia	37·159	33·44	38·80
Water	14·723	12·86	9·08
Alumina	——	0·73	——
Protox. Iron	4·046	8·72	8·28
Protox. Mang.	2·247	——	——
Carbonic Acid	——=99·835.	1·73=98·46.	4·70=100·90.

Serpentine admits of a high polish, and from its softness, may be turned in a lathe. It is, therefore, sometimes employed as a material for ornaments, as vases, boxes, &c. At Zöblitz, in Saxony, Bayreuth, and in Franconia, several hundred persons are employed in this manufacture.

Chromate of iron is usually found disseminated through serpentine, giving it frequently a variegated appearance, somewhat similar to the skin of a snake. From this peculiarity it received its name, *serpentine* and *ophite*.

AGALMATOLITE. OPHITIS FIGULARIS.

Figure Stone. Bildstein, *W.* and *L.* Koreite. Lardite. Pagodite. Talc Graphique, *H.*

284. Massive; structure sometimes slaty.

H.=2; yields to the nail. G.=2·815, Klaproth; 2·895, Thomson. *Lustre* waxy, nearly dull. *Streak* white or grayish-white, somewhat shining. *Color* white, greenish, grayish, yellowish, brownish; rarely also pink and mottled. Subtranslucent—nearly opaque. *Fracture* coarse splintery. Sectile. *Feel* greasy.

It contains

	Vauquelin	Klaproth.	John.	John.	Thomson.
Silica	56	55	55	51·5	49·816
Alumina	29	33	30	32·5	29·596
Lime	2	—	1·75	3·9	6·000
Protox. Iron	1	0·5	1	1·75	1·500
Protox. Mang.	—	—	trace.	1·2	——
Potash	7	7	6·25	6·0	6·800
Water	5	3	5·5	5·13	5·5

The specimens analyzed by the above chemists were from China. Klaproth obtained very nearly the same result with a specimen from Nagyag.

Before the blowpipe it whitens, but is infusible. With borax, it affords a colorless glass. It dissolves in part in sulphuric acid, leaving a siliceous residue.

Obs. Agalmatolite occurs principally in China, where it is carved into grotesque images or pagodas, and chimney-piece ornaments. It is found also at Nagyag, in Transylvania; in Norway and Wales, in less characteristic varieties.

KEROLITE. Ophitis reniformis.

285. In kidney-shaped or reniform masses. Structure lamellar and compact.

H.=2—2·25. G.=2—2·2. *Lustre* vitreous, or resinous. *Streak* white. *Color* white, green. Transparent—translucent. *Fracture* conchoidal. *Feel* greasy; does not adhere to the tongue.

It contains, according to Pfaff,

Silica	37·95
Alumina	12·18
Magnesia	16·02
Water	31·00=97·15

Kerolite occurs at Frankenstein, in Silesia; and at Zöblitz, in Saxony; associated at each locality with serpentine.

A variety, *Dermatin*, is described by Briethaupt, as occurring on serpentine at Waldheim, in Saxony, in reniform, rarely globular masses, and also in thin coatings and crusts. H.=2. G.=2·136. *Lustre* resinous. *Streak* straw- or pea-yellow. *Color* different shades of green; also dark liver-brown. Subtranslucent. *Fracture* conchoidal. *Feel* greasy. *Odor*, when moistened, argillaceous.

KILLINITE.

286. Occurs in irregular thin crystals, apparently rectangular prisms; also in crystalline masses.

H.=4. G.=2·65—2·75. *Lustre* vitreous, weak. *Streak* yellowish-white. *Color* greenish-gray, often tinged brown by oxyd of iron, or from decomposition. Faintly translucent.

It contains, according to Barker, Lehunt, and Blythe,

	Barker.	Lehunt.	Blythe.
Silica	52·49	49·08	47·925
Alumina	24·50	30·60	31·041
Potash	5·00	6·72	6·063
Water	5·00	10·00	10·000
Protox. Iron	2·49	2·27	2·328
Lime	——	0·68	0·724
Magnesia, with Mang.	——	1·08	0·459
Protox. Manganese	0·75=90·24.	——=100·43.	1·255=99·795.

It bleaches before the blowpipe, intumesces, and fuses with little difficulty into a white enamel; with carbonate of soda, it fuses into a transparent glass.

Obs. Killinite occurs at Killiney Bay, near Dublin, where it exists in granite veins, near their junction with mica slate. Its associate minerals at the locality are spodumene, quartz, feldspar, and garnet. Its crystals have sometimes a length of four inches or more, and a breadth and thickness of about an inch. They closely resemble spodumene in their external appearance.

PYRALLOLITE.

Tersilicate of Magnesia, *Thom.*

287. *Primary form:* an oblique rhomboidal prism; P : M=140° 49′, M : T=94° 36′. *Secondary form:* with the obtuse lateral edge replaced. *Cleavage* distinct parallel to M and T; also in the direction of $\bar{e}$. Usually massive, with a granular composition.

H.=3·5—4. G.=2·555—2·594. *Lustre* dull, sometimes slightly resinous. *Streak* white. *Color* white, sometimes greenish. Subtranslucent—opaque. *Fracture* earthy.

The following composition was obtained by Nordenskiöld:

Silica	56·62
Magnesia	23·38
Alumina	3·38
Lime	5·58
Protoxyd of Mang.	0·99
Perox. of Iron	0·09
Water	3·58
Bitumen, and loss	6·38=100.

Before the blowpipe, it first becomes black, then white again; afterwards it intumesces, and melts on the edges into a white enamel. With borax, it yields a transparent glass. With soda, it fuses easily into a transparent yellowish-green glass. With biphosphate of soda, there is a slight effervescence, but fusion is obtained with great difficulty.

Obs. The only known locality of pyrallolite is at Storgord, in the parish of Pargas, in Finland, where it occurs in a limestone bed, with feldspar, pyroxene, scapolite, moroxite, and sphene. It was discovered by Count Steinheil, and first described and analyzed by Nordenskiöld. Its name is from the Greek πυρ, *fire*, αλλος, *other*, and λιθος, *stone*, in allusion to the change of color it experiences in the heat of the blowpipe.

HYDROUS SILICATE OF MAGNESIA.

288. There are several compounds which may come under the above general name, whose titles to the rank of species are not fully determined. They are as follow:

Sea Foam; called also *Meerschaum*, and *Magnesite*. The specimen from Coulommiers, thirty miles east of Paris, analyzed by Berthier, was soft, impressible by the nail; had a smooth and unctous feel, and a grayish-white, and occasionally slightly reddish color; when immersed in water, it imbibed it readily, and increased in bulk, and finally formed a soft paste, without plasticity, similar to jelly. It contained Silica 54, Magnesia 24, Water 20·1, Alumina 1·4. When heated, it loses its grayish or reddish tint, and becomes white.

Meerschaum of Thomson. It occurs at Eski Scheher, in Natolia, in a large fissure six feet wide in calcareous earth. H.=2. *Lustre* dull. *Color* white. Opaque. *Fracture* fine, earthy. Surface smooth. It contains Silica 42, Magnesia 30·5, Water 23, Lime 2·3, Alumina with a trace of Manganese 2=99·8. Heated, it gives out water and a fetid odor, becomes hard and perfectly white. It is employed for the manufacture of the bowls of Turkey tobacco pipes, and thus supports a monastery of Dervises, established near where it is dug. The workmen assert that it grows again in the fissure, and puffs itself up like froth.

Quincite, of Berthier, is a red colored substance, which is disseminated through a limestone deposit, extending from Mehun, in France, beyond the village of Quincey. It may be obtained pure from the limestone, by treating it with acetic or dilute muriatic acid. It is in light particles of a carmine-red color; this color is removed by heat, which at the same time evolves water. It contains Silica 54, Magnesia 19, Protoxyd of Iron 8, Water 17=98. It is acted on imperfectly by the strong concentrated acids, which dissolve the magnesia and iron, and leave the silica in a gelatinous state.

PINITE. Stylus hexagonus.

Micarelle, *Kirwan*.

289. *Primary form:* a hexagonal prism. *Secondary form:* the primary with its lateral edges truncated or beveled; often the bevelment is so far extended as to produce twelve sided prisms. *Cleavage* is sometimes apparent parallel to the base of the prism; usually very indistinct.

H.=2·25. G.=2·7575, C. G. Gmelin, a variety from St. Pardoux; 2·782, Haidinger, crystallized specimen from France. *Lustre* resinous, inclining to pearly; glistening. *Streak* white. *Color* gray, grayish-green, or brown. Opaque. *Fracture* uneven.

It contains, according to Gmelin's analysis of a specimen from St. Pardoux,

Silica	55·964
Alumina	25·480
Potash	7·894
Soda	0·386
Peroxyd of Iron	5·512
Magnesia, with Manganese	3·760
Water	1·410=100·406.

Before the blowpipe it whitens and fuses on the edges, but does not melt. With borax it yields, after a continued blast, a transparent globule, colored by iron.

A variety from Saxony is entirely unalterable under the blowpipe. It also differs in composition, containing, according to Klaproth, Silica 29·5, Alumina 63·75, and Oxyd of Iron 6·75. No distinction has been noticed, however, in their forms.

Obs. This species was distinguished by Werner, and named from the Pini gallery in the Schneeberg mines, where it was first discovered. Prof. Shepard has united it with Mica, as a decomposed variety of this species. Its usually difficult cleavage seems, however, to be inconsistent with the supposition that it could arise from the alteration of so fissile a mineral as mica. Still there is much doubt connected with its specific nature.

Gieseckite appears to be but a variety of Pinite. It occurs in hexagonal prisms of a gray, green, or brown color; imperceptible cleavage, resinous lustre, and white streak. According to Stromeyer, it contains Silica 46·07, Alumina 33·82, Magnesia 1·20, Oxyd of Iron 3·35, Oxyd of Manganese 1·15, Potash 6·20, Water 4·88=96.67.

It occurs imbedded in decomposed feldspar-porphyry, at the Puy-de-Dome, in Auvergne; in granite, at Schneeberg, in Saxony; at Linsenz, in the Tyrol; and in primitive rocks in Cornwall and Aberdeenshire. Gieseckite was brought from Akulliarasiarsuk, in the district of Julianshope, in Greenland, by the late Sir Charles Giesecké, where it occurs imbedded in compact feldspar or quartz.

At Lancaster, Mass., this species occurs imbedded in quartz, associated with Andalusite; also at Haddam, Conn., with chrysoberyl, garnet, turmaline, &c.

FAHLUNITE. Stylus acrotomus.

Triclasite, *H.* Tricklasite, *P.* Fahlunite, *Hisinger.*

290. Occurs in six sided prisms. *Cleavage* perpendicular to the axis, or parallel to the base of the prism.

H.=3. G.=2·6—2·7. *Lustre* resinous or vitreous. *Streak* grayish-white. *Color* green, passing into dark-brown and black. Opaque.

It contains, according to Hisinger and Wachtmeister,

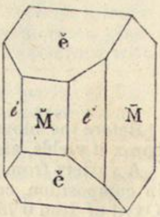
Silica	46·79	44·60
Alumina	29·73	30·10
Magnesia	2·97	6·75
Protoxyd of Iron	5·01	3·86
Oxyd of Manganese	0·43	2·24
Water	13·50=101·43, H.	9·35=96·90, W.

Before the blowpipe it becomes gray, and melts on its thinnest edges. It dissolves slowly with borax, yielding a glass slightly colored with iron.

Obs. It occurs in the mine of Eric Matts, near Fahlun, in Sweden, where it is found both massive and crystallized, imbedded in chlorite slate, and associated with copper pyrites, galena, and dichroite. The crystals, from their highly perfect cleavage, almost invariably break in parallel position with the slate, and thus present only sections of their form.

PICROSMINE. Nematus rectangulus.

Dihydrous Bisilicate of Magnesia, *Thomson.*



291. *Primary form:* a right rectangular prism, as deduced from cleavage. *Secondary form:* M̆ : é=153° 26′, é : é=126° 52′, M̆ : ĕ=121° 6′, ĕ : ĕ (over M̆) =62° 11′. *Cleavage* parallel to M̄ perfect, to M̆ less so. Occurs also imperfectly crystalline, and composed of fine columnar or granular particles.

H.=2·5—3. G.=2·596—2·66. *Lustre* of M̄ pearly; of other planes, inclining to vitreous. *Streak* white and dull. *Color* generally greenish-white, sometimes dark green. Subtranslucent—opaque. *Fracture* uneven, scarcely perceptible; of imperfectly crystalline varieties, splintery.

According to Magnus, (Poggendorf's Annalen, vi. 53,) it contains

Silica	54·88
Magnesia	33·35
Alumina	0·79
Peroxyd of Iron	1·39
Protoxyd of Manganese	0·42
Water	7·30=98·13.

It is infusible *per se;* but gives out water, becomes first black, then white and opaque, and acquires a hardness equal to 5. It is soluble in salt of phosphorus, with the exception of a skeleton of silica. When heated with nitrate of cobalt, it assumes a pale red color.

Obs. Picrosmine has been found only at the iron mine of Engelsburg, near Presnitz, in Bohemia, where it is associated with magnetic iron ore. It resembles common asbestus in external appearance, but was distinguished from that mineral by Haidinger, who named it Picrosmine, from πικρὸς, *bitter*, and ὀσμὴ, *odor*, in allusion to the bitter and argillaceous odor of the moistened mineral.

OSMELITE. Nematus scopiformis.

292. In thin prismatic concretions, scopiformly or stellularly arranged. *Cleavage* in one direction.

H.=4—5. G.=2·79—2·83. *Lustre* between pearly and vitreous—of low intensity. *Color* grayish-white, inclining to smoke-gray; on exposure, becomes dark hair-brown. Translucent. *Feel* greasy. *Odor*, when breathed upon, argillaceous. In the mouth it feels as if about to dissolve, although no change takes place.

Obs. It occurs on calcareous spar, mixed with datholite in trachyte, at Niederkirchen, near Wolfstein, on the Rhine. It was first described by Breithaupt. Its name is derived from ὀσμὴ, *odor*.

NEMALITE. Nematus gracilis.

Nuttall, Silliman's Jour. IV. 19. Amianthoid Magnesite. Silicious Hydrate of Magnesia, *Thomson*, Roy. Soc. Trans. Ed. XI. 468

293. Fibrous; fibres slender, elastic, sometimes curved, easily separable.

H.=2. G.=2·353, Thomson; 2·44, Nuttall. *Lustre* silky, or pearly. Some decomposed varieties have an earthy appearance. *Streak* white. *Color* grayish or bluish-white, sometimes slightly yellowish.

It is composed, according to Thomson, of

Magnesia	51·721
Silica	12·568
Peroxyd of Iron	5·874
Water	29·666=99·829.

In the flame of a lamp the fibres become opaque and rigid, and assume a light brown tinge. In this state the mineral is easily reducible to a powder. When rubbed with a piece of iron, the mineral phosphoresces with a yellowish light.

Obs. Nemalite forms veins in the serpentine rocks at Hoboken, in New Jersey. The name is derived from νημα, *a thread*, in allusion to its fibrous structure.

NATIVE MAGNESIA. Margaritus magnesicus.

Native Hydrate of Magnesia, Bruce's Min. Journ. I. 26. Native Magnesia, *Cleav.* Magnésie Hydraté, *H.*

294. *Primary form:* tetraxonal. *Secondary form:* (primary?) a six sided prism. This form is of rare occurrence. Native mag-

nesia generally presents large foliated plates, easily separable. The planes of separation, or of cleavage, are parallel to the base of the hexagonal prism.

H.=1·5. G.=2·35, Haidinger. *Lustre* pearly. *Streak* white. *Color* white, inclining to gray, blue, or green. Translucent—subtranslucent. Sectile. Thin laminæ flexible.

It consists of

	Bruce.	Fyfe.	Vauquelin.	Stromeyer.		Thomson.
Magnesia	70	69·75	64·0	66·67	68·345	67·98
Water	30	30·25	29·0	30·30	29·902	30·96
Protox. Mang.	—	——	——	1·57	0·637	1·57
Protox. Iron	—	——	2·5	1·18	0·116	
Lime	—	——	——	0·19	——	——
Silica	—	——	2·0	——	——	——
	100	100·00	97·5	99·91	99·030	100·51

The first of the two analyses by Stromeyer, and that by Thomson, were of specimens from Swinaness. The others are analyses of Hoboken specimens.

Before the blowpipe it becomes opaque, loses weight, and is rendered friable, but does not fuse. It is entirely soluble in the acids without effervescence.

Obs. It occurs in considerable veins traversing serpentine, at Swinaness, in Unst, one of the Shetland isles; also in the same rock at Hoboken, N. J., opposite the city of New York, in veins which are sometimes an inch in width. This mineral was first discovered and described by the late Dr. Bruce, of New York.

TALC. Margaritus saponaceus.

Prismatic Talc-Mica, *M.* Green Earth. Chlorite. Steatite. Vermiculite.

295. *Primary form:* a right rhombic prism; M : M=120°. *Secondary form:* it occurs in rectangular prisms and hexagonal plates. *Cleavage* perfect parallel with P. *Imperfect crystallizations:* globular and stellated groups; also massive; structure granular, often impalpable. Occasionally the particles are strongly coherent, and the mineral has a slaty structure.

H.=1—1·5. G.=2·697—2·713. *Lustre* pearly. Some massive varieties but slightly pearly, or nearly earthy. *Streak* usually white; of some dark-green varieties, a little lighter than the color. *Color* apple-green, passing into white, sometimes silvery-white; also inclining to greenish-gray, and dark-green. Sometimes the laminæ are bright green, viewed perpendicular to the cleavage surface, and of a brown tinge, and less translucent at right angles with this direction. Subtransparent—subtranslucent. *Fracture* of highly crystalline varieties not observable. Sectile in a high degree. Thin laminæ easily flexible, but not elastic. *Feel* greasy.

Several varieties of this mineral are distinguished by different names:

Green Earth includes the bluish or dark-green masses, imbedded in or coating the cavities of amygdaloid: it is the *Talc Zographique* of Haüy. Chlorite, (χλορος, *green,*) is applied to the dark-green or brownish varieties; if lamellar in its structure, it is termed *Foliated Chlorite.* When the massive variety is slaty, it is named *Chlorite Slate. Earthy Talc,* or *Nacrite,* consists of loose, slightly cohering particles. *Indu-*

rated Talc includes the light colored, and somewhat slaty varieties of common talc, with a nearly compact texture. *Steatite* is applied to the coarse gray and grayish-green massive varieties, having a very greasy feel. The name is derived from στεαρ, *fat*. *Vermiculite* is a variety of steatite, composed of minute foliated crystals. On heating the mineral, worm-like projections dart out on every side. These projections are composed of the separated foliæ of the crystals, and the result is probably owing to the vaporization of water. Hence its name, from vermiculus, *a little worm*. *Pot Stone*, or *Lapis Ollaris*, includes the coarse granular specimens, of a dark color.

The following are a few of the analyses of the different varieties of this species, according to Vauquelin and Thompson:

	Foliated Talc.	Foliated Talc.	Chlorite.	Nacrite.	Green Earth.
Silica	62·0	62·588	26·0	50·0	52·0
Magnesia	27·0	30·528	8·0	——	6·0
Oxyd of Iron	3·5	3·848	43·0	5·0	23·0
Alumina	1·5	——	18·5	26·0	7·0
Water	6·0	3·400	2·0	——	4·0
Potash	——	——	2·0	17·5	7·5
Lime	——	——	——	1·5	——
	100·0, V.	100·364, T.	99·5, V.	100·0, V.	99·5, V.

	Talc Slate.	Steatite.	Steatite.	Vermiculite.
Silica	57·560	42·320	43·884	49·080
Magnesia	27·216	25·680	24·144	16·964
Oxyd of Iron	4·716	9·384	9·872	16·120
Alumina	1·720	4·680	——	7·280
Water	1·600	1·083	——	10·276
Lime	7·944	16·960	21·228	——
	100·756, T.	100·107, T.	99·128, T.	99·720, T.

Before the blowpipe, some varieties lose their color, and fuse with difficulty; others, (the green earth in particular,) change into a blackish scoria, and are infusible, owing probably to the absence of potash and magnesia in their constitution.

Obs. This species is very generally diffused in primitive countries, and in some of its varieties, especially common talc, potstone, chlorite slate, and steatite, forms extensive beds in primitive regions, which are the repositories of several mineral species, among which are rhomb spar, dolomite, (var. bitter spar,) magnetic iron, apatite, and hornblende. Green earth occurs only in amygdaloidal rocks. Nacrite has been observed in veins of lead.

Apple-green talc occurs in large foliated masses, in the island of Unst, one of the Shetland Isles; also in the Gruner mountain, in Saltzburg; and in the Vallais. Other foreign localities are, of *green earth*, the Faroe Islands, Iceland, and the Tyrol; of *potstone*, the Valais and Grisons, and Wald, in Styria; of *nacrite*, St. Gothard and Monte Baldo, near Verona. The *soapstone*, which forms a vein in serpentine, at Lizard Point, Cornwall, when first extracted, may be kneaded like dough, but on exposure loses part of its moisture, and becomes subtranslucent. The above analyses of steatite by Thomson, are of specimens from this locality. Singular pseudomorphs of steatite, imitative of quartz crystal, and also of calc spar, occur at Göpfersgrün, in the principality of Bayreuth, which were at first supposed to be actual crystals of steatite. Their pseudomorphous nature is, however, at the present time, very generally admitted.

Extensive beds of steatite occur in various parts of the New England states, also in New Jersey, Pennsylvania, &c. A bed at Smithfield, R. I., affords a delicate green columnar variety of talc, and a primitive limestone in the same region, a white granular variety. At Bridgewater, Vt., a handsome green talc occurs, intermingled with a transparent massive dolomite. Chlorite is of very frequent occurrence, and the chlorite slate formation is traceable from Vermont to Georgia.

Slabs of steatite are extensively employed as fire stones in furnaces and stoves, for which purpose it is well adapted, on account of its extreme infusibility, and its slow conduction of heat. Green earth is employed as a green color for painting houses, and when burnt, it forms a reddish-brown paint, which is applied to the same purpose. Venetian talc is used for removing oil-stains from woollen cloth.

ORDER II. CHALICINEA.

MARGARITE. Mica margarina.

Rhombohedral Pearl-Mica, *M.* Perlglimmer, *L.*

296. *Primary form:* a hexagonal prism. *Cleavage* highly perfect parallel with the base of the prism; in traces parallel to its sides. It usually occurs in thin crystalline laminæ, irregularly intersecting each other.

H.=3·5—4·5. G.=3·032. *Lustre* pearly on P, vitreous on the other faces. *Streak* white. *Color* pale pearly-gray, passing into reddish-white, and yellowish-white. Translucent—subtranslucent. Rather brittle.

It contains, according to Du Menil,

Silica	37·00
Alumina	40·50
Oxyd of Iron	4·50
Lime	8·96
Soda	1·24
Water	1·00
Loss	6·80=100.

Obs. Margarite occurs at Sterzing, in the Tyrol, in primitive rocks, mixed with and engaged in foliated chlorite.

BLACK MICA. Mica hexagona.

Rhomboidal Talc-Mica, *M.* Mica. Glimmer *of the Germans*.

297. *Primary form:* a rhombohedron. It occurs usually in six sided prisms. *Cleavage* highly eminent at right angles with the vertical axis. It is also common in foliated masses.

H.=2—2·5 G.=2·8—3. *Lustre* pearly; often submetallic on the terminal faces of the prism: splendent—shining. *Streak* gray, or white. *Color* commonly dark-green, or brown; often appearing nearly black, in thick masses. Transparent—opaque. Sectile. Thin laminæ are flexible, and very elastic.

It contains, according to Klaproth and H. Rose,

	Black, from Siberia.	Siberia.	
Silica	42·5	42·50	40·00
Alumina	11·5	16·05	12·67
Magnesia	9·0	25·97	15·70
Potash	10·0	7·55	5·61
Peroxyd of Iron	22·0	4·93	19·03
Oxyd of Mang.	2·0	——	0·63
Fluoric Acid	——=97, K.	7·55=104·55, R.	2·10=95·74, R.

Before the blowpipe, it becomes white and opaque; sometimes it fuses into a scoria.

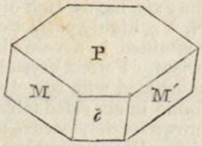
Obs. This species was long confounded with the following. Its distinctive characters were first discovered by an examination with polarized light, in which it exhibits but one axis of double refraction, or one system of rings, a fact inconsistent with the primary form of common mica. It also differs from this species in its composition, as it contains magnesia, which is not a constituent of the following species.

The most remarkable varieties of this species are the dark-colored micas from Siberia; and the deep brown and perfect hexagonal prisms, of gem-like brilliancy and transparency, which occupy the cavities of the ejected lavas of Vesuvius.

The localities of this species of mica in the United States, have not been distinguished from those of common mica.

COMMON MICA. Mica obliqua.

Hemi-prismatic Talc-Mica, *M.* Glimmer *of the Germans.* Lepidolite.



298. *Primary form:* an oblique rhombic prism; M : M= about 120°, P : M=98° 40′. *Secondary form:* the primary with the acute lateral edges truncated. M : ĕ=120°, M : M=60°. *Cleavage* eminent parallel to P. *Compound crystals: of the first kind,* in which composition has taken place parallel to M; frequently, composition takes places parallel to two or more lateral planes, producing compound crystals of several individuals having a stellated appearance. *Imperfect crystallizations:* occasionally present rough globular forms, composed of lamellar particles. Massive varieties usually have a lamellar composition, and are often composed of small aggregated scales.

H.=2—2·5. G.=2·832—3. *Lustre* more or less pearly. *Streak* white or gray. *Color* white, gray, pale-green, and violet-yellow, sometimes brown and dark olive-green. Transparent—translucent. Thin laminæ flexible and elastic, very tough. Sectile.

The analyses of this mineral give very different results. The following are a few of them, by Gmelin, H. Rose, and Turner: the two last are of specimens of violet colored mica.

	From Zinnwald.	From Broddbo.	From Kimito.
Silica	46·23	46·10	46·358
Alumina	14·14	31·16	36·800
Potash	4·90	8·34	9·220
Ox. of Iron	17·97	8·65	4·533
Ox. of Mang.	4·57	1·40	0·020
Fluoric Acid }	8·73	{ 1·12	0·760
Water }		{ 0·87	1·040
Lithia	4·21=95·75, G.	——=97·64, R.	——=98·731, R.

	Utön.		
Silica	47·50	50·35	52·254
Alumina	37·20	28·30	28·345
Potash	9·60	9·04	6·903
Ox. of Iron	3·20	——	——
Ox. of Mang.	0·90	1·23	3·663
Fluoric Acid	0·56	5·20	5·069
Water	1·39		——
Lithia	——=100·35, R.	5·49=99·61, T.	4·792=101·026, R.

The violet varieties usually contain several per cent. of lithia, which is mostly wanting in those of other colors.

Common mica generally does not fuse before the blowpipe, but only loses its transparency and becomes white; those specimens, however, which contain lithia, melt readily, and at the moment of fusion, tinge the flame of a delicate red. A violet variety occurring in small scales, has been distinguished by the name lepidolite.

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

Siberia affords laminæ of mica, sometimes exceeding a yard in diameter.

Fine crystallizations of mica occur in granite, at Acworth, N. H. Goshen and Chesterfield, Mass., afford rose colored crystals in granite, associated with turmaline. An emerald-green variety occurs at Brunswick, Me., and the lepidolite variety at Paris, of the same state, where it is intersected by crystals of red turmaline: the same variety is also found at Middletown, Conn. Handsome crystals, of a reddish-brown color, occur at Greenfield, near Saratoga, N. Y., in the granite vein that contains chrysoberyl, turmaline, and crystals of feldspar: these crystals when viewed across the axis, have a rich oil-green color. Near the iron mines of Munroe, at Greenwood, N. Y., highly perfect crystals of a large size and a dark greenish-black color, are contained in a vein about a foot in width. The form is an obtuse oblique rhombic prism. Perfect crystals of a small size, occur in the limestone of Orange Co. N. Y., associated with spinel and Brucite. A yellow variety, somewhat copper colored, is found in six sided tables of large size at Henderson, Jefferson Co., N. Y. A dark-brown variety occurs near Moriah, upon Lake Champlain, in plates of moderate size. Black crystals, presenting a hexagonal form, occur near Germantown, Penn., on the Schuylkill; and on the Wilmington road near the woodlands. A green variety is found at Chestnut hill, near the Wichichon, Penn.

This species will probably be divided, when the distinguishing characteristics of its several varieties have been more studied. The oblique rhombic prism, which is their primary, is, in some, oblique from an obtuse edge, in others, from an acute. Further examinations are necessary, previous to making the division which is therefore required.

When quite thin, the laminæ of mica are often transparent, and have been used in Siberia for windows. It is hence sometimes called Muscovy glass. It however soon loses its transparency on exposure, and is but a poor substitute for the valuable product of art in general use. It is also used on board the Russian naval vessels, as it is less liable to fracture with the concussion produced by the discharge of heavy artillery.

SCHILLER SPAR. Phyllinius Schilleri.

Diatomous Schiller Spar, *M.* Hydrous Bisilicate of Magnesia, *Thom.* Otrelite. Karstin. Schillerstein, *W.* Talkartiger Diallag, *Haus.* Spath-Chatoyant, Diallage Métalloide, (in part,) *H.*

299. *Primary form:* an oblique rhomboidal prism; M : T= between 135° and 145°. *Cleavage* in two directions, in one of which it is highly perfect and easily effected; in the other, it appears only in traces. It usually occurs in broad separable laminæ, disseminated in serpentine.

H.=3·5—4. G.=2—2·652, Köhler. *Lustre* metallic-pearly on cleavage faces, indistinctly vitreous on the other faces. *Streak* grayish-white, inclining a little to yellow. *Color* olive- and blackish-green, inclining to pinchbeck-brown upon the face of perfect cleavage. Subtranslucent. *Fracture* uneven, splintery. Sectile.

Its composition, as determined by Drapier, (Jour. de Ph. lxii. 48,) and Köhler, (Poggend. Annalen, ii. 192,) is as follows,

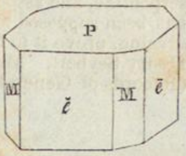
Silica	41	43·900
Magnesia,	29	25 856
Oxyd of Iron and Chromium	14	13·021
Water	10	12·426
Alumina	3	1·280
Lime	1	2·642
Protox. Manganese	—=98, Drapier.	0·535=99·66, Köhler.

In the flame of the blowpipe, supported by platinum forceps, it gives off water and becomes of a pinchbeck-brown color; the lustre is rendered still more metallic; in this manner thin pieces become attractable by the magnet. Fusion of the thinnest edges only can be effected by the blowpipe alone. With borax, it fuses with difficulty; the bead on cooling has a slight emerald-green tinge in consequence of the presence of chromium. The same phenomena are exhibited with biphosphate of soda, and a skeleton of silica is left. With carbonate of soda, it does not fuse, but exhibits on platinum foil the presence of manganese.

Obs. Schiller spar occurs at Baste, in the Forest of Harzeburg, in the Hartz, where it occurs mixed with massive serpentine in greenstone. At Blandford, Mass., a blackish-green variety is met with, associated with serpentine and marmolite; also near Westfield, Mass.

BRONZITE. Phyllinius Æreus.

Hemi-prismatic Schiller-Spar, *M.* Schiller Spar, (in part,) Blättriger Anthophyllite, *W.* Diallage Fibro-Laminaire Métalloide, *H.*



300. *Primary form:* an oblique rhombic prism; M : M=94° or 86°. *Secondary form:* P : ĕ=108°, M : ĕ=133°, M : ē=137°. *Cleavage* very perfect parallel with P; indistinct parallel with M and the diagonals of the prism. It is commonly found imbedded in its matrix in crystalline masses, which cleave with facility into thin laminæ.

H.=4—5. G.=3·251, a brown variety from Bayreuth. *Lustre* metallic-pearly, often resembling bronze. *Streak* grayish, corresponding to the color. *Color* several shades of dark green; liver and pinchbeck-brown; also ash-gray. Translucent—subtranslucent. Easily frangible.

It contains

Silica	60·0	56·813
Magnesia	27·5	29·677
Protoxyd of Iron	10·5	8·464
Protox. of Manganese	—	0·616
Alumina	—	2·068
Water	0·05	0·217
Lime	—=98·5, Klaproth.	2·195=100·050, Köhler.

It assumes a lighter color when heated, and gives off water; but is infusible alone before the blowpipe.

Obs. Bronzite occurs imbedded in serpentine and greenstone rocks. In serpentine, on Monte Bracco, near Sestri, on the coast road from Genoa to Nice, this species occurs in extremely large individuals of a beautiful pearly-gray color: also at Monte Ferato, near Florence, and in many other places along the Appennines, bronzite is quite abundant. It is met with also at Leprese, in the Venetian territory, and near Hof and Beyreuth; also in the Lizard district of Cornwall, where it is of a peculiarly dark-brown color.

SEYBERTITE. Phyllinius Seybertianus.

Seybertite, *Clemson*, Silliman's Am. Jour. XXIV. 171. Holmesite, *Thomson.*

301. Occurs in foliated masses.

H.=4—5. G.=3·098. *Lustre* metallic and metallic-pearly. *Streak* white, grayish-white. *Color* reddish-brown. Subtranslucent.

It contains, according to T. G. Clemson and Dr. T. Thomson,

Silica	17·0		19·35
Alumina	37·6		44·75
Magnesia	24·3		9·05
Lime	10·7		11·45
Protoxyd of Iron	05·0	Perox.	4·80
Oxyd of Manganese	——		1·35
Zirconia	——		2·05
Water	3·6		4·55
Fluoric Acid	——=98·2, C.		0·90=98·25, T.

It is infusible, *per se*, before the blowpipe. With carbonate of soda, on borax, a transparent pearl is obtained. In the state of a powder, it is acted upon by the nitric, muriatic, and sulphuric acids.

Obs. It occurs at Amity, Orange Co., N. Y., in limestone beds connected with serpentine, and associated with hornblende, pyroxene, and plumbago. This species has been supposed to be a variety of bronzite, but the above analyses, though disagreeing, prove it to be a distinct species. It was named by Clemson, in honor of Mr. Henry Seybert. More lately, Dr. Thomson has analyzed it and named it Holmesite. (Records of General Science, iii.)

HYPERSTHENE. Phyllinius metallinus.

Prismatoidal Schiller-spar, *M.* Labrador Schiller-spar, *J.* Labradorische Hornblende, Paulit, *W.* Diallage Métalloide, *H.*

302. *Primary form:* an oblique rhombic prism: M : M= about 93° 30′, and 86° 30′. *Cleavage* parallel to M and the shorter diagonal; very indistinct parallel to the base. The crystals are almost invariably imperfect at their extremities. A secondary form, consisting of the primary with beveled acute lateral edges, is met with at Warwick, N. Y. Occurs also massive.

H.=6. G.=3·389. *Lustre* bright metallic-pearly on the cleavage faces parallel to the diagonal: in other directions vitreous; sometimes silvery. *Streak* greenish-gray. *Color* grayish or greenish-black; also copper-red. Faintly subtranslucent——opaque. *Fracture* uneven. Brittle.

According to Klaproth, it contains

Silica	54·25
Magnesia	14·00
Alumina	2·25
Lime	1·50
Oxyd of Iron	24·50
Water	1·00
Manganese	trace.=97·5.

Before the blowpipe, *per se*, it is unaltered. On charcoal, it fuses into a greenish-gray opaque globule. With borax, a green glass is readily formed.

Obs. This mineral was first brought from the island of St. Paul, on the coast of Labrador, where it occurs in rolled masses. At Cuchullin, Isle of Skye, a range of mountains is composed almost entirely of hypersthene and feldspar. It is also found at Baffin's Bay.

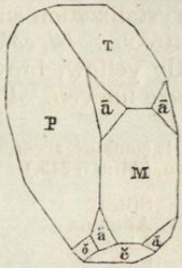
At Warwick, N. Y., it occurs with Brucite, in the limestone formation with which serpentine is associated. Its crystals are sometimes several inches long and half an inch in diameter; in general, however, they are quite minute.

Hypersthene is derived from ὑπερ, *above*, and σθενος, *strength*, in allusion to its greater hardness and lustre than hornblende, with which it was confounded.

HEULANDITE. Vulcanus rhombcideus.

Hemi-prismatic Kouphone-Spar, *M.* Hemi-prismatic Zeolite, Foliated Zeolite, *J.* and *W.* Stilbite anamorphique, *Haüy.* Stilbite, (in part.) Blättriger Stilbit, *Haus.* Blätterzeolit, *W.*

303. *Primary form:* a right rhomboidal prism; M : T=130° 30′. *Secondary form:* the annexed figure; M : ā=146°, T : ā=148°. P : ā=111° 56′. M : ĕ=114° 20′. P : ă=133° 35′. *Cleavage* parallel with P highly perfect. Its imperfect forms present sometimes globular forms in vesicular cavities; at others, they occur granularly massive.



H.=3·5—4. G.=2·2, Haidinger; 2·195, Thomson, a crystal from the Faroe Islands. *Lustre* of P perfect—pearly; of other faces, vitreous. *Streak* white. *Color* various shades of white; passing into red, gray, and brown. Transparent—subtranslucent. *Fracture* subconchoidal, uneven. Brittle.

It contains, according to Walmstedt, (Edinb. Journ. vii. 11,) and Thomson, (Min. i. 347,)

	From Campsie.	From Faroe.
Silica	59·95	59·145
Alumina	16·87	17·920
Lime	7·19	7·652
Water	15·10=99·11, W.	15·400=100·117, T.

It fuses in the blowpipe flame, with a slight intumescence, and is rendered phosphorescent. It does not gelatinize with acids.

Obs. Heulandite occurs principally in amygdaloidal rocks. It has been found also in metalliferous veins.

The finest specimens of this species come from Iceland and the Faroe Islands, and also the Vendayah Mts., in Hindostan. The red varieties occur at Campsie, in Sterlingshire, with stilbite of the same color. At Arendal it is met with of a brown tint. It also occurs in the Kilpatrick hills, near Glasgow.

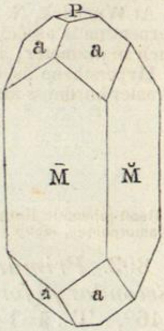
At Peter's Point, Nova Scotia, it occurs in trap, presenting white and flesh-red colors, and associated with Laumonite, apophyllite, Thomsonite, &c.; also at Cape

Blomidon, and other places in the same region, in crystals an inch and a half in length.

This species was named by Mr. Brooke from Mr. Heuland, of London, to whom the science of Mineralogy is much indebted. It may be distinguished from stilbite by its crystalline form, and its more perfectly pearly lustre.

STILBITE. VULCANUS FASCICULARIS.

Prismatoidal Kouphone-Spar, *M.* Radiated Zeolite, *J.* Foliated Zeolite, Strahlzeolith, *W.* Blättrich-strahliger Stilbite, *Haus.*



304. *Primary form:* a right rectangular prism. *Secondary form:* the annexed figure; a : a=119° 15′, $\bar{M}$: a= 120° 30′. Frequently the lateral edges are replaced, and M : *e*=136° 30′. *Cleavage* parallel to $\breve{M}$ perfect, to $\bar{M}$ less so. *Compound crystals* of a cruciform character are rarely met with. The crystals are frequently aggregated in the form of a sheath. Globular, divergent, and radiated forms, also occur, composed of columnar or thin lamellar particles.

H.=3·5—4. G.=2·133—2·143, Thomson; 2·161, Haidinger. *Lustre* of $\breve{M}$, both as faces of crystallization and cleavage, pearly; of other faces vitreous. *Streak* white. *Color* white; occcasionally yellow, brown, or red. Subtransparent—translucent. *Fracture* uneven. Brittle.

It contains, according to Dumenil, (Schweigger's Jahrbuch, vi. 163,) and Thomson, (Min. i. 345,)

Silica	52·25	52·500	54·805
Alumina	18·75	17·318	18·205
Lime	7·36	11·520	9·830
Soda	2·39	——	——
Water	18·75=99·50, D.	18·450=99·788, T.	19·000=101·840, T.

Before the blowpipe, it yields a colorless glass. It does not gelatinize with acids, except after a long exposure to, and frequent boiling in nitric acid.

OBS. Stilbite occurs mostly in cavities in amygdaloidal trap. It is also found in some metalliferous veins, and on granite and gneiss.

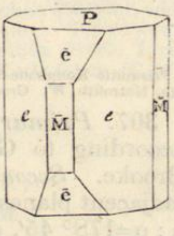
Stilbite is met with in great abundance on the Faroe Islands, in Iceland, and the Isle of Skye, in trap. At Andreasberg, in the Hartz, and Kongsberg and Arundel, in Norway, it occurs in veins and beds of iron ore. Judore, in the Vendayah Mts. in Hindostan, affords large translucent crystals, having a reddish tinge. Fine crystals, of a brick-red color, occur in porphyritic amygdaloid, near Kilpatrick, in Dumbartonshire. A brown variety occurs on granite, at the copper mines of Gustafsberg, near Fahlun, in Sweden. At Patridge Island, Nova Scotia, this species forms a perpendicular vein from three to four inches thick, and from thirty to fifty feet long, intersecting amygdaloid. Its colors are white and flesh-red. It is accompanied with wine-colored carbonate of lime. The specimens there obtained are extremely beautiful.

Stilbite is easily distinguished from the preceding species, by its property of not gelatinizing with acids; and from gypsum, which it sometimes resembles, by its superior hardness.

THOMSONITE. Vulcanus Thomsonianus.

Orthotomous Kouphone-Spar, *M.* Mesotype (in part) *of Haüy.* Needle Zeolite (in part) *of Werner.*

305. *Primary form:* a right rectangular prism. *Secondary form:* the annexed figure; M̄ : *e*=135° 20′, M̆ : *e*= 134° 40′, P : ē=125°. *Cleavage* parallel to M̄ and M̆ easily obtained. *Imperfect crystallizations:* columnar radiated structure; also amorphous.



H.=4·75. G.=2·29—2·3697. *Lustre* vitreous, inclining to pearly. *Streak* white. *Color* snow-white; impure varieties brown. Transparent—translucent. *Fracture* uneven. Brittle.

It contains, according to Thomson, (Min. i. 315,) and Berzelius, (Edin. Journ. iii. 9,)

	From Lochwinnoch.	
Silica	37·560	38·30
Alumina	31·960	30·20
Lime	15·096	13·54
Magnesia	1·080	——
Protox. Iron	0·720	——
Soda	——	4·53
Water	13·200=99·616, T.	13·10=99·67, B.

Before the blowpipe, it swells up like borax, and becomes opaque and snow-white. At a high heat, the edges merely are rounded.

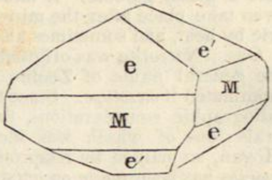
Obs. Thomsonite occurs in the neighborhood of Glasgow, at Lochwinnoch, and near Kilpatrick, imbedded in an amygdaloidal rock. It was named by Mr. Brooke, who first distinguished the species, in honor of Dr. Thomson, of Glasgow.

It has also been found in long slender prisms, of a grayish-white color, at Peter's Point, Nova Scotia, where it occurs in trap, and is associated with Laumonite, apophyllite, mesotype, and other trap minerals.

EDINGTONITE. Vulcanus hemiquadratus.

Hemi-pyramidal Feldspar, *Haid.* Brewster's Journ. iii. 376.

306. *Primary form:* a right square prism. *Secondary form:* a hemihedral crystal, the upper and lower basal edges of the same lateral face being differently modified. M : e′=154° 34′, e′ : e′ (over the summit) =129° 8′. M : e=136° 20½′. e : e (over the summit) =92° 41′. *Cleavage* parallel to M perfect.



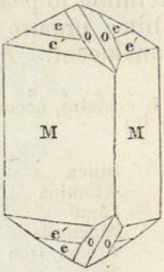
H.=4—4·5. G.=2·7—2·75. *Lustre* vitreous. *Streak* white. *Color* grayish-white. Translucent. Brittle.

It contains, according to an imperfect analysis by Dr. Turner, Silica 35·09, Alumina 27·69, Lime 12·68, Water 13·32, and, as Dr. T. supposes, 10 or 11 per cent. of some alkali; the quantity of the mineral subjected to analysis was so small, that he was unable to determine its nature more particularly. At a high heat, before the blowpipe, it fuses into a colorless mass, having first given off water, and become white and opaque.

Obs. Edingtonite was first observed by Mr. Haidinger, in small but distinct crystals, on a specimen of Thomsonite from Dumbartonshire, in the collection of Mr. Edington, of Glasgow. It is extremely rare.

NATROLITE. Vulcanus rhombicus.

Prismatic Kouphone-Spar, *M.* Prismatic Zeolite, or Mesotype. *J.* Mesotype, *P.*, *H.* Faserzeolith, Natrolith, *W.* Crocalite. Edelite. Hoganite, Feather Zeolite.



307. *Primary form:* a right rhombic prism; M : M=91° 10′, according to Gehlen and Fuchs, and also Mr. Brooke. *Secondary form:* M : e=116° 37′, e : e (adjacent planes)=126° 47′, e : e (over o)=143° 14,′ e : o=178° 45′, o : o=145° 44′, Brooke. Other secondaries exhibit only the terminal planes e, in connection with the lateral. The obtuse lateral edges are also frequently beveled or truncated; M : *e* (the truncating plane)=135° 35′. *Cleavage* parallel to M perfect. *Imperfect crystallizations:* globular, divergent, and stellated forms, composed of delicate acicular crystals, or narrow laminæ. It also occurs in dull friable masses, having an earthy fracture.

H.=4·5—5·5. G.=2·139—2·2303, Thomson. *Lustre* vitreous. *Streak* gray. *Color* white, inclining to yellow or gray; sometimes red. Transparent—translucent. *Fracture* uneven. Brittle.

The following are a few of its analyses; the first by Gehlen and Fuchs, (Schweig. Jour. xviii. 11,) the second and third by Thomson, (Min. i. 317.)

		From Auvergne.	From Antun.
Silica	48·0	48·04	47·560
Alumina	26·5	25·03	26·420
Protoxyd of Iron	——	——	0·580
Soda	16·2	16·76	14·932
Lime	——	——	1·400
Water	9·3=100.	9·65=99·48.	10·440=101·332.

Before the blowpipe it becomes opaque, gives off a phosphorescent light, and melts into a glassy globule. It dissolves in the acids, and forms a thick jelly; this will even take place after the mineral has been exposed to a red heat. It becomes electric by heat, and sometimes also phosphoresces.

Obs. Natrolite was originally included, together with several other species, under the general name of Zeolite. From these it was distinguished by Haüy, who denominated it *mesotype*. Since then it has been discovered, both by analysis and crystallographic considerations, that the species, mesotype, included two distinct minerals; one of which was identical with *natrolite*, a mammillary mineral, from Högan, so named by Klaproth, and the other was named *scolecite*. Still another species has been made on crystallographic examination, which retains the old name, *mesotype*.

Natrolite occurs in cavities in amygdaloidal and volcanic rocks, associated with analcime and chabazite.

Auvergne; the *graustein* of Aussig, in Bohemia; the trap rocks of Kilmalcolm, in Renfrewshire and Glenarm, in the county Antrim, are some of its foreign localities; also Duron, in the Fassa valley, where it is met with in radiating groups of a fine red color.

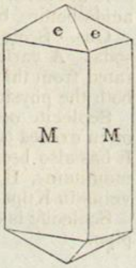
Natrolite is met with in the trap of Nova Scotia; also in the same rock at Cheshire, Conn. At Washington, Conn., it is stated to occur in seams, between hornblende and gneiss.

Natrolite is so called from natron, *soda;* alluding to the soda it contains.

The stellite of Dr. Thomson is closely allied to this species; it is, however, somewhat different in composition, and may be entitled to the rank of a species. It occurs in snow-white stellar aggregations on greenstone, near Kylsyth, on the banks of the Forth and Clyde canal. The cavities of crystals are about an inch in diameter, with their circumferences united and confused. Lustre silky, shining. Translucent. H.=3·25. G.=2·612. It contains, according to Thomson, Silica 48·465, Lime 30·96, Magnesia 5·58, Alumina 5·301, Protoxyd of Iron 3·534, Water 6·108=99·948. It fuses into a white enamel before the blowpipe.

MESOTYPE. VULCANUS PERITOMUS.

Peritomous Kouphone-Spar, *Haid.* Zeolith, *W.* Mesotype, (in part.)



308. *Primary form:* a right rhombic prism; M : M=91° 28′, Haidinger. *Secondary form:* the annexed figure. *Cleavage* parallel to M perfect. Occurs also fibrous, in stellated or divergent groups, and occasionally compact; also at times pulverulent.

H.=5—5·5. G.=2·2—2·3. *Lustre* vitreous. *Streak* white, or grayish-white. *Color* white, sometimes inclining to gray, or red. Transparent—translucent. *Fracture* of compact varieties splintery.

Its constituents are, according to Gehlen,

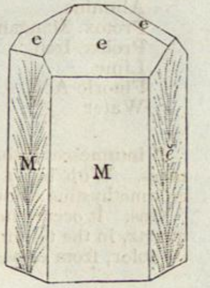
Silica	54·46
Alumina	19·70
Soda	15·09
Lime	1·61
Water	9·83=100·69.

Before the blowpipe the crystals become opaque without intumescing, and form a glassy globule. With borax, fusion is obtained with difficulty.

OBS. Mesotype occurs at the Faroe Islands, forming divergent groups in the vesicular cavities of amygdaloid; also in the trap rocks of the Giant's Causeway, in very delicate acicular crystallizations, and aggregated in radiating forms. It is met with in trap tufa, associated with analcime, at Montecchio Maggiore, in the Vicentine; and in the more ancient of the Vesuvian lavas, in small silky diverging tufts.

SCOLECITE. VULCANUS CRISPANS.

Harmophanous Kouphone-Spar, *Haid.* Mesolite. Needlestone. Mesotype, (in part.)



309. *Primary form:* a right rhombic prism; M : M=91° 25′. *Secondary form:* the primary with the acute lateral edges truncated; also with the terminal edges replaced so as to form a four sided pyramid at the extremity of the crystal. *Compound crystals:* similar to the annexed fig. The crystals are commonly slender, and occur interlacing one another, or in diverging groups. Scolecite is also found in radiating masses, and occasionally compact.

H.=5—5·5. G.=2·214—2·27. *Lustre* vitreous, inclining to pearly. *Streak* white. *Color* white. Transparent—translucent.

It contains, according to Fuchs and Gehlen, and Berzelius,

	Faroe.	Staffa.	Faroe.
Silica	46·49	46·75	46·80
Alumina	25·88	24·82	26·50
Lime	13·86	14·20	9·87
Water	13·62	13·64	12·30
Soda	0·48=100·23, F. & G.	0·39=99·08, F. & G.	5·40=100·87, B.

In the exterior flame of the blowpipe it becomes opaque, and then curls up like a worm, and finally melts into a very bulky and shining slag. In the interior flame this slag falls down, and is converted into a vesicular and slightly translucent bead. It becomes electric when heated.

It dissolves readily, and forms a thick gelatinous mass, with nitric and muriatic acids before, but not after ignition.

Obs. Scolecite differs from the preceding species in containing lime instead of soda. A variety, consisting of a mixture of scolecite and natrolite, has been separated from this species under the name of *mesolite*. In all its important characters, both the physical and those obtained by the action of acids, it resembles scolecite.

Scolecite occurs at Tiegerhottue, in the Berufiord, Iceland, where the crystals often exceed two inches in length, and are occasionally a quarter of an inch thick. It has also been met with in amygdaloid, at the Faroe Islands, Staffa; the Vendayah mountains, Hindostan; in Greenland; and at Pargas, Finland. It occurs also in veins in Kilpatrick hills.

Scolecite is derived from σκωληξ, *a worm*, in allusion to its action before the blowpipe.

CARPHOLITE. Vulcanus stramineus.

Karpholite, *J.*

310. Structure columnar, radiated and stellular, in tufts; particles rather incoherent.

H. about 5. G.=2·935, Breithaupt; 2·9365, Stromeyer. *Lustre* silky, glistening. *Color* pure straw-yellow; sometimes wax-yellow. Opaque. Very brittle.

The following is its composition, according to Stromeyer, (Untersuchungen, 410,) and Steinmann, (Schweig. Jour. xxv. 413,)

Silica	36·154	37·53
Alumina	28·669	26·48
Protox. Manganese	19·160	17·09
Protox. Iron	2·290	5·64
Lime	0·271	——
Fluoric Acid	1·470	——
Water	10·780=98·794, Strom.	11·36=98·10, Stein.

It intumesces before the blowpipe, whitens, and fuses slowly into a brown opaque mass. With borax it forms a transparent glass, which, in the outer flame, assumes an amethystine color; in the reducing flame it becomes green.

Obs. It occurs in minute divergent tufts, disposed on granite, along with fluor and quartz, in the tin mines of Schlaggenwald. It was named by Werner, in allusion to its color, from καρφος, *straw*.

DYSCLASITE. VULCANUS TENAX.

Dysclasite, *Connell.* Okenite, *Kobell.*

311. Structure delicately fibrous; also imperfectly fibrous or composed of a congeries of minute crystals.

H.=4·5—5. G.=2·362 of dysclasite, Connell; 2·28 of Okenite, Kobell. *Lustre* inclining to pearly. *Color* white, with a shade of yellow or blue; often yellow by reflected light, and blue by transmitted; frequently with an opalescent tint. Subtransparent —subtranslucent. Very tough. Exhibits double refraction.

Its composition, according to Connell and Kobell, is as follows:

Silica	57·69	56·99	55·61
Lime	26·83	26·35	26·59
Water	14·71	16·65	17·00
Soda	0·44	——	——
Protoxyd of Manganese	0·22	——	——
Potash	0·33	——	} 0·53
Peroxyd of Iron	0·32	——	
Alumina	——=100·54, C.	——=99·99, K.	——=99·73, K.

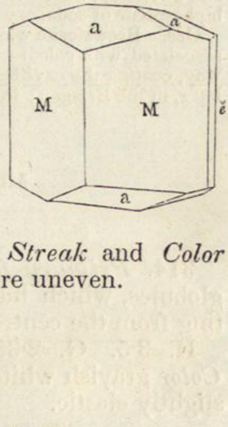
When heated in a glass tube, water is obtained. Before the blowpipe, *per se*, it becomes opaque and white, and fuses on the edges. It effervesces with carbonate of soda, and fuses into a subtransparent glass; with borax it forms a transparent colorless glass.

Pieces thrown into muriatic acid gradually become gelatinous. In a pulverized state, a jelly is readily formed.

OBS. The *dysclasite* of Connell was brought from the Faroe Islands by Count Varges Redemar, of Copenhagen. It was at first mistaken for mesotype. Okenite occurs, with other minerals of this family, in amygdaloid, in Greenland. Dysclasite is derived from δυς, *difficultly*, and κλαειν, *to break.*

EPISTILBITE. VULCANUS ACUTUS.

Diplogenic Kouphone-Spar, *Haid.* *Rose*, in Brewster's Jour. IV. 283.



312. *Primary form:* a right rhombic prism; M : M=44° 50′, and 135° 10′. *Secondary form:* M : ĕ=112° 25′, *a* : ĕ=106° 10′, a : a=109° 46′, M : a=122° 9′. *Cleavage* parallel to the shorter diagonal perfect; indistinct in other directions. Face M mostly uneven. It presents occasionally twin crystals of *the first kind.* Occurs also granularly massive.

H.=4—4·5. G.=2·249—2·25. *Lustre* pearly upon the cleavage face; upon M vitreous. *Streak* and *Color* white. Transparent—subtranslucent. Fracture uneven.

It contains, according to Rose,

Silica	58·59	60·28
Alumina	17·52	17·36
Lime	7·56	8·32
Water	14·48	12·52
Soda	1·78=99·93.	——=98·48.

It froths in the blowpipe flame, and forms a vesicular enamel, but cannot be fused into a globule. Borax dissolves a great part of it, and forms a clear globule. It is also soluble in salt of phosphorus, with the exception of a skeleton of silica. It is soluble in concentrated muriatic acid, with the exception of a fine granular residue of silica.

Obs. Epistilbite is associated with scolecite at the Berufiord, in Iceland, and is also found at Poonah, in India.

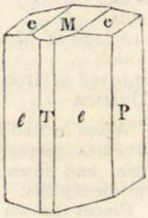
This species was separated from stilbite by Dr. G. Rose, of Berlin, from which it is perfectly distinct in its crystallization. It is also peculiar in exhibiting but one system of rings in polarized light, as has been determined by Dr. Brewster. The double refraction of Heulandite, is also much greater than that of the mineral just described.

BREWSTERITE. Vulcanus Breusterianus.

Brewsteritic Kouphone-Spar, *Haid.* Brewsterite, *Brooke*, Edin. Phil. Jour. VI. 112.

313. *Primary form:* a right rhomboidal prism; M : T=93° 40′. *Secondary form:* M : e=176°, e : e=172°. *Cleavage* highly perfect parallel to P.

H.=5—5·5. G.=2·12—2·432; the latter according to Thomson. *Lustre* of P pearly; of other faces vitreous. *Streak* white. *Color* white, inclining to yellow and gray. Transparent—translucent. *Fracture* uneven.



It contains, according to Dr. Thomson, (Min. i. 348,)

Silica	53·045
Alumina	16·540
Baryta	6·050
Strontia	9·005
Lime	0·800
Water	14·735=100·175.

Before the blowpipe it parts with its water and becomes opaque; it then froths and swells up, but fuses with difficulty. It leaves a silica skeleton when fused with biphosphate of soda.

Obs. Brewsterite was first observed at Strontian, in Argyleshire, where it occurs associated with calcareous spar. It has since been discovered in the Giants' Causeway, coating the cavities of amygdaloid; in the lead mines of St. Turpet, near Freiburg, in the Brisgau; in the department of the Isère, in France, and in the Pyrenees.

MESOLITE. Vulcanus flabelliformis.

Flabelliform Kouphone-Spar, *Haid.* Brewster's Journal, VII. 18.

314. *Primary form:* trimetric. Usually occurs in implanted globules, which have a flat columnar or lamellar structure, radiating from the centre. *Cleavage* perfect in one direction.

H.=3·5. G.=2·35—2·4. *Lustre* silky or pearly. *Streak* white. *Color* grayish white; sometimes yellow. Translucent. Laminæ slightly elastic.

It is composed, according to Hisinger and Berzelius, of

	Sweden.	Faroe.
Silica	42·17	42·60
Alumina	27·00	28·00
Lime	9·00	11·43
Soda	10·19	5·63
Water	11·79=100·15, H.	12·70=100·36, B.

Obs. Mesolite occurs, coating the vesicular cavities of amygdaloid and basalt, at Nalsoe, in the Faroe Islands, where it is associated with chabazite, apophyllite, stilbite, and others of the zeolite family. Also in Disco Island, Greenland, in aggregations which bear much resemblance to crystallized spermaceti.

Mesolite is distinguished from mesotype by its perfect single cleavage and pearly lustre; from stilbite or Heulandite, by its superior specific gravity; and from apophyllite, by its crest or fan-like aggregations, which are never presented by that mineral. When associated with apophyllite or stilbite, it forms the lowest stratum, immediately adjoining the rock in which it is situated.

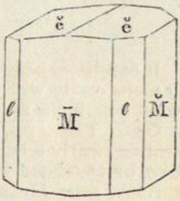
Dr. Thomson has described a mineral under the name of Harringtonite, whose composition is very similar to that of mesolite. It constituted a vein about 0·6 inch thick in an amygdaloid, in the north of Ireland. Its description is as follows: *Color* snow-white; texture compact and earthy; *lustre* like that of the almond; opaque; very tough. The following are the results of two analyses:

Silica	44·960	44·840
Alumina	26·848	28·484
Lime	11·008	10·684
Protoxyd of Iron	0·880	trace.
Soda	5·560	5·560
Water, with trace of muriatic acid	10·280=99·536,	10·280=99·848.

COMPTONITE. VULCANUS COMPTONIANUS.

Comptonitic Kouphone-Spar, *Haid.* *Brewster*, in Ed. Phil. Journ. IV. 131, and VI. 112.

315. *Primary form:* a right rectangular prism. *Secondary form:* M̄ : *e*=135° 30′, M̆ : *e*=134° 30′, M̆ : ĕ=92° 13′, ĕ : ĕ=175° 35′. *Cleavage* parallel to M̆ and M̄, the first a little more distinct. It frequently occurs as a coating on other minerals of this family.



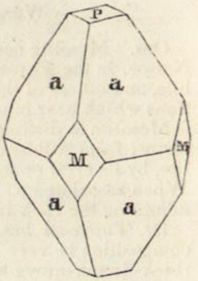
H.=5—5·5. G.=2·35—2·4. *Lustre* vitreous. *Streak* and *Color* white. Transparent—translucent. *Fracture* small conchoidal, uneven.

Before the blowpipe it parts with some water, intumesces a little, becomes opaque, and then fuses imperfectly into a vesicular glass. The globule, obtained with salt of phosphorus, contains a skeleton of silica, and becomes opaque on cooling. With borax, the globule is transparent and vesicular. It gelatinizes when exposed in powder to nitric, or muriatic acid. If it has been anhydrated by heat, the mineral is still dissolved by muriatic acid, but the silica separates in a powder, and does not gelatinize.

Comptonite was first found by Lord Compton, in the cavities of the vesicular lava of Vesuvius, associated with capillary mesotype, and other species of the genus Vulcanus. It has since been discovered in basalt, at the Pflaster Kaute, near Eisenach, in Hessia; also at Leitmeritz and Hauenstein, in Bohemia, forming a thin coating on the surface of mesotype, and occupying the cavities of *graustein*. At the Cyclopean Islands, Sicily, it occurs associated with analcime and Phillipsite.

APOPHYLLITE. Vulcanus quadratus.

Pyramidal Kouphone-Spar, *M.* Pyramidal Zeolite, *J.* Tesselite, *Brewster.* Ichthyophthalmite. Albin, *Wern.* Fischaugenstein, *Wern.* Mesotype Epointée, *H.*



316. *Primary form:* a right square prism. *Secondary form:* similar to fig. 51, Pl. I., also the annexed figure; a : a=104° 2′, P : a=119° 30′, M : a=127° 59′. Another form, similar to fig. 51, Pl. I., except that the planes a, are so extended as to produce four sided pyramids at each extremity of the crystal. Sometimes the crystals are nearly cylindrical and contracting in size towards each end, have a barrel-like shape. *Cleavage* highly perfect, parallel with P; less so parallel with M. The imperfectly crystalline varieties have usually a lamellar composition in the direction of P.

H.=4·5—5. G.=2·335, Haidinger, a variety from Iceland; 2·359, Thomson. *Lustre* of P pearly; of the other faces vitreous. *Streak* white. *Color* white, or grayish; occasionally with a shade of green, yellow, or red. Transparent—opaque. *Fracture* uneven. Brittle.

Its constituents, according to Stromeyer, Berzelius, Turner, and Thomson, are as follow:

	Fassa.	Faroe, Var. Tesselite.	Var. Oxahverite.	Uton.
Silica	51·8643	51·76	50·76	51·008
Lime	25·1992	22·73	22·39	26·236
Potash	5·1369	5·31	4·18	5·888
Fluosil. of Lime	——	3·53	trace.	——
Water	16·0438	16·20	17·36	16·500
	98·2442, S.	99·53, B.	94·69, Turn.	99·634, Th.

It exfoliates before the blowpipe, and ultimately fuses into a white vesicular glass. It melts easily with borax. In nitric acid it separates into flakes, and becomes somewhat gelatinous and subtransparent.

Obs. The term, *tesselite*, was applied by Brewster to a variety from Faroe, presenting nearly a cubical form, which, upon optical examination, exhibits a mosaic-like, or tesselated structure. *Oxahverite* is a pale green variety from the Oxahver springs, near Husavick, in Iceland, where it occurs on calcified wood; it is generally indistinctly crystallized and translucent. *Albin*, of Werner, is a white, opaque variety, found at Aussig, in Bohemia, associated with natrolite.

Greenland, Iceland, the Faroe Islands, and Poonah, in Hindostan, afford fine specimens of apophyllite. It occurs at these localities coating the cavities of amygdaloid, associated with chalcedonic quartz, stilbite, chabazite, &c. At Andreasberg it occurs in silver veins, traversing gray-wacke slate; in the Bannat, associated with Wollastonite. In Fifeshire, it has been found in large transparent crystals, occupying the interior of fossil shells. It is associated with magnetic iron, at Uton, in Sweden. Also at Puy-de-la-Piquette, in Auvergne, where it occurs in crystals in a tertiary limestone, but appears to have been formed by sublimation, caused by the adjoining basaltic rocks, subsequent to the deposition of the limestone.

In America it has been found at Peter's Point and Patridge Island, in the Basin of Mines, Nova Scotia. It here occurs both massive and crystallized, presenting white, reddish, and greenish colors. It is associated with Laumonite, Thomsonite, and other minerals of trap rocks.

Apophyllite was so named in allusion to its highly foliated character, from απο and φυλλον, *a leaf.* Its pearly lustre on the face of perfect cleavage, obtained for it the name of *Ichthyophthalmite*, from the Greek ιχθυς, *a fish*, and οφθαλμος, *an eye.*

LAUMONITE. VULCANUS EFFLORESCENS.

Diatomous Kouphone-Spar, *M.* Diprismatic Zeolite, *J.* Lomonite, *W.* Laumontit, *L.* Laumonit, *H.* Efflorescing Zeolite.

317. *Primary form:* an acute oblique rhombic prism; M : M= 86° 15′, P : M=66° 30′, or 113° 30′. *Secondary form:* similar to fig. 97, Pl. II.; also with the edge between each M and ă replaced. *Cleavage* parallel to the acute lateral edge. Imperfectly crystalline varieties have a radiating or diverging structure.

H.=3·5—4 of the mineral, fresh from its locality. G.=2·3, Haüy. *Lustre* vitreous, inclining to pearly upon the faces of distinct cleavage. *Streak* white. *Color* white, passing into yellow or gray. Transparent—translucent, becomes opaque on exposure. *Fracture* scarcely observable, uneven. Not very brittle.

It consists of

		From Huel Goet.	Skye.
Silica	49·0	48·3	52·04
Alumina	22·0	22·7	21·14
Lime	9·0	12·1	10·62
Water	17·5	16·0	14·92
Carbonic Acid	2·5=100, Vögel.	— 99·1, Gmelin.	—— =98·72, Con.

Before the blowpipe it intumesces and fuses into a white frothy mass. With borax, it forms a transparent globule. It gelatinizes with nitric or muriatic acids, but is not affected by sulphuric acid, unless heated. If insulated, it acquires negative electricity by friction. On exposure to the air, it loses its water of crystallization, and becomes opaque, and in this state is easily pulverized by the fingers, and often it falls to a powder of itself.

OBS. Laumonite occurs in the cavities of amygdaloid, also in porphyry, and occasionally in veins traversing clayslate with limestone. It was first observed in 1785, in the lead mines of Huel Goet, in Brittany, by Gillet Laumont, after whom it is named.

Its principal localities are the Faroe Islands; Disko, in Greenland; St. Gothard, in Switzerland; in the Fassa-thal, in large masses, exhibiting a radiated structure; at Hartfield Moss, in Renfrewshire, accompanying analcime; in the amygdaloidal rocks in the Kilpatrick hills, near Glasgow; and in several trap rocks of the Hebrides, and the north of Ireland.

Peter's Point, Nova Scotia, affords fine specimens of this species. It is there associated with apophyllite, Thomsonite, and other species of this family.

It has been observed in small quantities in the trap rocks of Connecticut and Massachusetts, and at Phillipstown, New York.

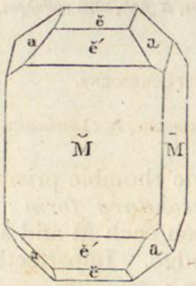
The rapid decomposition to which this mineral is exceedingly liable, may be prevented by dipping the specimen in a thin solution of gum Arabic, by means of which it is preserved from contact with the air.

HARMOTOME. VULCANUS GEMELLUS.

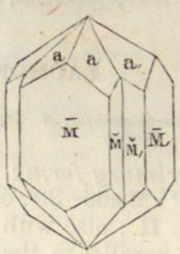
Paratomous Kouphone-Spar, *M.* Staurolite, *Kirwan.* Andreolite. Andreasbergolite; Ercinite. Kreuzstein, *W.* Harmotome, *H.*

318. *Primary form:* a right rectangular prism. *Secondary form:* fig. 1;

1



2



a : a=119° 4′, ĕ : a=149° 32′, M̆ : e=125° 5′, Phillips. *Cleavage* parallel to M̆ and M̄ imperfect. *Compound crystals:* the form in fig. 2 is composed of four individuals, united according to composition of the *third kind*, as explained in § 76, 77. These forms are of very frequent occurrence. Harmotome is rarely found massive.

H.=4—4·5. G.=2·4—2·448. *Lustre* vitreous. *Streak* white. *Color* white; passing into gray, yellow, red, or brown. Subtransparent—translucent. *Fracture* uneven, imperfectly conchoidal. Brittle.

It contains, according to Gmelin and Hepel, (Ann. des Mines, x. 257,) Connell and Thomson, (Min. i. 350,)

	Andreasberg.	Strontian.	Strontian.
Silica	56·30	47·04	48·753
Alumina	14·50	15·24	15·100
Barytes	17·52	20·85	14·275
Lime	1·00	0·10	3·180
Potash	——	0·88	2·550
Soda	1·25	0·84	——
Perox. Iron	——	0·24	——
Water	11·69=102·26, G. & H.	14·92=100·11, C.	14·000=97·858, T.

Before the blowpipe, on charcoal, it melts without intumescence into a clear globule. It phosphoresces when heated, giving out a yellow light. It is scarcely attacked by the acids, unless they are heated.

Obs. Harmotome occurs in metalliferous veins traversing gray-wacke, also on gneiss, and in the cavities of amygdaloid.

Strontian, in Argyleshire, affords the finest simple crystals of this species. They occur here disposed on calcareous spar, and are sometimes an inch in diameter. This locality affords also specimens of the compound crystals. These, however, are found more abundantly in a metalliferous vein at Andreasberg, in the Hartz. It also occurs at Oberstein, in Deuxponts, coating the cavities of silicious geodes; at Kongsberg, in Norway, on gneiss; accompanying analcime in the amygdaloid of Dumbartonshire.

PHILLIPSITE. Vulcanus Phillipsianus.

Staurotypous Kouphone-Spar, *M.* **Phillipsite,** *Levy.*

319. *Primary form*: a right rectangular prism. *Secondaries*

and *twin crystals*, similar to those of harmotome; a : a=about 123° 30′, and 117° 30′, Levy.

H.=4—4·5. G.=2—2·2. *Lustre* vitreous. *Streak* white. *Color* white, sometimes reddish. Translucent—opaque.

Its constituents, according to Gmelin and Hepel, are as follows:

	Morbourg.	Morbourg.
Silica	48·51	48·02
Alumina	21·76	22·60
Lime	6·26	6·56
Potash	6·33	7·50
Protox. Iron	0·29	0·18
Water	17·23=100·38.	16·75=101·61.

Obs. This species was united with the preceding, which it very much resembles, until Levy pointed out its peculiarities, and gave it the name it bears, in compliment to Mr. Phillips. It differs chemically from harmotome in not containing barytes, but, instead, lime and potash.

Dr. Thomson has separated another species from harmotome, which he calls *Morvenite*, or transparent harmotome, from Strontian. It occurs in rectangular prisms, with deeply replaced edges and angles. According to his measurement $\bar{\mathrm{M}} : e$ =124° 47′, $\bar{\mathrm{M}} : e$=145° 13′, e : a=149° 32′.

Phillipsite occurs in large translucent crystals in the cavities of amygdaloid, in the Giants' Causeway, in Ireland; in sheaf-like aggregations at Capo di Bove, near Rome. In long crystals aggregated in radiating masses, at Aci Reale, on the eastern coast of Sicily; also among the Vesuvian lavas; and in the island Magee, county Antrim, in minute flesh-red crystals, coating cavities of amygdaloid.

ANALCIME. VULCANUS CUBICUS.

Hexahedral Kouphone-Spar, *M.* **Hexahedral Zeolite**, *J.* **Cubizit**, *W.* **Analzim**, *L.* **Sarcolite.**

320. *Primary form:* the cube. *Secondary forms:* figs. 14, 15, 16, also fig. 2, and 2 and 5 combined, Pl. I. *Cleavage* parallel to the primary form, but only in traces. Massive varieties have a granular structure.

H.=5—5·5. G.=2·068, Haidinger; 2·278, Thomson. *Lustre* vitreous. *Streak* white. *Color* white; occasionally passing into gray or reddish-white. Transparent—nearly opaque. *Fracture* imperfectly subconchoidal, uneven. Brittle.

It is composed of

	Fassa.	Giants' Causeway.	Kilpatrick.
Silica	55·12	55·60	55·07
Alumina	22·99	23·00	22·22
Soda	13·53	14·65	13·71
Water	8·27=99·91, H. Rose.	7·90=101·15, Thom.	8·22=99·22, Connell.

It fuses before the blowpipe, on charcoal, without intumescence, into a clear glassy globule. It gelatinizes in muriatic acid. It becomes very slightly electric when heated.

Obs. The varieties of this species, which occur under the last two secondary forms above stated, have been separated by the late Dr. Thomson, of Naples, as a distinct species, under the name of Sarcolite. This, however, is unwarranted until analysis shall manifest a dissimilar composition. Their crystalline forms are not inconsistent with the idea of their identity.

The Cyclopean Islands, near Catania, on the Sicilian coast, afford the most perfect pellucid crystals of this species; their form is represented in fig. 14, Pl. I. The same form occurs also in the Tyrol. The form in fig. 16, or the trapezohedron, occurs in Dumbartonshire, the Kilpatrick Hills, Glen Farg. These crystals are generally opaque, and sometimes have a diameter of three or four inches.

Analcime is of frequent occurrence in the Faroe Islands, Iceland, the Vicentine, and elsewhere, in the cavities of amygdaloidal, basaltic, and trap rocks, associated with Prehnite, chabazite, apophyllite, &c. At Arendal, in Norway, it occurs in beds of iron ore; and at Andreasberg, in the Hartz, in silver mines. The cubo-octahedral variety, or sarcolite, occurs among the ancient lavas of Vesuvius, associated with Wollastonite, hornblende, and several species of the zeolite family. The name, Analcime, is derived from ἀναλκις, *weak*, in allusion to its weak electric power when heated.

SODALITE. VULCANUS DODECAHEDRUS.

Dodecahedral Kouphone-Spar, *M.* Sodalite, Hauyne, Spinellane, Azurestone, Lapis Lazuli, Ittnerite. Nosian, *Klaproth.* Sodalit, *L.* Auina, *Monticelli.*

321. *Primary form:* the rhombic dodecahedron. *Secondary forms:* figs. 4 and 5, Pl. I. *Cleavage* parallel to the dodecahedral faces, with different degrees of perfection.

H.=5·5—6. G.=2·295—2·378. *Lustre* vitreous. *Streak* white or bluish. *Color* various shades of brown, gray, green, white, and blue; the latter often deep azure blue. Translucent—subtranslucent—nearly opaque. *Fracture* conchoidal or uneven.

Its analyses afford very various results; the following are a few of them:

	Sodalite, from Greenland.		Vesuvius.	*Hauyne.*
Silica	38·52	36·00	35·99	35·48
Alumina	27·48	32·00	32·59	18·87
Soda	25·50	25·00	26·55	——
Potash	——	——	——	15·45
Muriatic Acid	3·00	6·75	5·30	——
Lime	2·70	——	——	12·00
Oxyd of Iron	1·00	0·25	——	1·16
Sulphuric Acid	——	——	——	12·39
Water	——	——	——	1·20
	98·20, Ekeberg.	100·00, Thom.	100·43, Arfwed.	96·55, Gmelin.

	Spinellane.	*Lapis-Lazuli.*	*Ittnerite.*
Silica	43·0	49·0	34·016
Alumina	29·5	11·0	28·400
Soda	19·0	8·0	11·288
Potash	—		1·565
Lime	1·5	16·0	5·235
Peroxyd of Iron	2·0	4·0	0·616
Sulphuric Acid	1·0	2·0	——
Gypsum	—	—	4·891
Common Salt	—	—	1·618
Water	2·5	trace.	10·759
Sulphuretted hydrogen	—	—	
	98·5, Klap.	90·0, Gmelin.	98·388

These different varieties behave very differently under the blowpipe. All, however, gelatinize with nitric acid.

Obs. *Sodalite* includes the white and light green crystallized varieties of this species; *Hauyne*, the bright blue or occasionally asparagus green crystallized specimens; *Spinellane*, or *nosian* of Klaproth, the dark ash-gray translucent crystals; and *Lapis-Lazuli*, the specimens almost always massive, of a rich Berlin or azure-blue color.

The sodalite from Greenland, is partly fused, though with extreme difficulty, in the reducing flame of the blowpipe. Its G.=2·29. The sodalite from Vesuvius, where it occurs in white translucent, lengthened dodecahedral crystals, form a colorless glassy globule; its G.=2·38. Sodalite occurs massive, of a gray color, imbedded in trap at the Kaiserstuhl, in the Brisgau; this variety has been denominated *Ittnerite*. *Hauyne* fuses slowly in the blowpipe flame, into an opaque mass. With borax it effervesces, and forms a transparent vitreous globule, which turns yellow on cooling. Its G.=2·68—3. It does not form a jelly with acids as easy as the other varieties. It occurs in the Vesuvian lavas, also in the vicinity of Rome, and at Niedermannich, near Andernach, on the Rhine. *Spinellane* is infusible. G.=2·28. It is met with in the drusy cavities of glassy feldspar, at the lake of Laach, near Andernach. *Lapis-Lazuli* fuses into an opaque globule, and, if previously calcined and reduced to powder, is decolorated by acids. G.=2·95. It is brought from Persia, China, Siberia, and Bucharia, where it is associated with feldspar and limestone, and contains often scales of mica and particles of pyrites. On the banks of the Indus, it occurs disseminated in grayish limestone. The richly colored specimens of Lapis-Lazuli, are highly valued as a material for costly vases and ornamental furniture. Magnificent slabs of it are contained in some of the Italian churches. It is also employed in the manufacture of Mosaics, and its powder forms a highly prized and exceedingly durable paint, called ultramarine.

LEUCITE. Vulcanus trapezohedrus.

Trapezoidal Kouphone-Spar, *M.* Dodecahedral Zeolite or Leucite, *J.* Amphigène, *H.* White Garnet. Leuzit, *W.*

322. *Primary form:* a rhombic dodecahedron, fig. 7, Pl. I. *Secondary form:* fig. 16, a tetragonal tris-octahedron. *Cleavage* very imperfect parallel to the primary planes, (e, fig. 18, Pl. I,) and also to the faces of the cube, (P in fig. 15, Pl. I.) Surface of the crystals even, though seldom shining. Occurs rarely in irregular forms of a granular structure.

H.=5·5—6. G.=2·483—2·49. *Lustre* vitreous. *Streak* white. *Color* ash-gray or smoke-gray, grayish-white. Translucent—nearly opaque. *Fracture* conchoidal. Brittle.

According to Klaproth (Beitrage, ii. 42) and Arfwedson, (Afhandlingar, vi. 256,) it contains,

	Vesuvius.	Albano.		Albano.
Silica	53·750	54	58·70	56·10
Alumina	24·625	23	19·95	23·10
Potash	21·350	22	21·40	21·15
Oxyd of Iron	——	—	0·40	0·95
Lime	——=99·725, K.	—=99, K.	1·35=91·80, Arf.	——=101·30, Arf.

Infusible before the blowpipe except with borax or carbonate of lime, with which it melts with difficulty into a clear globule. Its powder changes the blue tincture of violets to green.

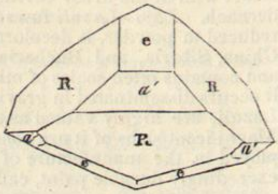
Obs. Leucite is abundant in the ancient lavas of the Rieden country, between the Laacher Lee and Andernach, on the Rhine. Vesuvius, however, presents the finest and largest crystallizations. In the vicinity of Rome, at Boghetto, to the north, and Albano and Frescati to the south, some of the older lavas are so thickly studded with this mineral, as to appear almost entirely composed of it. The crystals generally present the secondary form, above mentioned.

The Leucitic lava of the neighborhood of Rome, has been used for the last 2000 years at least, in the formation of mill stones. Mill stones of this rock have lately been discovered in the excavations at Pompeii.

Leucite is derived from λευκος, *white*, in allusion to its color; and because its form is similar to a common variety of the garnet, it has been designated *white garnet*.

CHABAZITE. VULCANUS RHOMBOHEDRUS.

Rhombohedral Kouphone Spar, *M.* Rhombohedral Zeolite or Chabasite, *J.* Chabasie, *P. L.* and *H.* Schabasit, *W.* Chabasin, *Haus.*



323. *Primary form:* a slightly obtuse rhombohedron; R : R=94° 46′. *Secondary form:* R : e=137° 23′, R : *a*′=126° 26′, a′ : a′ (over R)=72° 53′, e : e=125° 13′. *Cleavage* rather indistinct, parallel to R.

H.=4—4·5. G.=2·088, Thomson, transparent crystals from Kilmalcolm; 2·100, Haidinger, crystal from Bohemia; 2·472, Lehunt, an Irish specimen containing much soda. *Lustre* vitreous. *Streak* white. *Color* white, occasionally reddish, rarely yellowish. Transparent —translucent. *Fracture* uneven; brittle.

It contains, according to Berzelius, Arfwedson, Thomson, and Lehunt,

	Eustafsberg.	Faroe.	Kilmalcolm.	Scotland.
Silica	50·65	48·30	48·756	49·17
Alumina	17·00	19·28	17·440	18·90
Lime	9·73	8·72	10·468	——
Potash	1·70	2·50	1·548	Soda 12·19
Water	19·50=98·58, B.	20·00=98·80, A.	21·720=99·932, T.	19·73=99·99, L.

The last specimen contains soda in the place of potash. Before the blowpipe it fuses into a white spongy mass. It is not acted upon by acids. The opaque crystals become translucent in oils.

OBS. Amygdaloid is the principal repository of chabazite. It also occurs between the layers of gneiss and mica slate.

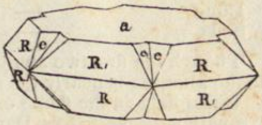
At the Faroe Islands, Greenland, and Iceland, fine crystallizations of this species are found, associated with chlorite and stilbite. Also at Aussig, in Bohemia, in a kind of greenstone, (*graustein* of Werner,) the Giants' Causeway; Kilmalcolm, Renfrewshire; Isle of Skye. In Nova Scotia, in amygdaloid, it occurs of a wine-yellow, or flesh-red color, in fine crystals, often highly modified; it is associated with Heulandite, analcime, and calcareous spar.

The trap region of Connecticut and Massachusetts affords occasional specimens of this mineral. In the same rock it also occurs near Baltimore, Md. At Hadlyme, Conn., it is met with on gneiss.

The name chabazite was derived by Box d' Antic, from the Greek word χαβαζιος, the name of one of the twenty stones, celebrated for their virtues, in the poem ascribed to Orpheus, entitled περι λιθων.

LEVYNE. Vulcanus Levyanus.

Macrotypous Kouphone-Spar, *M.* Levyne, *Brewster's* Jour. II., 332.



324. *Primary form:* a rhombohedron; R : R=79° 29′. *Cleavage* indistinct parallel with R. *Compound crystals:* annexed figure; R : R′=125° 12′, a : e=136° 1′, R : a=117° 29′, composition *of the third kind*, it being parallel to a plane on the vertical solid angle. Plane a, usually uneven, and often curved.

H.=4. G.=2·161, Thomson; 2·198. *Lustre* vitreous. *Streak* white. *Color* white; sometimes reddish. Subtransparent—opaque. *Fracture* subchonchoidal. Brittle.

Its composition, according to Thomson (Min. i. 336) and Berzelius, (Kong. Vet. Acad. Handl., 1824, p. 356,) is as follows:

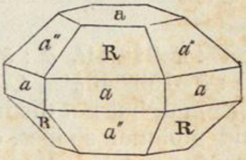
Silica	48·750	48·00
Alumina	20·333	20·00
Lime	8·833	8·35
Magnesia	0·770	0·40
Soda	3·333	2·75
Water	20·000	19·30
Potash	trace =98·019, T.	0·41=99·21, B.

Before the blowpipe it intumesces and whitens. With biphosphate of soda it yields a transparent globule, containing a skeleton of silica, which becomes opaque on cooling. It is unaltered in acids.

Obs. Levyne occurs in trap, with natrolite and mesotype, at the little Deer Park of Glenarm, county Antrim; also at Skagastrand, in Iceland; at Dalsnypen, in Faroe, accompanied by chabazite, analcime, and Heulandite; Godhavn, in Disco Island, Greenland; occasionally in large reddish opaque crystals at Hartfield Moss, in Renfrewshire.

GMELINITE. Vulcanus exfolians.

Hexagonal Kouphone-Spar, *Haid.* Hydrolite, *De Drée.* Sarcolite, *Vauquelin.* Gmelinite, *Brewster's* Jour. II. 262.



325. *Primary form:* a rhombohedron. *Secondary form:* a : R or $a : a''$=131° 48′, a : R or a : a''=138° 12′, R : a'' (over a)= 83° 36′. *Cleavage* apparent parallel to R, the face of a rhombohedron, though obtained with difficulty. Planes a horizontally striated.

H.=4—4·5. G.=2·054; 2·169, Hayes; variety *Ledererite. Lustre* vitreous. *Streak* white. *Color* white, passing into flesh-red. Transparent—translucent. *Fracture* uneven. Very brittle.

Its constituents, according to Thomson, Vauquelin, and Hayes, are as follow:

	From Antrim.	Castel.	Cape Blomidon.
Silica	39·896	50·00	49·47
Alumina	12·968	20·00	21·48
Peroxyd of Iron	8·270	——	0·14
Potash	9·000	——	Phosphor. acid 3·48
Water	29·866	20·00	8·58
Lime	——	4·25	11·48
Soda	—— =100, Thom.	4·25=98·50, Vauq.	3·94=98·57, H.

Though the first two analyses differ in some respects, yet the proportion of silica to the alumina is nearly the same.

When held in the flame of a candle it exfoliates and flies off in numerous scales. "Small portions," says David Brewster, "gradually raise themselves, and after standing on their ends, as if they were under the influence of electricity, they are propelled with violence from the fragment." In the blowpipe flame it increases in bulk, but does not melt into a glass.

Obs. This species includes the *Hydrolite* of De Drée, and the *Sarcolite* of Vauquelin; also the *Ledererite* of Jackson, (Silliman's Am. Journal, xxv. 80,) which is described as presenting the same form, and nearly identical angles, and in other respects is similar to this species.

Gmelinite occurs in the cavities of amygdaloidal rocks at Montecchio Maggiore, and at Castel, in the Vicentine; also in the county Antrim; at the Deer Park of Glenarm, of a white color, and at the Island Magee, near Larne, of a pale flesh-red tinge.

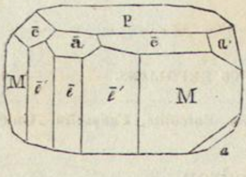
Ledererite was obtained by Messrs. Jackson and Alger, at Cape Blomidon, in Nova Scotia, where it occurs in basalt, associated with stilbite, mesotype, and analcime. The crystals are usually implanted in the analcime, or stilbite.

DATHOLITE. Vulcanus dystomus.

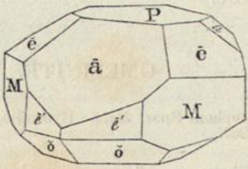
Prismatic Dystome-Spar, *M.* Borate of Lime, *P.* Borosilicate of Lime, *Thom.* Datholith, *W.* Esmarkite, *Haus.* Datolite. Humboldtite, *Levy.* Chaux Boratée Silicieuse, *H.*

326. *Primary form:* an acute oblique rhombic prism; M : M =77° 30′. *Secondary forms:*

1.



2.



P : e=91° 41′, $\bar{e}'$: $\bar{e}'$=116° 9′, $\bar{c}$: $\bar{e}'$=148° 4½′, M : e=128° 45′, M : $\bar{e}'$=150° 40½′ *Cleavage* parallel to M and also $\breve{e}$, or the shorter diagonal, but not distinct. *Imperfect crystallizations:* botryoidal and globular shapes, composed of a columnar structure; also divergent and radiating forms, consisting of delicate columnar particles; also granular.

H.=5—5·5. G.=2·989, Haidinger; a crystal from Arendal. *Lustre* vitreous, often inclining to resinous on the surface of fracture; sometimes also pearly. *Streak* white. *Color* white; sometimes inclining to gray, green, yellow, or red; rarely of a dirty olive-green or honey-yellow tinge. Translucent. *Fracture* uneven, subconchoidal. Brittle.

It contains, according to Klaproth (Beit. iv. 356, and v. 123) and Stromeyer, (Pogg. Ann. xii. 157,) and Du Menil,

	Var. Botryolite.			From Hartz.
Silica	36·5	36·0	37·36	38·51
Boracic acid	24·0	39·5	21·26	35·59
Lime	35·5	13·5	35·67	21·34
Water	4·0	6·5	5·71	4·60
Oxyd of Iron	—=100, K.	1·0=96·5, K.	—100·00, S.	—100·04, Du M.

The variety *Botryolite*, which included the botryoidal or reniform specimens, having a fibrous structure, differs much in composition from the crystals of datholite, and probably will hereafter form a distinct species. The observations which have heretofore been made, lead, however, to the conclusion, that they are merely different forms of the same species.

Datholite (including its varieties) becomes friable in the flame of a candle. Before the blowpipe it becomes opaque, intumesces, and melts into a glassy globule. It dissolves readily in, and gelatinizes with, nitric acid.

Obs. Datholite is found in amygdaloid and gneiss; sometimes also in beds of iron ore in primitive rocks. In the latter situation both varieties are found at Arendal, in Norway. The variety *Humboldtite*, which was instituted as a distinct species by Levy, occurs in agate balls at the Seisen Alp, in the Tyrol. Datholite is met with also in the valley of Glen Farg, Perthshire. The state of New Jersey, at Patterson, and Connecticut, at Middlefield, and near Hartford, afford finely crystallized specimens of this species, at each of which localities it occurs in amygdaloid.

PECTOLITE.

Pektolite, *Kobell.* Kastner's Archiv, XIII. 385.

327. Spheroidal masses, consisting of divergent fibres radiating from a centre.

H.=4—5. G.=2·69. *Lustre* of the surface of fracture pearly. *Color* grayish. Opaque.

It contains, according to Kobell, (Kastner's Archiv, xiii. 385,) Silica 51.3, Lime 33·77, Soda 8·26, Potash 1·57, Water 8·89, Alumina and Oxyd of Iron 0·9=104·69. Fuses into a white transparent glass.

Obs. Occurs in large masses on Monte Baldo, in Southern Tyrol, and at Monzoni, in the Fassa-thal. It resembles some radiating varieties of Mesotype.

BREVICITE.

328. Occurs in regular prismatic crystals; also massive, structure foliated and radiated. *Color* white; often crossed by bands of a deep dirty red color.

It contains, according to M. Sonden, Silica 43·88, Alumina 28·39, Soda 10·32, Lime 6·88, Magnesia 0·21, Water 9·63=99·31.

Obs. This species was sent to Berzelius by M. Ström, from Brevig, in Norway, and was named by the former from its locality.

POOHNAHLITE.

Brooke, Annals of Philosophy, August, 1831.

329. *Primary form:* a right rhombic prism; M : M=92° 20′.

H.=5—5·5. *Lustre* vitreous. *Color* white. Transparent—translucent.

Obs. This species accompanies the fine apophyllites, stilbites, &c. at Poohnah, in Hindostan. It much resembles natrolite; but its crystals traverse the matrix, instead of forming groups in cavities, and have not been observed with perfect terminations.

BERZELINE.

Necker de Saussure, in Leonhard's Jahrbuch der Mineralogie, II. 441.

330. In extremely minute crystals. *Lustre* of surface of fracture, vitreous. *Color* white. Slightly translucent.

It fuses with difficulty into a pale glass. With acids, it forms a jelly.

Obs. It accompanies crystals of black garnet, and pinchbeck-brown mica, in the drusy cavities of an augitic rock, at Galloro, near La Ricia, in the Roman states.

MONTICELLITE.

Brooke, Annals of Philosophy, October, 1831.

331. *Primary form:* a right rhombic prism; M : M=132° 34′. *Cleavage* not apparent.

H.=5—7. *Color* yellowish; sometimes nearly transparent, or colorless.

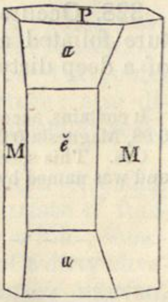
It gelatinizes in muriatic acid; fuses with difficulty before the blowpipe.

Obs. Occurs at Vesuvius in small imbedded crystals, in a crystalline carbonate of lime, associated with particles of black mica, and minute crystals of pyroxene. It was named by Brooke, in honor of the celebrated Neapolitan mineralogist, Monticelli.

PREHNITE. Clasistylus acrotomus.

Axotomous Triphane-Spar, *M.* Prismatic Prehnite, *J.* Koupholite.

332. *Primary form:* a right rhombic prism; M : M=99° 30′. *Secondary form:* M : M=80° 30′, M : ĕ=130° 15′. P : *a*=105° 30′. *Cleavage* distinct parallel with P. Tabular crystals often unite by P, so as to produce what appears to be a single crystal broken in several places, and somewhat rounded at its extremities. *Imperfect crystallizations:* reniform, globular, and stalactitic shapes, with a crystalline surface, and imperfectly columnar or lamellar, strongly coherent structure; also granularly massive structure, sometimes impalpable.



H.=6—6·5. G.=2·8—2·953. *Lustre* vitreous, except on P, whose lustre is pearly, especially of a face obtained by cleavage. *Streak* white. *Color* various shades of green, passing into white and gray. Subtransparent—translucent. *Fracture* uneven. Somewhat brittle.

It contains, according to Klaproth, Gehlen, Thomson, and Lehunt,

	A foliated var.	Fibrous var.	Fib. light-green.	White var. Edinb.
Silica	43·80	43·00	43·60	43·048
Alumina	30·33	23·25	23·00	23·840
Lime	18·33	26·00	22·33	26·164
Protox. Iron	5·66	2·00	2·00	0·640
Protox. Mang.	——	0·25	——	0·416
Potash and Soda	——	——	——	1·028
Water	1·16	4·00	6·40	4·600
	99·28, K.	98·50, G.	97·33, T.	99·736, L.

Before the blowpipe, on charcoal, it froths and melts into a slag of a light-green color. With borax it forms a transparent bead. In dilute muriatic acid, it dissolves slowly, but does not gelatinize, and leaves behind a flaky residue. When heated, it exhibits electric polarity.

Obs. Prehnite was first found at the Cape of Good Hope by Colonel Prehn. It has since been discovered in fine crystallizations in granite, gneiss, and trap rocks. At St. Chrystophe, in Dauphiny, it is associated with axinite and epidote; it also occurs in the Fassa valley, Tyrol; in Saltzburg; at Friskie Hall and Campsie, in Dumbartonshire; and at Hartfield Moss, in Renfrewshire, in veins traversing trap, associated with analcime and Thomsonite; also at Corstorphine Hill, the Castle and Salisbury Crag, near Edinburgh.

In the United States, finely crystallized specimens have been obtained at Farmington and Middletown, Conn. It occurs in small quantities in gneiss, at Bellows' Falls, Vt., and in Sienite, at Charlestown, Mass. Handsome polished slabs of this mineral have been cut from large masses brought from China.

NEPHRITE. Nephrus amorphus.

Uncleavable Nephrite-Spar, *Haid.* Common Jade, *P.* Jade Nephritique, *H.* Talcum Nephriticum, *Linn. Wern.*

333. Massive; fine granular, or impalpable composition.

H.=6·5—7·5. G·=2·932—3·024. *Lustre* vitreous. *Streak* white. *Color* leek-green, passing into blue, gray, and white. Translucent—subtranslucent. *Fracture* coarse, splintery. Very tough.

It contains, according to Kastner and Bowen,

			From Smithfield, R. I.
Silica	50·50		41·688
Magnesia	31·00		34·631
Alumina	10·00		0·562
Ox. Iron	5·50		1·747
Ox. Chrome	0·05	Lime	4·250
Water	2·75=100·80, K.		13·417=96·295, B.

The dissimilarity between the analysis of the Smithfield variety and the preceding, may be owing, in part, to its intermixture with calcareous spar, in which it is imbedded.

It is infusible, *per se*, before the blowpipe, but becomes white; with borax it forms a clear glass.

Obs. Jade was originally brought from China and Egypt. A fine sky-blue variety occurs in the primitive limestone of Smithfield, R. I., and a greenish and reddish-gray variety in the same species of rock at Easton, Penn.

The name *Nephrite* is derived from *νεφρος*, a *kidney;* it was supposed to be a cure for diseases of the kidney.

SAUSSURITE. NEPHRUS PERITOMUS.

Prismatic Nephrite-Spar, *Haid.* Jade Tenace, Felspath Tenace, *H.*

334. *Imperfectly crystallized : cleavage* in two directions parallel to the lateral faces of a rhombic prism of 124°, nearly. Composition often granular, impalpable ; strongly coherent.

H.=5·5—6. G.=3·256, a granular variety from Piedmont ; 3·342, a compact variety from the Pays de Vaud. *Lustre* pearly, inclining to vitreous upon the faces of cleavage ; also resinous in some specimens, particularly the massive. *Streak* white. *Color* white, passing into greenish-white, mountain-green, or ash-gray. *Fracture* uneven, splintery. Extremely tough, and difficultly frangible.

It contains, according to Klaproth and Saussure,

Silica	49·00		44·00
Alumina	24·00		30·00
Lime	10·00		4·00
Magnesia	3·75	Potash	0·25
Oxyd of Iron	6·50		12·50
Soda	5·50		6·00
Ox. Manganese	——		0·05
Loss	0·75=99·55, K.		3·20=100, S.

Before the blowpipe it fuses with great difficulty into a white glass.

OBS. Saussurite occurs in primitive regions, and with hornblende and augite constitutes the rocks called gabbro and euphotide. It was first found on the borders of the lake of Geneva, by Saussure Senior, whose name it bears. It also occurs at Monte Rosa and its vicinity, in Corsica, in Greenland, at Madras, and elsewhere, as a constituent of the above rocks.

In the United States, at Canaan, Conn., it composes a mountain some miles in extent.

PETALITE. PETALUS RHOMBICUS.

Prismatic Petaline-Spar, *M.* Berzelite.

335. *Imperfectly crystallized. Cleavage* parallel to a prism of 95°, nearly. Structure sometimes columnar, occasionally impalpable, usually strongly coherent.

H.=6—6·5. G.=2·42, Arfwedson ; 2·45, Dr. Clarke ; 2·426, C. G. Gmelin. *Lustre* vitreous and glistening ; pearly on the faces of perfect cleavage. *Streak* white. *Color* white, or gray, with occasionally a reddish or greenish tinge. Translucent. *Fracture* imperfectly conchoidal. Brittle.

It contains, according to Arfwedson (Afhand. vi. 145) and Gmelin, (Ann. Phil. xv. 343,)

Silica	79·212	74·17
Alumina	17·225	17·41
Lithia	5·761	5·16
Lime	trace	0·32
Water	——=102·198, A.	2·17=99·23, G.

Gently heated, it emits a blue phosphorescent light. In the blowpipe flame, on charcoal, it becomes glassy, subtransparent, and white, and melts only on the edges. With borax, it forms a clear, colorless glass. When boiled in acids, it is partly decomposed.

Obs. Petalite occurs near Stockholm, at the iron mine of Uton, accompanying the lepidolite variety of mica, turmaline, spodumene, and quartz; also at Bolton, Mass., where it is associated in a lime quarry with scapolite, sphene, and pyroxene.

Lithia was first discovered in this mineral by Arfwedson. The name *petalite* is derived from *πεταλον, a leaf.*

TURQUOIS. Lazulus amorphus.

Uncleavable Azure-Spar, *M.* Calaite. Mineral Turquois. Agaphite. Johnite. Birousa *of the Persians.* Callaïs, probably, of *Pliny.*

336. In reniform masses. *Cleavage* none.

H.=6. G.=2·83—3·00. *Lustre* somewhat waxy, internally dull. *Streak* white. *Color* a peculiar bluish-green. Feebly subtranslucent—opaque. *Fracture* small conchoidal.

Its constitution, according to John's analysis, (Ann. des Mines, 2d ser. iii. 231,) is as follows:

Alumina	44·50
Phosphoric Acid	30·90
Oxyd of Copper	3·75
Protoxyd of Iron	1·80
Water	19·00=99·95.

Berzelius states that he obtained in his analysis of this mineral, phosphate of alumina, phosphate of lime, silica, oxyd of iron, and copper.

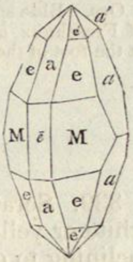
It becomes brown in the reducing flame of the blowpipe, and colors it green, but is infusible; it fuses readily, however, with borax or salt of phosphorus. It is insoluble in muriatic acid, and thus may be distinguished from other species called by the name of Turquois.

Obs. This species occurs only in a mountainous district in Persia, not far from Nichabour. According to Agaphi, the only naturalist who has visited the locality, turquois occurs in veins which traverse the mountain in all directions.

It receives a fine polish, and is valued for ornamental purposes; and when finely colored, is highly esteemed as a gem. The Persian king is said to retain for his own use all the larger and finely tinted specimens.

Pliny remarks concerning the Callaïs, which appears to be identical with the turquois, that it occurred of a pale-green (e viridi pallens) color, and that its finest color was emerald. He states, also, that its form was usually round, and that it was found in Asia, projecting from the surface of inaccessible rocks, whence it was obtained by means of slings.

LAZULITE. Lazulus rhombicus.



Prismatic Azure-Spar, *M.* Azurite, *P.* Azurestone. Hydrousdiphosphate of Alumina and Magnesia, *Thom.*

337. *Primary form:* a right rhombic prism; M : M=91° 30′. *Secondary form:* M : ē=135° 45′, M : e=158° 10′, M : e′=140° 46′, *a* : *a*=120° 40′, *a* : *a*′=150°, ē : a=150° 45′, a : e=138° 45′. *Cleavage* indistinct parallel with M. Occurs also granularly massive; particles strongly coherent.

H.=5—6. G.=3·057. *Lustre* vitreous. *Streak* white. *Color* various shades of azure-blue; commonly of a fine deep blue, viewed in one direction, and a pale greenish-blue, at right angles with the same direction. Subtranslucent—opaque. *Fracture* uneven. Brittle.

According to Fuchs (Schweig. Jour. xxiv. 373) it consists of

Phosphoric Acid	41·81
Alumina	35·73
Magnesia	9·34
Silica	2·10
Protoxyd of Iron	2·64
Water	6·06=97·68.

It slightly intumesces before the blowpipe, assumes at a high heat a glassy appearance, but does not fuse. With borax, it yields a clear colorless globule.

Obs. It occurs both massive and crystallized in narrow veins, traversing clay slate, in the torrent beds of Schlamming and Radelgraben, near Werfen, in Saltzburg. It is also found near Vorau, in Styria, whence it has been called Voraulite.

BLUE SPAR. Lazulus triclinatus.

Prismatoidal Azure-Spar, *M.* Feldspath bleu, *H.*

338. Crystallization undetermined. Commonly occurs in indistinct crystals and masses. *Cleavage* imperfect; sometimes observable in one direction, and apparently in traces in two other directions oblique with the first.

H.=5·5—6. G.=3·024, Haidinger. *Lustre* vitreous. *Streak* white. *Color* smalt-blue, inclining sometimes to white or green. Subtranslucent—opaque. Fracture uneven.

According to Brandes, its constituents are,

Phosphoric Acid	43·32
Silica	6·50
Alumina	34·50
Magnesia	13·56
Lime	0·48
Protoxyd of Iron	0·80
Water	0·50=99·66

Before the blowpipe it loses its color, but is infusible, *per se.* With borax, it dissolves slowly and with difficulty. With boracic acid and iron wire, it affords a globule of phosphuret of iron.

Obs. Blue spar occurs, imbedded in quartz and mixed with mica, in the valley of Freschnitz, near Krieglach, on the Mürz, in Upper Styria; also at Thorenburg, at the foot of the Wechsel mountain, in Lower Austria.

BIOTINE.

Biotina, *Monticelli,* Mineralogia Vesuviana, 438.

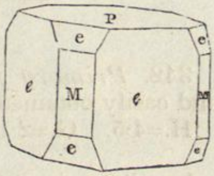
339. Scratches glass. G.=3·11. *Lustre* splendent. *Color* white or yellowish. Transparent and limpid. *Fracture* vitreous, inclining to conchoidal; exhibits double refraction.

Is not affected by the blowpipe, but partly soluble in nitric acid.

Obs. This mineral has been observed by Sig. Monticelli, among the volcanic debris of Vesuvius. Its superior brilliancy readily distinguishes it from its associated minerals. It was named in honor of M. Biot.

SOMERVILLITE.

Brooke, Quar. Jour. of Science, XVI. 275.



340. *Primary form:* a right square prism; *Secondary form:* the annexed figure, with the edge M : *e* replaced; M : *e*=135°, P : e=147° 5′, e : M=122° 55′. *Cleavage* perfect parallel with P.

H. under 6. *Lustre* vitreous. *Color* pale dull yellow.

It decrepitates before the blowpipe, and fuses, *per se*, into a gray colored globule, and with borax into a transparent one.

Obs. Somervillite accompanies black mica and other minerals, in the ancient scoria of Vesuvius. It differs from idocrase in decrepitating before the blowpipe, and in not affording a greenish globule by fusion. This species was first determined by Brooke, and named in compliment to Dr. Somerville.

NEPHELINE. Spatum hexagonum.

Rhombohedral Feldspar, *M.* Rhomboidal Feldspar, *J.* Sommite, *P.* Davina, and Nefelina, *Monticelli.* Davyne. Covellonite. Beudantite.

341. *Primary form:* a hexagonal prism. *Secondary form:* fig. 125, Pl. II. M : *e*=150°, P : e=134° 3′, Phillips. *Cleavage* parallel with P and M, both indistinct.

H.=5·5—6. G.=2·4—2·56. *Lustre* vitreous; somewhat opalescent and pearly in some varieties. *Streak* white. *Color* white or yellowish. Transparent—opaque. *Fracture* conchoidal. Brittle.

It contains, according to Gmelin, Arfwedson, and Monticelli,

			Var. Davina.
Silica	43·36	44·11	42·91
Alumina	33·49	33·73	33·28
Soda	13·36	20·46	—
Potash	7·13	—	—
Moisture	1·39	0·62	7·43
Lime	0·90	—	12·02
Ox. Mang.	1·50 =101·03, Gm.	—	1·25
Ox. Iron		—=98·92, Arf.; loss.	3·11=100, Mont.

The variety Davyne, agrees nearly in composition with nepheline, and is identical in crystallization. M : e′ (of Davyne) is given at 115° 33′, from which, by calculation, we find M : e (of nepheline) =134° 8′, which is nearly the angle of nepheline, obtained by observation.

Before the blowpipe, on charcoal, the edges of the fragment of nepheline are rounded; perfect fusion cannot be effected. Fragments thrown in nitric acid lose their transparency, and assume a nebulous appearance. This character gave rise to the name nepheline, from νεφελη, *a cloud.* Davyne is described as acting somewhat differently in the blowpipe flame. Alone, before the blowpipe, it fuses with effervescence into a white opaque and somewhat porous globule. With nitric acid it effervesces and forms a jelly.

Obs. Both varieties of this species occur at Vesuvius, in the ancient lavas, associated with garnet, mica, idocrase, Wollastonite, &c. The collection of Sig. Monticelli contains some splendid specimens of this species. Nepheline has also been found at Capo di Bove, near Rome, and in Clinkstone, at Katzenbuckel, near Heidelberg. Davyne was named in compliment to Sir Humphrey Davy.

HERSCHELLITE. Spatum Herschellianum.

Ann. of Philosophy, 2d ser. X. 361.

342. *Primary form:* a hexagonal prism. *Cleavage* perfect, and easily obtained parallel with P.

H.=4·5. G.=2·11. *Color* white. Translucent—opaque.

According to the trials of Dr. Wollaston, it contains Silica, Alumina, and Potash.

Obs. It occurs in the cavities of trap at Aci Reale, near Catania, in Sicily, associated with Phillipsite. The crystals are sometimes isolated, but generally aggregated in a manner similar to those of Prehnite.

ELÆOLITE. Spatum oleaceum.

Fettstein, *W.* Pierre Grasse. Elaolite, *Allan.* Lythrodes. Sodaite.

343. *Imperfectly crystallized. Cleavage* parallel to the base and faces of a right rhombic prism of 112° and 68°, nearly.

H.=5·5—6. G.=2·546—2·618. *Lustre* resinous. *Color* dark-green, bluish-gray, brownish, or brick-red. Some varieties are opalescent, when cut and polished. Translucent. *Fracture* conchoidal.

It contains, according to Gmelin (Schweig. Jahrb. vi. 82) and Vauquelin, (Tableau Comp. p. 228,)

Silica	44·190	44·00
Alumina	34·424	34·00
Soda	16·874	} 16·50
Potash	4·733	
Lime	0·519	0·12
Magnesia	0·687	—
Perox. Iron	0·652	4·00
Water	0·600=102·679, G.	—=98·62, V.

Before the blowpipe it fuses into a white enamel. In a powder it gelatinizes readily with acids.

Obs. Elæolite occurs only in Norway, imbedded in the Zircon-Sienite of Laurvig, Stavern, and Fredereckswarn. The opalescence of the pale blue variety renders it somewhat valuable for ornamental purposes.

The name elæolite is derived from *ελαιον*, *oil*, in allusion to its oily lustre.

LABRADORITE. Spatum opalescens.

Polychromatic Feldspar, *M.* Labrador Feldspar.

344. *Primary form:* an oblique rhomboidal prism; P : M=93°

28′, P : T=114° 28′, M : T=119° 16′. *Secondary form:* similar to those of albite. *Cleavage* parallel with P and M most distinct; with T indistinct. It occurs also imperfectly crystallized, with the above cleavages.

H.=6. G.=2·69—2·76. *Lustre* of cleavage faces parallel with P pearly, passing into vitreous. *Streak* white, or grayish-white. *Color* gray, brown, or greenish. By changing the position of the specimen, a beautiful *change of colors* may be observed; of these changeable colors, blue and green are the predominant; yellow, red, and pearl-gray, are also apparent. Translucent—subtranslucent.

Its constituents, according to Klaproth (Beitrage iv. 250) and Thomson, (Min. i. 298,) are,

	From Labrador.	From Labrador.
Silica	55·75	55·408
Alumina	26·50	26·920
Lime	11·00	10·892
Protoxyd of Iron	1·25	1·508
Soda	4·00	4·392
Water	0·50=99, K.	0·840=99·96, T.

Before the blowpipe, on charcoal, it becomes glassy and white, but fuses only on the edges. With oxyd of nickel and borax, it affords a blue pearl. It is entirely dissolved by heated muriatic acid, which does not attack either feldspar or albite.

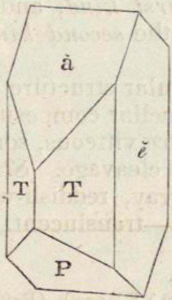
Obs. Labradorite was originally brought from the island of St. Paul, on the coast of Labrador, associated with hornblende, hypersthene, and magnetic iron ore. It exists in magnificent specimens and great abundance in Essex county, N. Y.

FELDSPAR. Spatum orthotomum.

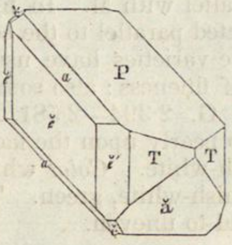
Orthotomous Feldspar, *M.* Prismatic Feldspar, *J.* Felspar. Ice Spar. Ryakonite Adularia, Murchisonite, Leelite, Amausite, Amazonstone, Sunadin, Moonstone, Napoleonite, Lemanite, Courzeranite, Necronite. Feldstein, *Haus.* Feldspath, *H.* Eisspath, *W.*

345. *Primary form:* an oblique rhombic prism; T : T=120°, P : T=67° 15′. *Secondary forms:*

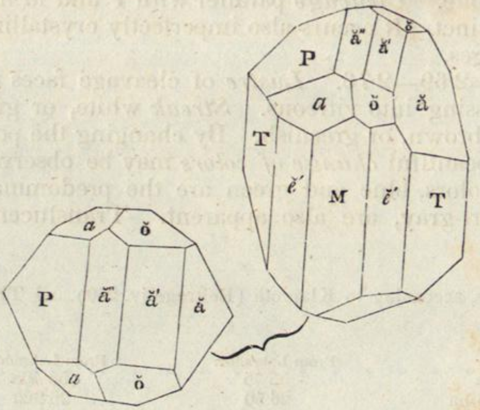
1



2

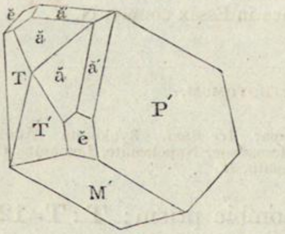


3

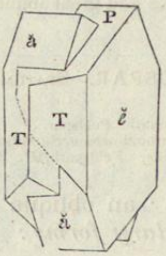


P : á=99° 29′ or 80° 31′, P : ă′=128° 51′, P : ă″=144° 11′. P : a=ĕ : a=135°, T : ĕ=120°, T : ĕ′=150°=ĕ : ĕ′. *Cleavage* parallel with P perfect; with ĕ, or the shorter diagonal, less distinct. *Compound crystals :*

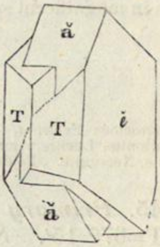
4



5



6



in figs. 5 and 6, composition is of the *first kind*, and has taken place parallel with M. In fig. 4 it is of the *second kind*, and has been effected parallel to the edge P : M.

Massive varieties have usually a granular structure of different degrees of fineness; also sometimes a lamellar composition.

H.=6. G.=2·394—2·581, Rose. *Lustre* vitreous, sometimes inclining to pearly upon the faces of perfect cleavage. *Streak* white, or grayish-white. *Color* white; often gray, reddish-white, flesh-red, greenish-white, green. Transparent—translucent. *Fracture* conchoidal to uneven.

It contains, according to Vauquelin, (Haüy, ii. 592,) Klaproth, (Beitrage, vi. 242,) and Berthier, (Ann. des Mines, vii. 239,)

	Green; Siberia.	Carlsbad.	Fredrickswärn.	Var. Adularia.
Silica	64	64·50	65·00	64·20
Alumina	20	19·75	20·00	18·40
Potash	14	11·50	12·25	16·95
Lime	2	trace	trace	trace
Oxyd of Iron	—	1·75	1·25	——
Water	—=100, V.	0·75=98·25, K.	0·50=99, K.	——=99·55, B.

Before the blowpipe it fuses with difficulty, and only on the edges. With borax it forms a transparent glass. With carbonate of soda, it fuses into a vesicular glass. It is not acted on by the acids.

Obs. Difference of color and lustre has given rise to distinct names for several of the varieties of this species. *Adularia* includes the transparent or translucent varieties found in primitive rocks. The crystals are often quite large, and are found in the greatest perfection in the highest districts of Savoy; they derive their name from Adula, one of the highest peaks of St. Gothard. The Adularia, which, when polished, exhibits a chatoyant reflection of light, has been called *moonstone*, and when containing interspersed minute scales of mica, *sunstone*. The sunstone reflects a pinchbeck brown tint. This opalescence can be observed only in the direction of a plane which replaces the edge T : T somewhat obliquely.

The more transparent specimens, imbedded in trachytic and volcanic rocks, having a perfect vitreous lustre, have been distinguished by the term *glassy feldspar*. *Ice spar* applies to a similar variety, which occurs crystallized in the Vesuvian lavas. *Common feldspar* includes the more common varieties, which occur as constituents of granite, gneiss, and mica slate rocks. Other varieties are the *Murchisonite* of Levy, which is a yellowish-gray variety from Dawlish and Arran; the *Leelite* of Dr. Clarke, (the Helleflinta of the Swedes,) which occurs at Gryphyttan, in Sweden, with a peculiar waxy lustre, and a deep flesh-red color; and also the *Variolite*, a dark green variety, containing lighter globular particles, from Drae river, in France. *Kaolin* is a term applied to decomposed feldspar. *Courzeranite* is a grayish-black, or blackish-blue variety from the steep defiles of Salleix, in the Pyrenees, termed "des Courzerans," where it occurs imbedded in limestone. Its composition, according to Dufrénoy, (Ann. des Mines, iv. 227,) are, Silica 52·37, Alumina 24·02, Potash 5·52, Lime 11·85, Magnesia 1·40, Soda 3·96=99·12.

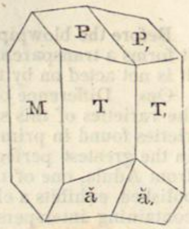
Fine crystallized feldspar is found at Carlsbad and Elbogen, in Bohemia. The twin crystals, represented in figs. 5, 6, are very abundant at the former place, where they occur from two to four inches in length, scattered over the fields, from the decomposition of the granite of the region. Ekatherinenburg, in Siberia; Warmbrunn, in Silesia; Arendal, in Norway; Baveno, in Peidmont; Land's End, &c., are among the interesting localities of this species. At the Mourne mountains of Ireland, fine specimens occur, associated with beryl and topaz. Glassy feldspar occurs in great abundance in the trachyte of the Drachenfels, on the Rhine; also in the lavas which devastated the island of Ischia, near Naples, in 1302. Ice spar is found principally at Vesuvius. It may be obtained in profusion in the valley called Fossa Grande. Porcelain earth, or *kaolin*, occurs at Carclaise and Cigga, in Cornwall; at Aue, near Schneeberg, in Saxony; on the island of Bornholm, in the Baltic; and at Hafnezzell, near Passau, in Bavaria.

In the United States, fine crystals of feldspar are frequently obtained at Rossie and Gouverneur, and the neighboring region, St. Lawrence Co., N. Y. It is usually associated in this region with hornblende, apatite, and scapolite. In a similar situation it is found both perfectly crystallized and cleavably massive, in Buck's Co., Penn., three miles west of Attleboro. It also occurs at Greenfield, near Saratoga, N. Y., and at Haddam, Conn. Large masses of cleavable feldspar may be obtained at Acworth, N. H.; Paris, in Maine, near Ticonderoga; also in still greater abundance in the Highlands of New York, and in Charles Co., Penn. *Kaolin* occurs at Andover, Mass., and Cheshire, Conn. Sunstone is met with at Lyme, Conn.

Feldspar is a necessary material in the manufacture of porcelain. The moonstone and sunstone varieties are often used in jewelry.

PERICLINE. Spatum gemellum.

Heterotomous Feldspar, *M.* Periklin, *Breit.*



346. *Primary form:* an oblique rhomboidal prism; P : M=93° 19′, P : T=114° 45′, M : T =120° 18′. Occurs only in twin crystals similar to the annexed fig., in which composition is of *the first kind*, parallel to M. *Cleavage* perfect, parallel to P and T; rather more easily obtained in the direction of T, instead of P, and in this respect unlike feldspar and albite.

H.=6. G.=2·54—2·55. *Lustre* pearly, sometimes vitreous upon P and T. *Streak* white. *Color* white, yellowish, or reddish. Subtransparent—subtranslucent; often the latter.

It contains, according to Prof. Gmelin's analyses of the Zöblitz variety, Silica 67·91, Alumina 18·93, Soda 9·99, Potash 2·41, Lime 0·15, Oxyd of Iron 0·48=99·87.

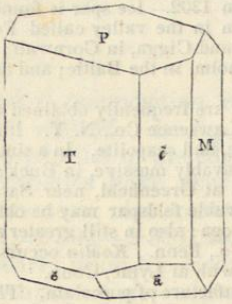
Obs. It is found in large and perfect crystals in sienite, at St. Gothard, in Switzerland; in the Pfunderstahl and Schmiernerthal, in the Tyrol; upon the Sau Alpe in Carinthia; at Zöblitz, in Bohemia, and elsewhere. It was distinguished from Albite by Breithaupt.

ALBITE. Spatum triclinatum.

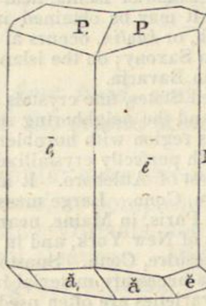
Tetarto-Prismatic Feldspar, *M.* Cleavelandite, *P.* and *Levy.* Kieselspath, *Haus*

347. *Primary form:* an oblique rhomboidal prism; P : M= 93° 50′, P : T=115° 5′, M : T=117° 53′. *Secondary forms:*

1.



2.



M : ē=119° 52′, P : ē=119° 51′, P : ă=127° 23′. *Cleavage* perfect, parallel with M and P, with T less so. *Compound crystals:* similar to the above figures; but usually flattened parallel to M, which face is consequently much enlarged;—this is an instance of composition similar to that described under pericline. *Imperfect crystallization:* lamellar and granular structure; the laminæ have sometimes a stellular arrangement; the particles of the granular structure are occasionally quite fine, approaching to impalpable.

H.=6. G.=2·6—2·68. The albite of Finbo, according to Eggertz, has a G. of 2·612; that of Broddbo, 2·619. *Lustre* pearly upon cleavage planes, vitreous in other directions. *Streak* white. *Color* white; also occasionally bluish, gray, reddish, greenish, and green; it sometimes exhibits a bluish opalescence. Transparent—subtranslucent. *Fracture* uneven. Brittle.

Its composition, according to Eggertz, (Afhandlingar, v. 28,) Rose, (Gilbert's Annalen, lxxiii. 173,) and Laurent and Holmes, (Ann. de Ch. et de Ph. vol. 60, p. 331,) is as follows:

	From Finbo.	From Arendal.	Var. Cleavelandite.
Silica	70·48	68·46	68·4
Alumina	18·45	18·30	20·8
Soda	10·50	9·27	10·5
Lime	0·55	0·68	0·2
Oxyd of Iron and Mang.	——=99·98, E.	0·28=97·99, R.	0·1=100, L. & H.

Before the blowpipe the action is similar to that of feldspar.

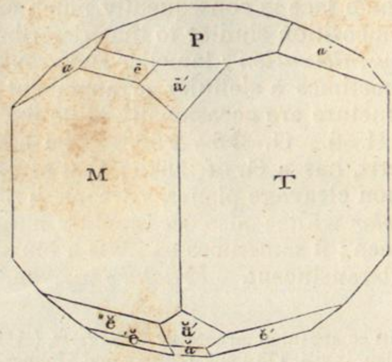
Obs. Albite often replaces feldspar as a constituent of granite; in other instances it is associated with feldspar, as in Pompey's pillar, and then may be generally distinguished by its superior whiteness. The albite granites are often repositories of several of the granite minerals, turmalines of different colors, beryls, &c. It is associated with pearl spar in the Tyrol, where it occurs in large transparent crystals; with epidote and garnet at Arendal; with eudialyte and hornblende in Greenland. It is frequently one of the constituents of sienite and greenstone. Such is the case in the rocks about Edinburgh. In Massachusetts, U. S., at Chesterfield, it occurs in lamellar masses, the laminæ arranged frequently so as to produce a wedge-like form, and having a slightly bluish tint. It is also met with at the same locality, of a finely granular structure, and rarely in small crystals. It is the bed of the fine red and blue tourmalines of Chesterfield. It occurs in a similar manner, and containing the same minerals, at Paris, Maine, and also at Goshen, Mass. At Haddam, Conn., it is accompanied with chrysoberyl, beryl, columbite, automalite, black turmalines, and pinite. At Monroe, Conn., is found a fine granular variety containing beryl.

The name *Albite*, is derived from *albus*, white, in allusion to its color, as observed by Gahn and Berzelius, who thus named it in 1814. The variety from Chesterfield was denominated Cleavelandite, in compliment to Prof. Cleaveland, by Mr. Brooke, who supposed at the time that it was a distinct species. The crystallization of albite was first perfectly developed by Dr. Gustavus Rose, in Gilbert's Annalen, Feb. 1823. More latterly, Mr. W. Phillips proved it to be a frequent constituent of the granite of England.

ANORTHITE. Spatum Vesuvianum.

Anorthomous Feldspar, *M.* Christianite, *Monticelli.* Anorthite, *Rose.* Indianite, *H.*

348. *Primary form:* an oblique rhomboidal prism; P : T=110° 57′, M : T=120° 30′. *Secondary form:* T : ĕ (a plane replacing the



acute lateral edge)=94° 12′, P : à=137° 32′, P : *a*′=133° 13′, P : ā′=138° 46′. *Cleavage* parallel with P and M perfect. *Compound crystals* of anorthite never occur in nature. *Imperfect crystallizations :* structure columnar, or coarse lamellar.

H.=6. G.=2·65—2·78 ; a massive variety was determined by Rose to have the specific gravity 2·762. *Lustre* of cleavage planes inclining to pearly ; of other faces vitreous. *Streak* white. *Color* white. Transparent—translucent. *Fracture* conchoidal. Brittle.

It contains, according to G. Rose, (Gilbert's Annalen, lxxiii. 173,) Silica 44·49, Alumina 34·46, Lime 15·68, Magnesia 5·26, Peroxyd of Iron 0·74=100·63.

It is similar in its action before the blowpipe to the two preceding species, except that with carbonate of soda it does not afford a clear glass, but froths, and forms an enamel. It is entirely decomposed in concentrated muriatic acid.

Obs. Anorthite occurs at Mount Vesuvius, among the old lavas in the ravines of Monte Somma. It generally occupies the cavities of chloritic masses, and is associated with ice spar, augite, mica, and idocrase. It also occurs on the island of Procida, near the entrance to the bay of Naples.

Anorthite was first distinguished as a distinct species by Dr. G. Rose, in 1823, who named it from *ανορθος*, *oblique*, because all its interfacial angles were oblique. It was afterwards described by Monticelli, in his Mineralogia Vesuviana, and named Christianite, in honor of the crown prince of Denmark.

The species *Indianite*, agrees closely in composition and crystallization with anorthite. It is described as occurring in translucent grains of a greenish-white color, cleaving parallel to two planes, inclined to one another at an angle of 95° 15′. It consists, according to Chenevix and Laugier, of

Silica	42·5	43·0
Alumina	37·5	34·5
Lime	15·0	15·6
Oxyd of Iron	3·0	1·0
Soda	—=98, C.	2·6=96·7, L.

with a trace of manganese. It is infusible, but becomes friable and gelatinous in acids. It forms the gangue of the Indian corundum, and is found principally in the Carnatic, associated with garnet, fibrolite variety of kyanite, and hornblende.

LATROBITE. Spatum roseum.

Latrobite, *Brooke*. Diploite, *Breit*.

349. *Primary form :* an oblique rhomboidal prism ; P : M=91° 9′, P : T=98° 30′, M : T=93° 30′ ; obtained from cleavage planes. *Cleavage* parallel to P, M, and T. Occurs also massive.

H.=5·5—6·5. G.=2·72, Gmelin ; 2·8, Brooke. *Lustre* vitreous, of P dull, M and T unequally shining. *Color* a pale rose-red, or a pink, resembling the color of the lepidolite variety of mica. Subtranslucent—opaque.

Gmelin obtained the following composition in two analyses, (Annals of Phil. 2d ser., x. 235,)

Silica	44·653	41·780
Alumina	36·814	32·827
Lime	8·291	9·787
Oxyd of Manganese	3·160	5·767
Magnesia, with some Manganese	0·528	——
Potash	6·575	6·575
Water	2·041=102·062.	2·041=98·777.

Held in the platinum forceps in the blowpipe flame, it fuses with some intumescence into a white enamel. With borax, it affords a globule, which has a pale amethyst-red color in the oxydating flame, and is colorless in the reducing flame. With salt of phosphorus it melts into a clear glass, containing a skeleton of silica.

Obs. Latrobite has been found only on Ametik island, near the coast of Labrador, where it is associated with feldspar, mica, and calcareous spar. It was discovered by the Rev. C. J. Latrobe.

AMPHODELITE.

Nordenskiöld, in Jahresbericht, 1833, p. 174.

350. Resembles feldspar in crystalline form. *Cleavage* parallel to two planes, which meet at an angle of 94° 19′.

H.=4·5. G.=2·76. *Color* light red. *Fracture* similar to that of scapolite.

It contains, according to the analyses of Nordenskiöld, Silica 45·80, Alumina 33·45, Lime 10·15, Magnesia 5·05, Oxyd of Iron 1·70, Water 1·85=100.

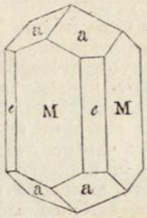
Obs. This species was found by Nordenskiöld in the limestone quarries of Lojo, in Finland.

SCAPOLITE. Spatum quadratum.

Pyramidal Feldspar, *M.* Meionite, Prismato-pyramidal Feldspar, *J.* Dipyre, *P.* Paranthine, Wernerite, *H.* Tetraklasit, *Haus.* Schmelzstein, Scapolith, *Wern.* Bergmannite?

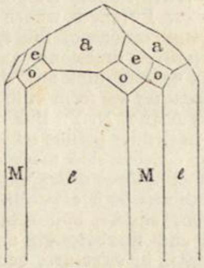
351. *Primary form:* a right square prism. *Secondary forms:*

1.



Gouverneur, N. Y.

2.



Vesuviu .

M : *e*=135°, *e* : a=121° 54′, a : a=136° 7′, a : e=158° 3½′. *Cleavage* parallel with M and *e* rather distinct, but interrupted. Imperfectly crystalline varieties occur columnar, lamellarly fibrous, and massive; commonly the particles are strongly coherent.

H.=5—5·5, nearly 6, a subtransparent variety from Gouverneur, N. Y. G.=2·612—2·749. *Lustre* often pearly externally, inclining to resinous; on the cleavage and fracture surface parallel with P, it is vitreous; on the lateral cleavage planes vitreous, inclining to resinous. *Streak* grayish-white. *Color* white, gray, blue, green, and red; colors usually light. Transparent—faintly subtranslucent. *Fracture* subconchoidal. Brittle.

It contains, according to Stromeyer, Nordenskiöld, John, and Vauquelin,

	Meionite, from Somma.	Scapolite, from Finland.	Wernerite.	Dipyre.
Silica	40·531	41·25	50·25	60
Alumina	32·726	33·58	30·00	24
Lime	24·245	20·36	10·45	10
Potash, with Soda	1·812	——	2·00	—
Perox. Iron	0·182	——	3·00	—
Protox. Mang.	——	0·54	——	—
Water	——=99·496, S.	3·32=99·05, N.	2·85=98·55, J.	2=96, V.

Strongly heated in the blowpipe flame it fuses into a vesicular glass, and intumesces considerably; it then assumes the appearance of ice, and continues no longer in fusion. With borax, it dissolves with effervescence and fuses into a clear globule.

Obs. The great variety of appearance among the different specimens of this species, gave rise to its division, by the earlier mineralogists, into several distinct species. *Meionite* includes the pure transparent perfect crystals found in the debris of Mount Somma. *Scapolite* was applied to the translucent varieties of a gray, greenish-gray, or green color. It sometimes occurs of a red tinge, from an admixture of iron. *Wernerite* occurs in short crystals, similar to the second of the above figures, and with darker shades of color than scapolite. *Paranthine* included the more compact varieties of a pure white and pale blue colors. *Dipyre* was distinguished from scapolite, principally, by its reddish-white color and thin columnar structure in imperfectly crystalline varieties. *Nuttallite* differs from Wernerite only in possessing a tinge of blue with the gray, and a feeble chatoyant reflection of light.

These several varieties of scapolite are usually met with in primitive regions; very often in the primitive limestone, near its junction with the granite; and in beds of magnetic iron, accompanying this rock. In the latter situation, scapolite occurs at Arendal, in Norway, and Wärmeland, in Sweden; also in fine crystallizations in Pargas, Finland, &c. At Arendal it is associated with hornblende and garnet in limestone, and occurs in long slender crystals. *Wernerite* is found in short thick crystals at the same locality. *Paranthine* occurs in the limestone quarries of Galsjo and Malsjo, in Wärmeland. *Dipyre* is confined principally to the torrent of Mauléon, in the western Pyrenees, where it is imbedded in slate.

Beautiful crystallizations of this species occur at Gouverneur, N. Y., thickly disseminated in primitive limestone, and associated with apatite, sphene, and augite. The crystals are usually thick and short prisms, varying in length from half to two inches, and presenting the form of the first of the above figures. In a similar gangue it is met with at Amity, N. Y., Bolton and Boxborough, Mass. *Nuttallite* also occurs at Bolton, in slender prisms seldom terminated; also at the same place a purple variety forming considerable masses, and having a distinctly cleavable structure. In Bucks Co., Penn., three miles west of Attleboro, in a quarry of primitive limestone, scapolite occurs both crystallized and massive, associated with tabular spar, pyroxene, zircon, apatite, and sphene. Compact varieties are met with near Marlboro', Vt., and Boxborough and Westfield, Mass. A pure white variety, somewhat fibrous in its structure, occurs at Monroe, Conn. The variety Bergmannite, which is frequently described as a distinct species, is stated to occur massive and in promiscuous concretions: *color* grayish, passing into white and brick-red; opaque; *lustre* pearly. It occurs at Stavern, in Norway, associated with feldspar, elæolite, and quartz.

GLAUCOLITE.

Bergmann, Edin. New Phil. Jour. III. 385.

352. Massive; traces of cleavage parallel with the faces of a rhombic prism of about 143° 30′, according to Brooke.

H.=5. G.=2·72—2·9. *Lustre* vitreous. *Color* lavender blue, passing into green. Subtranslucent. *Fracture* splintery.

It contains, according to Bergmann,

Silica	50·58	54·58
Alumina	27·60	29·77
Lime	10·27	11·08
Magnesia	3·73	——
Potash	1·27	4·57
Soda	2·96=96·41.	——=100,

with a little iron and manganese. Before the blowpipe it whitens and fuses only on the edges; with borax or salt of phosphorus, it is readily soluble.

Obs. This species was observed by Menge near Lake Baikal, in Siberia, imbedded in compact feldspar and granular limestone. It has also been met with at Lauvig, in Norway, accompanying elæolite.

GEHLENITE. Spatum Gehlenianum.

Stylobite.

353. *Primary form:* a right square prism, which is the usual form it presents. *Cleavage* parallel to P indistinct.

H.=5·5—6. G.=2·9166—3.029. *Lustre* resinous, inclining to vitreous. *Streak* white—grayish-white. *Color* different shades of gray; none bright. Faintly subtranslucent—opaque. *Fracture* uneven—splintery.

It contains, according to Fuchs, (Schweig. Journ. xv. 377,) Kobell, and Thomson,

Silica	29·64	31·0	29·132
Alumina	24·80	21·4	25·048
Lime	35·30	37·4	37·380
Protox. Iron	6·56	4·4	4·350
Water	3·30	2·0	4·540
Magnesia	——=99·6, F.	3·4=99·6, K.	——=100·45, T.

Before the blowpipe thin splinters fuse with difficulty. With borax it fuses slowly, forming a vitreous globule colored by iron. It gelatinizes in muriatic acid.

Obs. Gehlenite is found mostly at Mount Monzoni, in the Fassa Valley, in isolated or aggregated crystals, invested by calcareous spar. It also occurs massive in the same neighborhood, forming an exceedingly tough rock, containing imbedded crystals of pleonaste. According to Monticelli, this species is found indistinctly crystallized in calcareous spar at Vesuvius. Gehlenite was named by Fuchs in honor of his colleague, Gehlen.

GISMONDINE. Spatum volcanicum.

Abrazite. Zeagonite. Gismondine, *Leonhard*. Sesquisilicate of Lime, *Thom.*

354. *Primary form:* a right square prism. *Secondary form:*

a square octahedron, with truncated basal edges; e : e=122° 54′, M : e=132° 31′. *Cleavage* parallel with M imperfect.

H.=6—6·5. G.=2·16—2·2. *Lustre* adamantine. *Color* pale smalt-blue, milk-white, pearl-gray, rose-red. Translucent—nearly transparent. *Fracture* conchoidal.

It consists of Silica 41·4, Lime 48·6, Alumina 2·5, Magnesia 1·5, Oxyd of Iron 2·5=96·5, Carpi. It phosphoresces before the blowpipe and becomes friable, but does not fuse. It forms a jelly with acids without effervescence.

Obs. It occurs in white translucent crystals coating cavities of lava at Capo di Bove, near Rome; and in small purple colored crystals in the drusy cavities of ice spar and other volcanic minerals, at Vesuvius. The purple variety has been called zeagonite; but it appears to be identical with Gismondine. The white variety was first described by Gismondi, and hence its name.

MELLILITE.

355. *Primary form:* a right square prism. *Secondary form:* the primary with the lateral edges truncated.

Gives sparks with steel. G.=3·041—3·28. *Lustre* vitreous. *Color* yellow, reddish, or greenish. Opaque. *Fracture* subconchoidal.

It contains, according to Carpi, Silica 38, Lime 19·6, Magnesia 19·4, Alumina 2·9, Oxyd of Iron 12·1, Titanic Acid 4, Oxyd of Manganese 2=98.

It fuses before the blowpipe into a greenish glass. When pulverized it gelatinizes with acids.

Obs. It occurs in the cavities of a volcanic rock, at Capo di Bove and Tivoli, near Rome, associated with nepheline.

MANGANESE SPAR. Spatinius decolorans.

Bisilicate of Manganese. *Thomson.*

356. *Primary form:* an oblique rhomboidal prism; fig. 104, Pl. II.; M : T=121°, M : P=93°—94°, P : T=112° 30′. *Cleavage* highly perfect parallel with P; less perfect parallel with M and T.

H.=5·5—6·5. Some varieties have a hardness equal to 7. G.=3·4—3·634. *Lustre* vitreous. *Streak white.* *Color* light brownish-red, flesh-red, sometimes greenish, or yellowish, when impure. Transparent—opaque. *Fracture* conchoidal—uneven. Brittle.

The composition of the manganese spar from Longbanshyttan, Sweden, has been determined as follows, by Berzelius:

Oxyd of Manganese	52·60
Silica	39·60
Oxyd of Iron	4·60
Lime and Magnesia	1·50
Water	2·75=101·05.

The impure varieties, *Rhodonite*, *Photizite*, and *Allagite*, contain variable proportions of spathic iron, or carbonate of manganese, and alumine.

Dr. Thomson has made distinct species of two silicates of manganese from Franklin, New Jersey, which do not agree with the variety of long standing in mineralogy, in their composition.

One which he calls chemically the simple silicate of manganese, is composed of

Silica	29·64
Protox. Manganese	66·60
Peroxyd of Iron	0·92
Moisture	2·70
Alumina	trace=99·86.

Its color is a light brownish-red. Hardness 6·25. Sp. Gr. 4·078. Powder light red.

The other, a sesquisilicate, is composed of

Silica	42·70
Protox. Manganese	50·72
Protox. Iron	6·76=100·18.

It occurs in crystals whose primary is the oblique rhomboidal prism, which has been given above as the form of these species. The crystals are often several inches long, and an inch in diameter. H.=6·25. G.=3·586. *Color* brown, slightly reddish. It has been named Fowlerite, in compliment to Professor Fowler.

Before the blowpipe manganese spar becomes dark brown, and melts into a reddish-brown glassy globule. In the oxydating flame it colors borax hyacinth-red, but in the reducing flame, the borax remains uncolored. In the state of a powder, it is partly dissolved by muriatic acid, and the insoluble part becomes of a white color. All the varieties grow dark on exposure to the air, and often the weathered surface has nearly a black color.

Obs. The foreign variety first recognised as the foundation of this species, occurs at Longbanshyttan, near Phillipstadt, in Sweden, in iron ore beds, sometimes in broad foliæ, at others granular, and of a paler color; also at Elbingerode, in the Hartz; in the district of Ekatherinenburg, in Siberia; with gray copper ore, at Kapnik, in Transylvania.

The same variety occurs in the United States, in large boulders, at Cummington, Mass., scattered over the fields.

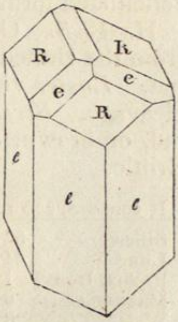
The variety Fowlerite is found at Hamburgh, N. J., at the Franklin furnace, where it occurs in a bed in limestone, with magnetic iron, Franklinite, and garnet. The silicate of manganese is associated with Troostite, automolite, and red zinc ore, at Sterling, N. J.; also at Cumberland, R. I., where it is associated with Yenite.

The varieties allagite, rhodonite, photizite, and corneous manganese, are found near Rübeland, in the Hartz.

Manganese spar receives a high polish, and is sometimes employed for inlaid work.

TROOSTITE. SPATINIUS RHOMBOHEDRUS.

Ferruginous Silicate of Manganese, *Thomson*.



357. *Primary form:* an obtuse rhombohedron; R : R=115°, measured with the common goniometer. *Secondary form:* R : e=147° 30′, R : *e*=122° 30′. *Cleavage* perfect parallel to *e*, less distinct at right angles with the axis. Parallel to R in traces. Occurs also massive, and having a granular composition.

H.=5·5. G.=3·014—3·034, Thomson. *Lustre* vitreous, inclining to resinous. *Streak* white. *Color* pale asparagus-green, yellow, gray, reddish-brown; none bright. Transparent—translucent. *Fracture* conchoidal. Brittle.

According to Dr. Thomson, it consists of

Silica	30·650
Protox. Manganese	46·215
Perox. Iron	15·450
Moisture and Carbonic Acid	7·300=99·615.

In the blowpipe flame it becomes transparent, and fuses on the edges. To borax it gives the violet tinge of manganese. It dissolves with effervescence in muriatic acid, giving out chlorine.

Obs. Troostite occurs with Franklinite at Sterling, N. J., in beds of primitive limestone.

BUSTAMITE. Spatinius reniformis.

358. Occurs in spherical or reniform masses, having a radiated or almost laminated structure.

H.=6—6·5. G.=3·1—3·3. *Color* pale gray, with a slight tint of green or red. Subtranslucent.

Its composition, according to Dumas, (Ann. des Mines, 2d series, i. 272,) is as follows:

Silica	48·90
Protox. of Manganese	36·06
Lime	14·57
Protox. of Iron	0·81=100·34.

Obs. This mineral was discovered by M. Bustamente, of Mexico, accompanied with quartz and manganese, at Real de Minas de Fetela, and at Inotlœ, in the province of Publa, Mexico.

TABULAR SPAR. Augitus tabularis.

Prismatic Augite-Spar, *M.* Tabular Spar. Table Spar. Grammite. Schaalstein, *W.* Tafelspath, *M.*

359. *Primary form:* according to Brooke, an oblique rhomboidal prism; P : M=126° ? P : T=93° 40′, M : T=95° 15′. *Cleavage* perfect and easily obtained parallel to one of the lateral faces; less so parallel with the other; indistinct parallel with P. *Imperfect crystallizations:* columnar; particles long and slender; often sub-lamellarly arranged; at other times crossing, so as to produce reticulated forms; rather strongly coherent.

H.=4—5. G.=2·78—2·9 : 2·785—2·895, Thomson, specimens from the United States; 2·805, Haidinger, specimen from the Bannat. *Lustre* vitreous, inclining to pearly upon the faces of perfect cleavage. *Streak* white. *Color* white, inclining to gray, yellow, red, or brown. Subtransparent—translucent. *Fracture* uneven. Brittle.

It contains, according to Bonsdorf, Stromeyer, and Thomson,

Silica	52·58		51·445	51·716
Lime	44·45		47·412	42·352
Protox. Iron	1·13		0·401	1·908
Magnesia	0·68	Protox. Mang.	0·257	——
Water	0·99=99·73, B.		0·076=99·591, S.	3·200=100·176, T.

Before the blowpipe it fuses with difficulty into subtransparent colorless glass. With borax it forms readily a clear glass. Thrown into nitric acid, it effervesces rapidly at first, and soon falls to a powder.

Obs. Tabular spar is found in granite and primitive limestone; also in basalt and lavas.

It occurs in the copper mines of Cziklowa, in the Bannat of Temeswar. It accompanies garnet, fluor, and native silver, in limestone, at Pargas, in Finland, and Kongsberg, in Norway. At the Castle rock of Edinburgh it is met with in basalt, associated with Prehnite, presenting a fibrous radiated structure. A greenish-white variety occurs in lava at Capo di Bove, near Rome.

In the United States, this species occurs at Willsborough, N. Y., forming the sides of a powerful vein of garnet, which traverses a mountain of gneiss; at Boonville, N. Y., it is met with in large boulders; also at Grenville, Lower Canada, associated with green coccolite. It is found in large tabular masses of a fibrous structure, in Bucks Co., Penn., three miles west of Attleboro', associated with scapolite, pyroxene, and sphene.

Dr. Thomson has described under the name of *Wollastonite*, a variety of this species from Kilsyth, where it occurs in greenstone veins. It differs in composition from tabular spar in containing 1 part of trisilicate of soda to 4 of tabular spar.

SPODUMENE. Augitus rhombicus.

Prismatic Triphane-Spar, *M.* Prismatic Spodumene, *J.* Triphan, *L.* Triphane, *H.*

360. *Imperfect crystallizations:* structure foliated; yields by cleavage rhombic prisms of 93°.

H.=6·5. G.=3·11—3·19. 3·17, Haidinger; 3·188, Thomson; specimen from Dublin Bay. *Lustre* pearly. *Streak* white. *Color* grayish-green, passing into greenish-white and grayish-white. Translucent—subtranslucent. *Fracture* uneven.

It contains, according to Stromeyer and Thomson,

	Utön.	Killiney.
Silica	43·288	63·812
Alumina	28·776	28·508
Lithia	5·626	5·604
Protox. Iron	0·794	0·828
Protox. Mang.	0·204	Lime 0·728
Moisture	0·775=99·463, Strom.	0·360=99·840, Thom.

Before the blowpipe it loses its translucency and color, and swells to a foliated reddish-yellow mass, which easily falls to a powder. The exterior portions fuse into small glassy globules.

Obs. It occurs on the Island of Utön, in Sudermanland, Sweden, with magnetic iron ore, quartz, turmaline, and feldspar; also near Sterzing, in the Tyrol; and of a pale green or yellowish color, imbedded in granite, at Killiney Bay, near Dublin.

It occurs in granite, at Goshen, Mass., associated at one locality with blue turmaline and beryl; also at Chesterfield and Sterling, Mass. Spodumene is derived from *σποδος*, *ashes*, and was so called because it assumes a form like ashes before the blowpipe.

PYROXENE. Augitus diatomus.

Paratomous Augite-Spar, *M.* Pyramido-Prismatic Augite, *J.* Augite. Coccolite. Diopside. Sahlite. Pyrgom. Fassaite. Pentaclasite. Jeffersonite,[*] *Keating*. Asbestus, in part. Green Diallage, Kokkolit, Baikalit, Omphazit, *W.* Pentaklasit, *Haus.* Pyroxene, Malacolithe, *Hauy*.

361. *Primary form:* an oblique rhombic prism; M : M=87° 5′,

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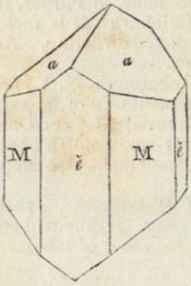
[*] For remarks on the identity of Jeffersonite and pyroxene, see an article by Dr. Troost, on the pyroxene of the United States, in the Jour. Acad. Nat. Sci. Philad. iii. 105; also by its original describers in vol. iv. of the same Journal, p. 3.

P : M=101° 5′. *Secondary forms:* fig. 1, a crystal from Etna, also Gouverneur, N. Y.; fig. 2, a crystal from Fassa, Tyrol; fig. 3, from Ala, Piedmont, and Bytown in Lower Canada.

1.



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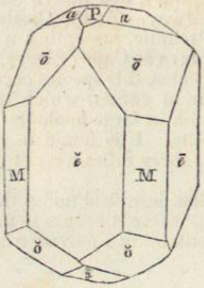

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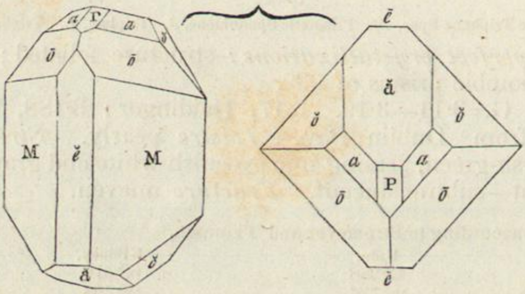


P : *a*=150°, *a* : *a*=120°, ō : ō=95° 28′, ŏ : ŏ (adjacent planes) = 81° 46′, ŏ : ŏ=131° 8′, M : ē=136° 28′, M : ĕ=133° 33′. *Cleavage* parallel to M rather perfect, often interrupted; also parallel to ĕ and ē. *Compound crystals:* fig. 14, Pl. III.; composition of the second kind; parallel to the front lateral edge. *Imperfect crystallizations:* coarse lamellar structure in large masses, parallel to P or ĕ, arising from an aggregation of separate individuals; the plane of union between the laminæ are joints of composition; granular—particles frequently very coarse and weakly connected; at other times fine and strongly coherent.

H.=5—6. G.=3·233—3·349. *Lustre* vitreous, inclining to resinous; sometimes pearly. *Streak* white—gray. *Color* green of various shades, verging on the one side to white or grayish white, and on the other, to brown and black. Transparent—opaque. *Fracture* conchoidal—uneven. Brittle.

This species presents a great variety of forms and is, therefore, subdivided into several varieties. These varieties in appearance, arise from the isomorphous nature of oxyd of iron and magnesia, on which account, one may replace the other without producing a change in the crystalline form. Pyroxene invariably contains one of these two substances, and according as the iron or the magnesia is more abundant the color varies, becoming darker as the iron predominates. The following two tables exhibit the composition of the *light* and *dark* varieties.

1. Light varieties, according to Rose, Bonsdorf, and Hisinger:—

	Wärmeland.	Taumare.	Var. Sahlite.
Silica	55·32	54·83	54·18
Lime	27·01	24·76	22·72
Magnesia	16·99	18·55	17·81
Prot. of Mang.	1·59	——	1·45
Perox. Iron	2·16	0·99	2·16
Alumina	—	0·28	—
Water	—=103·07, R.	0·32=99·73, B.	1·20=99·52, H.

Before the blowpipe they fuse, *per se*, into a colorless glass. With borax or soda, they easily melt into a transparent glass; with salt of phosphorus, they undergo a slow decomposition, and leave a siliceous residue.

2. Dark varieties, according to Rose:—

	Dalecarlia.	Dalecarlia.	Wärmeland.
Silica	54·08	54·55	53·36
Lime	23·47	20·21	22·19
Magnesia	11·49	15·25	4·99
Protox. of Iron	10·02	8·14	17·38
Protox. of Mang.	0·61	0·73	0·09
Alumina	—=99·67.	0·14=99·02.	—=98·01.

Their action before the blowpipe is similar to the preceding, except that the color of the bead is affected by the presence of the iron.

Obs. The term *augite* is often applied to this species, but was formerly restricted to opaque individuals of a dark green color, sometimes inclining to brown or black; it is often a volcanic product. The *crystallized green earth* found in beds of trap tufa, are the result of the decomposition of augite. *Diopside* presents dark green, and greenish-white colors, and is often subtransparent; it occurs in compressed divergent prisms, and in crystalline masses, having a coarse foliated structure, arising from composition parallel with P. The name *Alalite* has been applied to specimens of this variety from Ala, in Piedmont. *Sahlite* includes subtranslucent imperfectly crystallized specimens of a pale green, or grayish-green color. *Baikalite*, *pyrgom*, *Fassaite*, are names of dingy green varieties of Sahlite. *Omphazite* is a compact foliated leek-green variety. *Coccolite* (from κοκκός, *a seed*) includes granular varieties; the particles may be of various sizes, and are generally angular and easily separable. Occasionally they appear rounded. Green diallage, a grass-green variety, occurs either massive or crystallized; the massive specimens have a granular or foliated structure, the latter arising from composition parallel with P or ē. The above varieties are separated by very slight shades of difference, and, in general, the distinctions are quite unimportant.

Pyroxene is principally confined to primitive basaltic or volcanic rocks, and is associated at different localities with granite, granular limestone, serpentine, greenstone, basalt, or lavas. Aussig and Teplitz, in Bohemia, afford large crystals of augite imbedded in basalt. It also occurs in small but highly polished crystals in the lavas of Vesuvius, accompanied with nepheline, idocrase, and mica. Diopside is met with in crystals at Ala, in Piedmont, associated with garnets and talc in veins traversing serpentine. Its more transparent crystals from this locality are sometimes polished and worn as gems. Coccolite occurs in veins in primitive rocks at Arendal, in Norway. Sahlite is met with in a similar situation at Sahla, and elsewhere. Baikalite occurs principally on the borders of Lake Baikal, at the mouth of the Sljumanka River. Omphazite accompanies granular garnet at the Sau Alp, in Carinthia, and near Hoff, in Bayreuth, with the smaragdite variety of hornblende, which it much resembles.

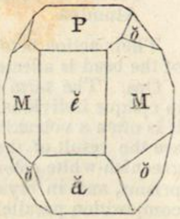
Beautiful white subtransparent crystals of this species are met with at Bytown, Lower Canada, where they occur, often one and a half inches long and an inch in diameter, in calcareous spar. Crystals, equally large but less clear, are found in the town of Canaan, Conn., disseminated in beds of Dolomite; also at Kingsbridge, N.Y., with white hornblende. Black crystals occur in the trap at Montreal. Diopside is found in handsome crystals in the limestone quarry of Bolton, Mass. Sahlite occurs in the verd-antique quarries of New Haven and Milford, Conn.; in the iron mine at Monroe, N. Y.; at Bolton, Mass. Coccolite of a fine green color is met with at Willsborough, N. Y., in a granite vein containing garnet and tabular spar. In a similar situation, both crystalline and granular varieties are found in Bucks Co., Penn., three miles west of Attleboro'; also in large boulders at Boonville, N. Y. Near Ticonderoga, at Rogers' Rock, on Lake George, an imperfectly crystalline pyroxene is very abundant; also at Monroe, N. Y.

Pyroxene was thus named by Haüy, from πῦρ, *fire*, and ξένος, *stranger*, in allusion to its occurrence in lavas, where, according to Haüy, it did not naturally belong, or was a stranger. *Augite*, which is frequently employed to designate this species, is derived from ἀυγη, *lustre*, alluding to the fact, that its lustre is usually superior to that of hornblende.

Crystals of this species have been obtained by fusion, and are not unfrequent, of a black color, among the iron slags of Sweden. Mitscherlich and Beudant have succeeded in forming white crystals, by mingling silica, lime, and magnesia, and subjecting them in a charcoal crucible to the heat of a porcelain furnace.

BUCKLANDITE. Augitus dystomus.

Dystomic Augite-Spar, *Haid.* Diagonal Scotine, *Breit.*



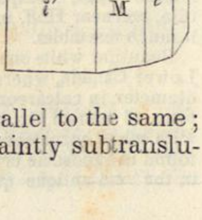
362. *Primary form:* an oblique rhombic prism; M : M=70° 40′, P : M=76° 4′, or 103° 56′. *Secondary form:* P : M=103° 56′, M : ĕ=125° 20′, P : ĕ=114° 55′, P : ă=99° 41′, ĕ : ă=164° 46′. *Cleavage* not observable.

H. 6 or higher. *Lustre* vitreous. *Color* dark brown, nearly black. Opaque. *Fracture* uneven.

Obs. Its crystals are usually small; rarely they occur an inch or more in length. It is met with at Arendal, in Norway, where it is accompanied by black hornblende, feldspar, and apatite. It has also been observed by Prof. G. Rose, in minute but brilliant crystals in the lavas of the Lacher-See. According to Rose, it is completely soluble in muriatic acid; he obtained a specific gravity of 3.945. This species was instituted by Levy. It bears a strong resemblance to pyroxene.

BABINGTONITE. Augitus acrotomus.

Axotomous Augite-Spar, *M. Levy*, Ann. Phil. 2d ser. VII. 275.



363. *Primary form:* an oblique rhomboidal prism; P : M=92° 34′, P : T=88°, M : T= 112° 30′, P : *a*=150° 25′, M : ē=137° 5′, M : ĕ= 132° 15′, ē : ĕ=89° 20′, Levy. *Cleavage* perfect, and easily obtained parallel with P, less perfect in the direction of T.

H.=5·5—6. G.=3·4—3·5. *Lustre* vitreous, splendent. *Color* dark greenish-black; thin splinters green perpendicular to P, and brown parallel to the same; faintly translucent. Large crystals, opaque, or faintly subtranslucent. *Fracture* imperfectly conchoidal.

It contains, according to Mr. Children, Silica, Iron, Manganese, Lime, and a trace of Titanium. Before the blowpipe it fuses on the surface into a black enamel. With borax it affords a clear amethystine colored globule, which becomes green in the reducing flame.

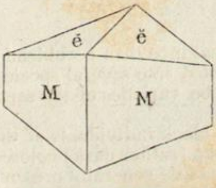
Obs. Babingtonite occurs in distinct crystals at Arendal, in Norway, associated with epidote and massive garnet, and in the Shetland Isles, imbedded in white quartz. It was named in compliment to Dr. Babington, by Mr. Levy, who first distinguished it as a species; it resembles some dark varieties of pyroxene.

HORNBLENDE. Augitus Protæus.

Hemi-Prismatic Augite-Spar, *M.* Axotomous Shiller-Spar or Green Diallage, Hemi-Prismatic Augite, *J.* Actinolite, Tremolite, Pargasite, Smaragdite, Asbestus, in part, Amianthus, Amianthinite, Amianthoid, Lotalite, Amphibole, Actinote, Strahlstein, Tremolith, Kalamit, Amiant, *W.* Grammatit, Byssolith, *Haus.*

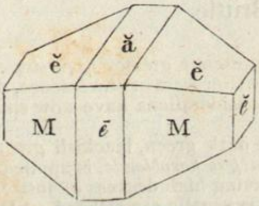
364. *Primary form :* an oblique rhombic prism ; M : M=124° 30′, P : M=103° 13′. *Secondary forms :*

1.



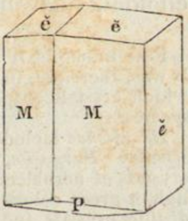
Edenville, N Y.

2.



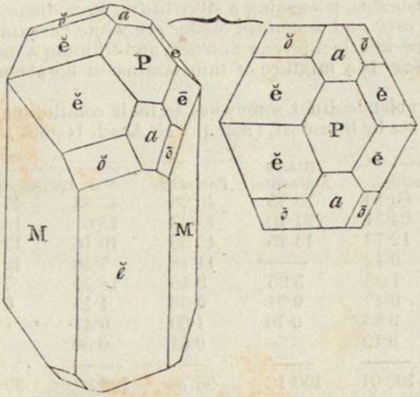
Gouverneur, N. Y.

3.



Teplitz, Bohemia.

4.



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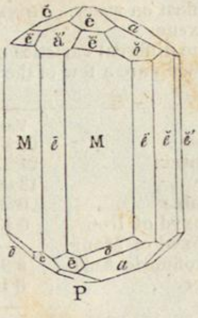
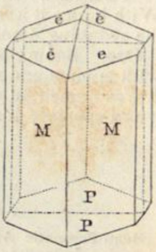


Vesuvius.

ĕ : ĕ=149° 38′, ă : ĕ=164° 49′, ă : ē=104° 58′, M : ē=152° 15′, M : ĕ=117° 45′. *Cleavage* highly perfect, parallel with M. Sometimes distinct parallel to the diagonals. Lateral planes often longitudinally striated.

6.



Compound crystals: composition of *the second kind*, parallel to the obtuse edge M : M. The simple crystals composing this twin, are represented in fig. 3. *Imperfect crystallizations:* fibrous, and slightly divergent columnar; columns coarse—filiform—sometimes lamellar, often exceedingly delicate fibres: granular; particles of various sizes usually strongly coherent; sometimes friable.

H.=5—6. G.=2·9—3·2; 2·931, tremolite variety; 3·026, actinolite, from Zillerthal; 3·167, basaltic hornblende, from Lower Stiria. *Lustre* intermediate, between vitreous and pearly on cleavage faces; occasionally true pearly; vitreous parallel to P. Some fibrous varieties have a silky lustre. *Streak* white, grayish-white, brown. *Color* various shades of green, inclining to blackish-green and a pure black on the one side, and white on the other. Occasionally, almost transparent; usually, subtranslucent—opaque. *Fracture* subconchoidal, uneven. Brittle.

Few minerals, if any, present a greater diversity of appearance than hornblende. It was, therefore, in the earlier state of the science, distributed into several species, which crystallographic considerations have now shown to be varieties of the same species.

Hornblende includes the dark green, blackish green, and black individuals of the species. *Pargasite*, or *Pargas hornblende*, is applied to green (rather dark) colored crystals of hornblende, having high degrees of lustre. *Actinolite* generally presents lighter green colors, and is usually crystallized in long slender prisms. When in distinct crystals, and with high degrees of lustre, it is termed *glassy* actinolite; if columnar in its structure, *asbestiform* actinolite; if granular, *granular* actinolite. The individuals having a white color, were named *tremolite*, except when the particles were very thin columnar or filiform, in which case it was designated *asbestus;* and the more delicate specimens of asbestus, possessing a silky lustre, were distinguished by the name *amianthus*. *Rock cork* and *mountain leather* are white varieties, composed of minute fibrous particles interlacing one another, and forming a mass that will float on water. *Green diallage* is a mixture of thin laminæ of hornblende and pyroxene.

The different varieties of hornblende differ somewhat in their constitution. The following are a few of the analyses by Bonsdorf, (Kong. Vet. Acad. Handl. 1821:)

	Var. Tremolite.		Glassy Actinolite.	Pargasite.	Var. Hornblende.	
Silica	60·31	60·10	59·75	46·26	43·83	45·69
Magnesia	24·23	24·31	21·10	19·03	13·61	18·79
Lime	13·66	12·73	14·25	13·96	10·16	13·83
Alumina	0·26	0·42	——	11·48	7·48	12·18
Protoxyd of Iron	0·15	1·00	3·95	3·48	18·75	7·32
Protoxyd of Mang.	—	0·47	0·31	0·36	1·15	0·22
Hydrofluoric Acid	0·94	0·83	0·76	1·60	0·41	1·50
Water	0·10	0·15	—	0·61	0·50	—
	99·65	100·01	100·12	96·78	100·89	99·53

Before the blowpipe it readily enters into fusion, attended with a slight ebullition. The *white* varieties form a subtransparent glass; the *green*, a glass, colored more or less by the iron they contain. With borax it fuses easily, producing a similar globule. It is not decomposed with salt of phosphorus; after a long blast, the glass (of white varieties) becomes opaline on cooling. With a very small portion of carbonate of soda, it fuses into a transparent, or colored glass, as above. More of the flux causes an intumescence, and the formation of an infusible scoria.

Obs. The variety hornblende of this species is one of the constituents of sienite and greenstone. It also forms beds in primitive regions. Frequently it possesses a slaty structure, and is then called hornblende-slate. Hornblende also occurs in primitive limestone. Actinolite is found in the greatest perfection in talcose rocks, and tremolite occurs most abundantly in the primitive limestones and dolomite. Asbestus often traverses serpentine rocks and primitive limestones.

Aussig and Toplitz, in Bohemia; Tunaberg, in Sweden; Pargas, in Finland; afford fine specimens of the dark colored hornblendes. Actinolite occurs at Saltzburg and Greiner, in the Zillerthal; Tremolite, at St. Gothard, in primitive limestones or dolomite; also at Sebes in Transylvania, the Tyrol, the Bannat, Gulsjo in Sweden, Glentilt, &c. A soft asparagus-green variety occurs at Normarken, in Sweden, in prisms in serpentine; it has been called *calamite*. Asbestus is found in Savoy, Saltzburg, the Tyrol; also in the island of Corsica, where it is so abundant that Dolomieu employed it in packing his minerals. Rock cork is obtained in Saxony, Portsoy, and Leadhills, where also mountain leather occurs. Oisans, in France, affords a variety of amianthus, composed of fibres having some degree of elasticity. It is the *amianthoide*, of Haüy.

In the United States, hornblende occurs in shining black crystals, with truncated acute lateral edges, at Franconia, N. H. Also with the obtuse edges truncated, at the same place, and at Chester, Mass.; and with distinct terminal secondary planes, at Newton, N. J. Small, but perfect crystals, of a black color, are met with at Willsborough, N. Y., where they occur on a mountain near the locality of tabular spar and garnet, imbedded in black turmaline. Fine crystallizations, of a dark green color, have been obtained at Gouverneur, St. Lawrence Co., N. Y., where it is associated with apatite, pyroxene, and crystallized feldspar; the crystals are sometimes two, or even three inches in diameter, though possessed of a length of little more than an inch. Other slender crystals, (var. Pargasite,) of high degrees of lustre, occur in the same region, and at Antwerp, N. Y. Amity, N. Y., affords distinct reddish-brown crystals, one or two inches long, and nearly the same in diameter. The limestone of Edenville, N. Y., contains highly polished crystals of a hair-brown and greenish-white color. Beautiful specimens of glassy actinolite, are to be obtained in the steatite quarries of Windham, Readsborough, and New Fane, Vt., also at Middlefield, Mass. New Fane affords also a friable granular variety, composed of intermingled grains of actinolite and quartz, also asbestiform and massive specimens. At Plympton, Vt., and at Edenville, N. Y., are obtained massive and easily cleavable varieties of hornblende. Tremolite, or white hornblende, occurs abundantly in large flattened crystals, often above an inch long, and three quarters of an inch wide, at Canaan, and other places in Litchfield Co., Conn., imbedded in dolomite beds. Less splendid specimens, though interesting, are common throughout the dolomite beds and granular limestone of the country. It occurs also near Philadelphia, at London grove, in a limestone quarry. Asbestus is found abundantly on Staten Island, N. Y.; at West Farms, Conn.; at Brighton and Dedham, Mass.; at Barnet's Mill, Fauquier Co., Va.

A variety of hornblende, on the island of Corsica, admits of a high polish, and is known to the Italian lapidaries under the name of *Verde de Corsica duro*. Asbestus was manufactured into cloth by the ancients, who were acquainted with its incombustibility. This cloth was often the material for their napkins, and was preferred for this purpose on account of the ease with which it was cleansed; it was merely necessary to throw them into the fire. This material was also employed for the wicks of lamps in the ancient temples, and because it maintained a perpetual flame without being consumed, was named ασβεστος, *unextinguished*. It is used at the present time, for the same purpose, by the natives of Greenland. The ancients also called it αμιαντος, *undefiled*, because of the simplicity of the means of restoring it, when soiled, to its original purity.

Hornblende was thus named in allusion to its extreme toughness; in this respect slightly resembling horn. The radiating, or divergent structure, frequently presented by actinolite, suggested this name from ἀκτῖν, *radius solis*. Tremolite was first found at Tremola, in Switzerland, and Pargasite, at Pargas, in Finland.

ANTHOPHYLLITE. AUGITUS PHYLLINUS.

Prismatic Schiller-Spar, *M.* Strahliger Authophyllite, *W.* Strelite.

365. *Primary form:* a rhombic prism; M : M=about 125° 30′, and 54° 30′. *Cleavage* parallel to M and both diagonals; that parallel to the longer diagonal the most distinct.

H.=5—5·5. G.=2·94—3·1558. *Lustre* submetallic, inclining to pearly. *Streak* white. *Color* between gray and dark clove-brown; also brownish-green. Translucent—subtranslucent. Brittle.

It contains, according to Vopelius, (Pogg. Annalen, xxiii. 355,) Gmelin, (Pogg. Ann. xxiii. 358,) and Thomson, (Min. i. 207,)

Silica	56·74	56	57·12
Alumina	——	3	trace
Magnesia	24·35	23	25·92
Lime	——	2	1·32
Protox. Iron	13·94	13	13·52
Protox. Mang.	2·38	4	—
Water	1·67=99·08, V.	— =101, G.	1·36=99·24, T.

It is, therefore, composed of 3 parts of *bisilicate of magnesia* and 1 of *bisilicate of iron.*

Before the blowpipe, *per se*, it remains unaltered. With borax it melts with difficulty into a grass-green transparent bead.

OBS. *Anthophyllite occurs in promiscuous fibres and foliated distinct concretions,* in beds of mica slate, accompanied by garnet, pyroxene, turmaline, iolite, &c. The cobalt and copper mines of Kongsberg, and of Snarum, near Modum, in Norway, are among its foreign localities. It also occurs at Ujordlersoak, in Greenland, associated with pyroxene.

At Haddam, Conn., it is associated with turmaline and iolite, in mica slate. It is also found in the same rock with quartz, at Chesterfield and Blandford, Mass.

This mineral approaches hornblende very closely in external characters and composition. Its lateral interfacial angle has been stated at 124° 30′, which is identical with that of hornblende; but it was obtained from cleavage faces, and cannot be wholly relied on. The name *anthophyllite* is derived from ἄνθος, *flower*, and φύλλον, *leaf.*

CUMMINGTONITE. AUGITUS SCOPIFORMIS.

366. *Imperfectly crystalline:* structure thin, columnar, divergent, scopiform, stellular, rather incoherent.

H.=6—6·5. G.=3·2014. *Lustre* somewhat silky. *Color* ash-gray. Translucent—opaque. Brittle.

According to Muir, it contains Silica 56·543, Protoxyd of Iron 1·669, Protoxyd of Manganese 7·802, Soda 8·439, Volatile Matter 3·178. Before the blowpipe, *per se*, it is infusible, except on thin edges. With carbonate of soda it fuses with effervescence into a dark glass. With borax it forms a black glass.

OBS. It occurs in mica slate, at Cummington and Plainfield, Mass., associated with garnet and iron pyrites.

ARFWEDSONITE. Augitus peritomus.

Peritomous Augite-Spar, *M.* Arfwedsonite, *Brooke.* Arfvedsonite.

367. *Primary form:* an obtuse oblique rhombic prism; M : M (cleavage planes) =123° 55′. *Cleavage* eminent and affording brilliant surfaces parallel to M; none parallel to the base. It is doubtful whether the prism be right or oblique.

H.=5—6. G.=3·35—3·369, Thomson. *Lustre* vitreous. *Color* black. Opaque.

It contains, according to Dr. Thomson, Silica 50·508, Peroxyd of Iron 35·144, Sesquoxyd of Manganese 8·92, Alumina 2·488, Lime 1·56, and Moisture 0·96=99·58. Before the blowpipe, in the platinum forceps, it fuses readily into a black globule. With borax it affords a glass colored with iron. With salt of phosphorus, a similar but paler globule is obtained; it becomes colorless on cooling, and leaves a skeleton of silica.

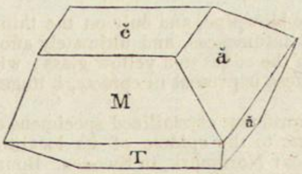
Obs. Arfwedsonite is associated with sodalite and eudialyte, at Kangedluarsuk, in Greenland. It was considered a ferriferous hornblende, until its distinctive characters were pointed out by Brooke, who named it in honor of Prof. Arfwedson.

EPIDOTE. Augitus rhomboideus.

Prismatoidal Augite-Spar, *M.* Zoisite. Pistacite. Thallite. Scorza. Delphinite. Arendalite. Piemontischer Braunstein, *W.*

368. *Primary form:* a right rhomboidal prism; M : T=115° 24′. *Secondary forms:*

1.



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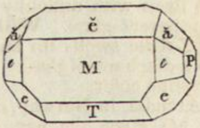

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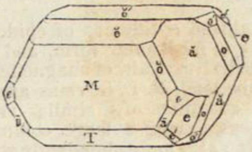


figs. 1 and 2, of a crystal from Arendal, Norway. M : ĕ′=116° 17′, T : ĕ′=128° 19′, ŏ : ŏ=109° 27′. ĕ′ : ŏ=125° 16′. M : *e*′=121° 34′, M : ĕ=90° 33′. T : e=144° 31′. *Cleavage* perfect parallel to M, less so to T. *Compound crystals:* composition of the *first kind* parallel to M. *Imperfect crystallizations:* structure columnar, divergent, or parallel; granular, particles of various sizes, sometimes impalpable.

H.=6—7. G.=3·25—3·46; 3·425, Haidinger; 3·46, Descotils; 3·289, Thomson, var. Scorza. *Lustre* vitreous, inclining to pearly upon M, both as faces of crystallization and cleavage. *Streak* grayish-white. *Color* green and gray prevalent; green colors usually somewhat yellowish. Crystals commonly less yellow in the direction of the vertical axis, than at right angles with it. The gray colors occasionally pass into red and white. Subtransparent—opaque; generally subtranslucent. *Fracture* uneven. Brittle.

Those specimens which were formerly separate, under the name of Zoisite, are included in this species, in consequence of the identity of their crystallization with the true epidote. They differ essentially, however, in composition, and also in color; Zoisite being usually of a gray, brownish, or bluish-gray, or white color, and epidote presenting some variety of green. Other less distinctly marked varieties are as follows: *Scorza*, a variety found in the form of a sand on the banks of the Arangos, and so named by the inhabitants of Transylvania; *Epidote magnésifère*, of Haüy, the *Piemontischer Braunstein*, of Werner, is a manganesian epidote; it contains sometimes twelve per cent. of oxyd of manganese, and, owing to its presence, has a reddish-black color.

The following table exhibits the composition of epidote and Zoisite, according to Laugier, Thomson, and Bucholz:

	Epidote.	Epidote.	Zoisite.	Zoisite.
Silica	37·200	38·240	40·25	39·300
Alumina	23·825	18·828	30·25	29·488
Lime	23·075	24·080	22·50	22·956
Magnesia	——	0·480	——	——
Protoxyd of iron	13·041	17·440	4·50	6·480
Moisture	2·000	0·800	2·00	1·360
	99·141, L.	99·868, T.	99·50, B.	99·584, T.

Epidote fuses with difficulty before the blowpipe, and only on the thinnest edges, into a transparent glass. With borax it intumesces, and ultimately affords a clear globule. Zoisite swells up and melts on the edges to a yellow glass; with borax it fuses into a diaphanous glass. If manganese is present in epidote, it tinges the flame an amethystine color.

Obs. Arendal, in Norway, affords magnificent crystallized specimens of this species, and has given the name *Arendalite* to the epidote of its localities. Large translucent crystals occur at Aggruvan, near Nordmark, in Sweden. Bourg d'Oisans is a fine locality of pistachio-green crystallized specimens. Zoisite occurs accompanying kyanite, hornblende, and titanium, in the Sau Alpe and the Bacher Mountain in Styria, in the Tyrol, &c. The manganesian variety occurs at St. Marcel, in the valley of Aosta, in Piedmont.

At Franconia, N. H., crystallized specimens of epidote are quite abundant. It also occurs in the same vicinity in a granular form, and of a pistachio-green color, containing imbedded dodecahedral crystals of magnetic iron. Crystals of epidote have also been found at Cumberland, R. I., in veins and cavities, in a kind of trap rock. Haddam affords small quantities of a similar variety, imbedded in gneiss. Zoisite is obtained in specimens, having a large columnar structure, at Milford, Conn., and at Willsborough, Vt.; also more abundantly at Goshen and Williamsburg, Mass., where it exists in quartz, traversing mica slate; at Montpelier, Vt., where it occurs of a bluish-gray color, associated with calcareous spar in mica slate. A variety occurs in the eastern part of Maine, which is purplish-red at the centres of the fibrous masses, but pistachio-green, where the columns are most divergent.

The name *Epidote* was derived by Haüy from επιδιδωμι, *to increase*, in allusion to the fact, that the base of the primary is frequently very much enlarged in some of the secondary forms. *Zoisite* was so named in compliment to its discoverer, Baron Von Zois.

WITHAMITE. Augitus Withami.

369. *Primary form:* a right rhomboidal prism; M : T=116° 40′, T : ĕ=128° 20′. *Secondary form:* similar to fig. 1, under epidote.

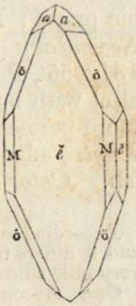
H.=6. G.=3·1—3·3. *Lustre* vitreous. *Streak* white. *Color* carmine-red, or pale straw-yellow, when seen in certain directions by transmitted light. Translucent.

In an imperfect analysis, Dr. Coverdale obtained for its constitution, Silica 55·28, Alumina 16·74, Peroxyd of Iron 21·13, Lime 8·13, and Water 3·13=104·41. Its behavior before the blowpipe very much resembles that of epidote. It intumesces, and fuses with difficulty into a greenish-gray scoria. With salt of phosphorus it dissolves with effervescence into a globule, containing a skeleton of silica, and becomes opaque on cooling.

Obs. This mineral was discovered by Mr. Witham on the surface of a reddish trap in Glencoe, and was named and described by Dr. Brewster, (*Brewster's* Journ. II. 218.) It bears a close resemblance to epidote, and possibly is a variety of that species,

ACMITE. Augitus cuspidatus.

Achmite Akmit, *Haid.* *Stromeyer* and *Berzelius*, Kong. vet. Ac. Handl. 1821, p 160.



370. *Primary form:* an acute oblique rhombic prism; M : M=86° 56′. *Secondary form:* M : ĕ=133° 28′, M : ē=136° 32′, *a* : *a*=119° 30′. *Cleavage* distinct parallel to M, less so parallel to the diagonals. Plane ĕ often longitudinally striated. *Compound crystals:* composition of the *second kind* parallel to ĕ. These forms are of common occurrence.

H.=5·5—6. G.=3·2—3·4; 3·398, Thomson. *Lustre* vitreous, inclining to resinous. *Streak* pale yellowish-gray. *Color* brownish or reddish-brown; in the fracture, blackish-green. Opaque. *Fracture* uneven—earthy. Brittle.

It contains, according to Berzelius (Kong. Vet. Acad. Handl. 1821, p. 160) and Lehunt, (Thomson's Min. i. 480,)

Silica	55·25		52·016
Perox. Iron	31·25	Protox.	28·080
Soda	10·40		13·333
Protox. Mang.	1·08		3·487
Lime	0·72		0·876
Magnesia	—		0·504
Alumina	— =98·70, B.		0·685=98·981, L.

Before the blowpipe it readily fuses into a black bead. It is not attacked by acids.

Obs. Acmite has been found only at Rundemyr, about four miles north of Dunserud, near Kongsberg, in Norway. It there occurs in crystals nearly a foot long, imbedded in granite and quartz. They are often macled and bent, and are detached with difficulty, on account of their frangibility.

The name of this species is derived from *ακμη, a point,* in allusion to the peculiar pointed form of the extremities of the crystals. It has been improperly spelled *achmite*.

AMBLYGONITE. Augitus Lithicus.

Amblygonic Augite-Spar, *Haid.*

371. *Primary form:* a rhombic prism; but whether right or oblique is uncertain; M : M=106° 10′, and 73° 50′. Planes M usually rough. *Cleavage* parallel to M producing brilliant surfaces. Also massive, structure columnar.

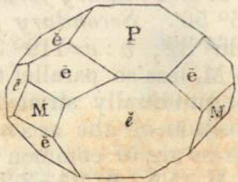
H.=6. G.=3—3·04. *Lustre* vitreous, inclining to pearly on the faces of perfect cleavage. *Color* pale mountain, or sea-green. Subtransparent—translucent. *Fracture* uneven.

According to Berzelius, it contains 55·69 of Phosphoric Acid, 25·69 of Alumina, and 9·11 of Lithia. Before the blowpipe it fuses easily, with intumescence, and becomes opaque and white on cooling. With borax it forms a transparent colorless glass.

Obs. This species has hitherto been found only at Chursdorf, near Penig, in Saxony, where it is associated with turmaline and garnet in granite. It was first ranked as a species by Breithaupt. Its trivial name is derived from αμϐλυς, *blunt*, and γονη, *angle*.

TURNERITE.

Levy, Ann. of Phil. XVIII. 241. Pictite.



372. *Primary form:* an oblique rhombic prism; M : M=96° 10′, P : M=99° 40′. *Secondary form:* M : ē=138° 5′, M : ĕ= 131° 55′, P : ē=133° 50′. *Cleavage* parallel with both diagonals of the prism, one more perfect than the other. H. above 4. *Lustre* adamantine. *Streak* white or grayish. *Color* yellow or brown. Transparent—translucent.

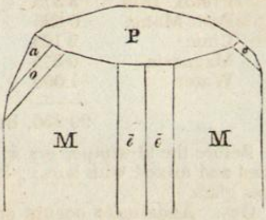
According to Children, it contains Alumina, Lime, Magnesia, and a little Iron; and it differs from sphene, of which it has been considered avariety, in containing very little silica and no titanium.

Obs. Accompanies quartz, albite, feldspar, Critchtonite, and anatase, at Mount Sorel, in Dauphiné. It was distinguished by Levy, and named in honor of Mr. Turner, in whose collection it was first found.

ORDER VI. HYALINEA.

ANDALUSITE. ANDALUSIUS PRISMATICUS.

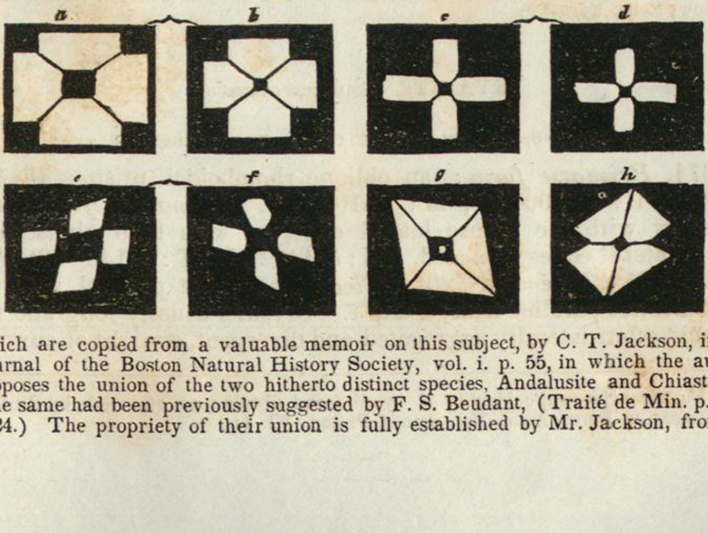
Prismatic Andalusite, *M.* Disilicate of Alumina, *Thom.* Feldspath Apyre, *H.* Macle. Chiastolite. Crucite.



373. *Primary form:* a right rhombic prism; M : M=91° 33′, and 88° 27′, *Secondary form:* $\bar{e}:\bar{e}$=128° 6′, M : $\bar{e}$=161° 43′, P : *a*=144° 44′. *Cleavage* parallel to M distinct. *Imperfect crystallizations:* indistinctly columnar and also granular.

H.=7·5. G.=3·13—3·32. *Lustre* vitreous. *Streak* white. *Color* flesh red, passing into pearl-gray. Subtranslucent—nearly opaque. *Fracture* uneven. Tough.

The variety chiastolite varies in its hardness from 3 to 7·5, owing to the impurities of its crystals. These crystals generally present a tesselated appearance, as if formed by the union of four separate individual crystals, of a grayish-white color, with the borders and interstitial spaces filled with the dark material that composes the gangue. This peculiar structure is exhibited in the following figures,



which are copied from a valuable memoir on this subject, by C. T. Jackson, in the Journal of the Boston Natural History Society, vol. i. p. 55, in which the author proposes the union of the two hitherto distinct species, Andalusite and Chiastolite. The same had been previously suggested by F. S. Beudant, (Traité de Min. p. 159, 1824.) The propriety of their union is fully established by Mr. Jackson, from an examination of a large number of specimens, in which he finds an insensible gradation, from those of the lowest degrees of hardness to crystals of the hardness of Andalusite. Moreover, the internal parts of the crystal have an irregularly rhombic form, sufficiently distinct to prove that the supposition is not inconsistent with the crystalline form of Andalusite. The hypothesis of Beudant, to account for these freaks in nature, appears to be the most consistent with the appearances presented, that is, that they are simple crystals, with extraneous matter, regularly arranged by the process of crystallization. This is a common effect of crystallization from a medium containing any impurities mechanically suspended, and it fully accounts for the occurrence. The irregularity of the whitish prisms, in the different parts of the same crystals, (figs. *a* and *b*, are from opposite extremities of the same crystal; so also *c* and *d*, and *e* and *f*,) appear to oppose the hypotheses of the compound nature of these crystals. Figure *h* appears to be the only one of the above sections, which belongs to a compound crystal. The chemical constitution of this variety, as determined by Jackson, is sufficient to settle the question of their identity.

Andalusite contains, according to Brandes, (Schweigger's Journ. xxv. 113,) Bucholz, Thomson, and Jackson,

	Tyrol.		Tyrol.	Var. Chiastolite.
Silica	34·000	36·5	35·304	33·0
Alumina	55·750	60·5	60·196	61·0
Potash	2·000	—	—	—
Protox. Iron	3·375	4·0	1·324	4·0
Prot. Mang.	0·625	—	—	—
Lime	2·125	—	—	—
Magnesia	0·375	—	1·000	—
Water	1·000	—	2·032	1·5
	99·250, Br.	101·0, Buch.	100·856, Thom.	99·5, J.

Before the blowpipe, *per se*, it does not melt, but whitens in spots. When pulverized and mixed with borax, it fuses with extreme difficulty into a transparent colorless glass.

Obs. Andalusite occurs only in primitive strata. It was first observed in the province of Andalusia, in Spain. In the Linsenz valley, above Innspruck, in the Tyrol, it occurs in large crystallizations; other foreign localities are Braunsdorf in Saxony; Galdenstein in Moravia; in Bavaria; in Siberia; at Botriffney, in Banffshire, in gneiss; at Killeny Bay, Ireland, in mica slate. The chiastolite variety occurs at Jago di Compostella, in Spain, Barèges, in the Pyrenees, the Bayreuth, and Cumberland, England.

At Westford, Mass., it is found abundantly, both crystalline and massive; Litchfield, Conn., has afforded a few fine crystals. Chiastolite is very abundant in the towns of Lancashire and Sterling, Mass., and at the former place occasionally in quartz, presenting all the essential characters of Andalusite. It is met with also near Bellows Falls, Vermont.

KYANITE. Epimecius cyaneus.

Prismatic Disthene-Spar, *M.* Disthene, *H.* Cyanite. Fibrolite,[*] Sappar, Rhœtizit, *W.*

374. *Primary form:* an oblique rhomboidal prism; P : M=93° 15′, P : T=100° 50′, M : T=106° 15′. *Secondary form:* the primary with the obtuse lateral edge, or with both obtuse and acute lateral edges replaced. M : *ē*=145° 16′, T : *ē*=140° 59′, M : ĕ=131° 25′, T : ĕ=122° 20′. *Cleavage* perfect parallel with M, less distinct parallel with T and *ē*. Crystals usually long and flat prisms, often laterally aggregated and divergent, straight or curved;

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[*] For remarks on the identity of kyanite and fibrolite, see an article by Prof. L. Vanuxem, in Journ. Acad. Nat. Sci. of Philad. VI. 41.

occasionally fine fibrous. *Compound crystals:* composition of the *first kind;* parallel to M.

H.=5—7; the lowest degrees on M, the highest on the solid angles and terminal edges. G.=3·559—3·675; the former of a milk-white variety of Rhœtizite, the latter of a blue transparent specimen which had been cut and polished. *Lustre* pearly upon M, particularly the cleavage face; inclining to vitreous on other faces. *Streak* white. *Color* blue or white prevalent; also gray, green, and even black; frequently blue along the axis of the crystal, and white each side. Transparent—subtranslucent. *Fracture* uneven. Brittle.

It contains, according to Arfwedson, (Kong. Veten. Acad. Handl. 1821, p. 147,) and Chenevix,

Silica	34·33	36·9	37·0	38·00
Oxyd of Iron	——	—	—	0·75
Alumina	64·89=99·22, A.	64·7=101·6, A.	62·5=99·5, A.	58·25=97·00, C.

Unaltered before the blowpipe, *per se.* With borax it fuses slowly into a transparent colorless glass.

Obs. The white varieties of this species were formerly considered as forming a distinct species, under the name of *Rhœtizite.* *Fibrolite* is also a variety of this species; it commonly occurs in shorter crystals, having a structure somewhat fibrous, whence its name. In other respects it is identical with kyanite.

Gneiss and mica slate are the principal repositories of kyanite. It is often accompanied by garnet and staurotide.

Transparent crystals of this species are met with at St. Gothard, in Switzerland, Styria, Carinthia, Bohemia; Villa Rica, in South America, also afford specimens of this species. A fine blue lamellated variety is found at Botrifny, in Banffshire. The white or *rhœtizite* variety, occurs principally at Kemeten, in the Pfitsch Valley, Tyrol. The foreign locality of fibrolite is in China, and the Carnatic, where it is associated with corundum.

Chesterfield, Mass., affords fine specimens of this mineral. It occurs there in long slender prisms, with white sides and blue central line, in mica slate, which contains also garnet. At Litchfield, Conn., it occurs in large rolled masses, and is associated with corundum and massive apatite. It is also abundant near the old iron furnace, two miles N. E. from Chancellorville, Spotsylvania Co., Va. Fibrolite is met with in prismatic crystals, from one to two inches long, at Bellows Falls, Vt., imbedded in gneiss; at Westfield and Lancaster, Mass.; near Wilmington, Delaware, in fine fibrous crystallizations, occasionally approaching to bladed lamellar; also on the Schuylkill river, back of the Robin Hood tavern, on the Ridge-road; and on the road to Cooper's Gap, in Rutherford Co., N. C. A black variety occurs in North Carolina, accompanied by crystals of Rutile. Near Philadelphia, it occurs in gneiss on the Springfield road, about two hundred yards from the Darnley bridge.

Kyanite, when blue and transparent, and in sufficiently large masses, is employed as a gem, and has some resemblance to sapphire.

This species was named because of its color, from κυανος, *blue.* The name, sappare, arose from a mistake by Saussure, in reading a label of this mineral, on which it was named *sapphire.*

WŒRTHITE.

375. Has been observed only in rolled masses, having a foliated crystalline structure.

H.=7·25. G. above 3. *Lustre* similar to that of kyanite. *Color* white. Translucent.

It contains, according to Dr. Hess, (Pogg. Ann. xxi. 73,)

Silica	40·58	41·00
Alumina	53·50	52·63
Magnesia	1·00	0·76
Water	4·63	4·63
Peroxyd of Iron	trace =99·71.	— =99·02.

Heated in a glass tube it becomes opaque, and gives out water. It dissolves slowly with borax, but undergoes no perceptible change with salt of phosphorus. When moistened with nitrate of cobalt, and strongly heated, it gives a beautiful dark-blue.

Obs. This species was discovered by Mr. Von Wörth, of St. Petersburgh, and an account of it published by Dr. Hess. It has been considered a variety of kyanite.

DIASPORE. Epimecius dissiliens.

Euklastic Disthene-Spar, *Haid.* Dihydrate of Alumina, *Thom.*

376. *Primary form:* according to Phillips, an acute oblique rhomboidal prism; P : M=71° 30′, P : T=78° 40′, M : T=65°; according to Mohs, a rhombic prism of 130° may be obtained by cleavage. It occurs in irregular lamellar prisms.

H.=6—6·5. G.–3·4324, Haüy. *Lustre* vitreous, brilliantly splendent on cleavage faces. *Color* greenish-gray, or hair-brown. When thin, translucent—subtranslucent.

It contains, according to Vauquelin (Ann. de Chimie, xlii. 113) and Children, (Ann. Phil. 2d ser., iv. 146,)

Alumina	80·0	76·06
Protoxyd of Iron	3·0	7·78
Water	17·3=100·3, V.	14·70=98·54, C.

In the blowpipe flame it decrepitates with violence, and splits into numerous scaly particles, which fuse readily with borax into a colorless glass. According to Berzelius, these particles, after being slightly heated, will restore the blue color of reddened litmus paper. Mr. Children did not succeed in obtaining this result.

Obs. The locality of diaspore was for a long time unknown. Mr. Fieldler has lately reported that it occurs in a primary limestone, not far from Ekatherinenburg, in the Marmorbruch, at the back of the Koroibrod. Its superior lustre distinguishes it from Kyanite, some varieties of which it much resembles.

Diaspore is so named from its action under the blowpipe, from διασπειρω, *to scatter.*

SILLIMANITE. Epimecius Sillimanianus.

Bowen, Jour. Phil. Acad. Nat. Sc. III. 375. American Journ. of Science, VIII. 113.

377. *Primary form:* a rhombic prism; whether right or oblique is uncertain. The interfacial angle M : M, varies from 110° to 98°; those crystals in which the faces M are smooth and plain, present the latter, which therefore appears to be the correct angle of the primary rhombic prism. The specimens which afford a greater angle, are longitudinally striated, thus evincing some irregularity in the crystallization. *Cleavage* highly perfect, parallel to the longer diagonal, and producing brilliant surfaces; parallel to

M indistinct. The crystals are usually very long and slender; often curved, parellel, or slightly divergent, or traversing the gangue in various directions.

H.=7—7·5. G.=3·2—3·238, the latter the result of the author's trials. *Lustre* vitreous, inclining to pearly; hardly shining on M. but splendent on the face of perfect cleavage. Parallel to P, vitreous, inclining to resinous. *Streak* white. *Color* hair-brown—grayish-brown. Translucent. *Fracture* uneven, parallel to P. Brittle. The long crystals are detached from the rock entire, with great difficulty, on account of their frangibility.

It contains, according to Bowen and Muir,

Silica	42·666	38·670
Alumina	54·111	35·106
Zirconia	——	18·510
Oxyd of Iron	1·999	7·216
Water	0·510=99·286, B.	——=99·502, M.

These analyses are apparently quite unlike. But probably, as the amount of zirconia and alumina in Muir's analyses equals the alumina in that by Mr. Bowen, the zirconia is included by Mr. Bowen with the alumina.

Before the blowpipe, both *per se*, and with borax it is infusible.

Obs. It has been suggested that this species is but a variety of Bucholzite. Future examinations may possibly prove this to be the fact. But the analyses heretofore made, show so great a discrepancy, that it would be premature to unite them till their identity has been proved by farther investigations. Bucholzite has never been observed sufficiently crystallized to exhibit the similarity or dissimilarity of their crystallization. They differ considerably in hardness, and also in other of their physical characters.

Sillimanite occurs in slender prisms, thickly traversing quartz, in a vein of gneiss, at Chester, Conn. It was named by Bowen, in honor of Prof. B. Silliman, of Yale College.

BUCHOLZITE. Epimecius Bucholzianus.

Brandes, Schweigger's Jour. XXV. 125, 1819. *Thomson*, Roy. Trans. XI. 263. Anhydrous Silicate of Alumina, *Thom.*

378. Imperfectly crystalline; structure fibrous.

H.=6—7. G.=3·19. *Lustre* pearly and glistening. *Streak* white. *Color* white, or gray, inclining to yellow. Thin fragments slightly translucent—subtranslucent. *Fracture* conchoidal, perpendicular to the fibres. Brittle, and easily frangible.

It contains, according to Brandes and Thomson,

	Tyrol.	Chester, Penn.
Silica	46·0	46·40
Alumina	50·0	52·92
Potash	1·5	——
Oxyd of Iron	2·5=100, B.	trace=99·32, T.

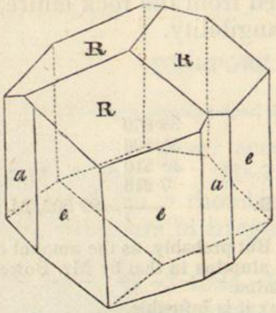
Obs. Bucholzite was originally obtained from Fassa, in the Tyrol. It has since been discovered at Chester, Pennsylvania, on the Delaware. Bucholzite is named after Bucholz, a celebrated German chemist.

TURMALINE. Turmalus rhombohedrus.

Rhombohedral Tourmaline, *M.* Schorl. Rubellite. Indicolite. Aphrizite. Aphrite, *W.* Turmalin. Tourmaline Apyre, *H.*

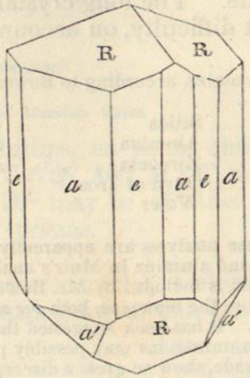
379. *Primary form:* an obtuse rhombohedron; R : R=133° 26′. *Secondary forms:* fig. 110, Pl. II., also the annexed figures:

1.



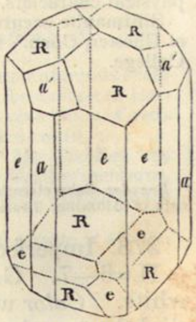
Monroe, Conn.

2.



Haddam, Conn.

3.



Gouverneur, N. Y., Newton, N. J.

R : e=156° 43′, R : *a*′=140° 40½′, e : e=155° 9′, R : *e*=113° 17′, *e* : *a*=150°, *e* : *e*=120°. Crystals often hemihedrally modified, or having dissimilar extremities. *Cleavage* parallel with R and *e*, difficult. *Imperfect crystallizations:* columnar, of various sizes of columns; often thin parallel, or divergent; sometimes the columnar particles are distinct, at others, closely aggregated into a compact mass, striated externally; granular structure rare.

H.=7—8. G.=3·076, Haidinger; 3·021, a transparent red turmaline from Paris, Maine, Shepard. *Lustre* vitreous. *Streak* white. *Color* black, brown, blue, green, red, and rarely white; sometimes red internally, and green externally; again, some specimens are red at one extremity, and green, blue, or black, at the other. Occasionally all these colors appear in the same crystal. Transparent—opaque; less transparent, viewed in the direction of the axis, than when at right angles with it, and often exhibiting different tints of color in the two directions. Some varieties are bluish, viewed parallel to the vertical axis, and red, perpendicular to it; others are liver-brown in one direction, and reddish brown in the other. *Fracture* subconchoidal—uneven. Brittle.

The different colored turmalines contain, according to Gmelin and Arfwedson,

	Black.	Black.	Green.	Red.	Red.
Silica	33·048	35·20	40·30	42·127	39·37
Alumina	38·235	35·50	40·50	36·430	44·00
Lime	0·857	0·55	—	1·200	—
Protox. Iron	23·857	17·86	4·85	—	—
Magnesia	—	0·70	—	—	—
Potash	—	—	—	2·405	1·29
Soda	3·175	2·09	—	—	—
Boracic Acid	1·890	4·11	1·10	5·744	4·18
Lithia	—	—	4·30	2·043	2·52
Protox. Mang.	—	0·43	1·50	6·320	5·02
Moisture	—	—	3·60	1·313	1·58
	101·062, G.	96·44, G.	96·15, Arfw.	97·582, G.	97·96, G.

The action of these varieties before the blowpipe is quite various. In general, they more or less intumesce, some fusing readily, particularly those which contain lime, others assuming a slaggy appearance, without melting, while others, especially the red variety, are not acted on at all. When heated, they exhibit polarity, the most modified extremity becoming positive, and the other negative. In this particular it resembles other hemihedrally modified crystals. At a certain temperature it loses its polarity, but exhibits it again on cooling. Its polarity continues with the decrease of temperature, until it reaches 32° F.; a continued increase of cold re-excites the electric polarity, though with reversed poles. If the excited crystal be broken, each part thus produced will equally possess polarity; and even in the powdered state, it retains its pyro-electricity.

Obs. The different colors presented by this species have given rise to names designating these varieties. Blue turmalines have been termed *indicolite*, from their indigo-blue color; red turmalines, *rubellite;* and to the black, the name *schorl* was formerly applied. These names are, however, of no importance in the present state of the science. It is preferable to state the color, than call them by a name which might convey the idea that they were distinct species.

Turmaline is usually found in granite, gneiss, or mica slate. It also occurs in dolomite or primitive limestone. Its crystals are frequently very long, and pierce the gangue in every direction. Occasionally they occur short, not longer than broad, and when so, they are perfectly terminated at their extremities.

Black turmalines, of a large size, occur in Greenland, at Hörlberg, near Bodenmais, in Bavaria; at Karinbricka, in Sweden; and near Bovey, in Devonshire. Small brilliant crystals are met with, imbedded in decomposed feldspar, at Andreasberg, in the Hartz, forming the variety called *Aphrizite*. Rubellite occurs in a species of lithomarge, near Ekatherinenburg, in Siberia; pale yellowish brown crystals are found in talc, at Windisch Kappell, in Carinthia; white specimens come from St. Gothard and Siberia.

In the United States, magnificent specimens of red and green turmalines have been found at Paris, Maine. Some transparent crystals from this locality exceed an inch in diameter, and present a clear red color, internally surrounded by green; or are red at one extremity, and green at the other. Blue and pink varieties, most commonly imbedded in lepidolite, are still to be obtained at this place. Red and green turmalines occur also at Chesterfield, Mass., in a narrow vein of granite traversing gneiss. The crystals are commonly small and curved, nearly opaque, and exceedingly frangible. Green crystals often contain distinct prisms of a red color, especially when they occur in smoky quartz. Blue turmalines also occur at this locality. These crystals are accompanied by albite. At Goshen, Mass., similar varieties occur, and the blue turmaline is met with in greater perfection. Very perfect crystals, of a dark brown color, occur imbedded in mica slate, at Monroe, Conn. The crystals are commonly 1½ to 2 inches long, and nearly as broad; and uniformly they are perfectly terminated at the two extremities. (See fig. 1.) They are frequently aggregated in compound forms. Haddam, Conn., also affords fine black crystals, and occasionally some of quite a large size. They are profusely mingled in a mica slate, and associated with anthophyllite and hornblende. A cinnamon-brown variety is met with at Gouverneur, N. Y., imbedded in quartz, and also associated with scapolite, apatite, and sphene, in granular limestone. These crystals are often very highly modified; they occasionally exhibit the faces of a scalene dodecahedron, in addition to the terminal planes R and e. Similar specimens occur at Grenville, Lower Canada; also at Newton, N. J., associated with corundum, spinel, and rutile; and at Kingsbridge, N. Y., and Carlisle, Mass., with garnet.

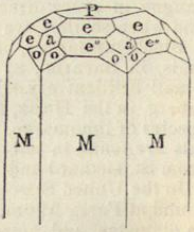
The red turmaline, when transparent, and free from cracks and fissures, admits of a high polish, and forms a most beautiful and costly gem. A specimen from Siberia, presented to Mr. Grenville by the king of Ava, and now in the British museum, was valued at £500 sterling. The yellow turmaline, from Ceylon, is but little inferior to the real topaz, and is often sold for this gem. The green specimens, when transparent and firm, are also highly esteemed, but commonly the tint of color is, for the most part, dingy. Paris, Me., has afforded splendid gems of both green and red. The Siberian red turmaline, cut *en cabochon*, exhibits a milk-white chatoyant lustre.

It has been supposed that turmaline was known to the ancients under the name of *lyncurium*, (λυγκούριον,) which is described as having electrical properties. This name, however, was more probably applied to some variety of amber, which was so called from its supposed origin from the urine of the lynx. The identity of the red turmaline with the hyacinth of the Greeks, is more probable. The other varieties were either unknown, or possibly connected under a common name with other species of the same color. The turmaline received no attention from the moderns till Lemery, in the year 1717, published his discoveries. The word *turmaline* is a corruption of the name for this mineral at Ceylon, whence it was first brought into Europe. It has been gallicised into *tourmaline*; the original word does not contain the *o*. The name *schorl*, which has been applied to the black turmalines, and also some other mineral species, is reported to have been derived from Schorlaw, the name of a village in Saxony, which afforded specimens of this variety.

BERYL. BERYLLUS HEXAGONUS.

Rhombohedral Emerald, *M.* Beryl. Aquamarine. Smaragd. Emeraude, *H.* Basaltes Hexahedrus, *Born.* Βηρυλλος. Σμαραγδος.

380. *Primary form:* a hexagonal prism. *Secondary forms:* fig. 125, Pl. II., also the annexed figure; M : a=119° 53′, P : a=150° 6′. M : a″=139° 1′, P : a″=130° 59′, P : a′=163° 3′, M : *e*=150°. *Cleavage* parallel with P; indistinct parallel with M. *Imperfect crystallizations:* rarely coarse columnar; occasionally large granular.



H.=7·5—8. G.=2·732, Haidinger, emerald variety; 2·678, an apple-green variety. *Lustre* vitreous; sometimes resinous. *Streak* white. *Color* green, passing into light-blue, impure yellow, and white. The brightest of these colors is emerald-green. Transparent—subtranslucent. *Fracture* conchoidal, uneven. Brittle.

It contains, according to Klaproth (Beitrage iii. 219 and 226) and Berzelius, (Afhandlingar, iv. 192,)

	Emerald.	Beryl.	From Broddbo.
Silica	68·50	66·45	68·35
Alumina	15·75	16·75	17·60
Glucina	12·50	15·50	13·13
Oxyd of Chromium	0·30	—	—
Peroxyd of Iron	1·00	0·60	0·72
Oxyd of Columbium	—	—	0·27
Lime	1·25=99·30, K.	—=99·30, K.	—=100·07, B.

Transparent varieties become clouded before the blowpipe; at a high temperature the edges are rounded, and ultimately a vesicular scoria is formed. A transparent colorless glass is obtained with borax.

Obs. Emerald and beryl are varieties of the same species, and are distinguished merely by their color; the former including the rich green transparent specimens, the latter those of other colors. The finest specimens of emerald are found in a vein of dolomite, which traverses a hornblende rock at Muso, near Santa Fè de Bogota, in Grenada. A perfect hexagonal crystal from this locality, two inches long, and about an inch in diameter, is in the cabinet of the Duke of Devonshire. It weighs 8 oz. 18 dwts., and though containing numerous flaws, and therefore but partially fit for jewelry, has been valued at 150 guineas. A more splendid specimen, though somewhat smaller, it weighing but 6 oz., is in the possession of Mr. Hope, of London. It cost £500. Mount Zalora, in Upper Egypt, affords a less distinct variety, and was the only locality which was known to the ancients. Other localities are Canjargum, in Hindostan, and Saltzburg, where it is imbedded in mica slate.

Pliny speaks of the finest beryls as those "qui viriditatem puri maris imitantur," and hence we apply to the crystals of beautiful shades of sky-blue, or mountain-green, the term aqua-marine. This variety has been found in Siberia, Hindostan, and Brazil. In Siberia, they occur in the granite district of Nertschinsk, and in the Uralian and Atai ranges of Siberia. They have been obtained exceeding a foot in length; they are commonly very deeply striated longitudinally. The most splendid specimen of this variety, of which we have any account, belongs to Don Pedro. It approaches in size, and also form, the head of a calf, and exhibits a crystalline structure only on one side: the rest is waterworn. It weighs 225 ounces troy, or more than 18¾ pounds. The specimen is perfectly transparent, and without a flaw; its color is a fine pale bottle-green. Less clear crystals of beryl occur at the Morne Mountains, England, county Down; at Cairngorum, in Aberdeenshire; at Limoges, in France; Finbo and Broddbo, in Sweden; Bodenmais and Rabenstein, in Bavaria, and elsewhere.

The United States have afforded some magnificent specimens of beryl; they are remarkable, however, only for their size. The largest has been found at Acworth, New Hampshire, about fifteen miles from Bellows Falls, where the beryls occur in an extensive vein of granite, traversing gneiss. It measured 4 feet in length, and 5½ inches across its lateral faces, and was therefore 11 inches in diameter. Its color was a bluish-green, excepting a foot at one extremity, where it passed into a dull green and yellow. Its weight was about 240 lbs. This locality affords smaller beryls in great perfection; they are usually of a pale yellow color; rarely a deep honey or wax yellow. Small regular crystals of beryl occur also at Bowdoinham and Topham, Me., in veins of graphic granite; their color is a pale green, or yellowish-white; also at Georgetown, Parker's Island, at the mouth of Kennebec river, associated with black turmaline. It also occurs at Goshen and Chesterfield, Mass., in irregular crystals of a pale green color, some of which are transparent; at Monroe, Conn., in a granite vein, of colors similar to the preceding; at Haddam, Conn., at the chrysoberyl locality, and also in the quarries of gneiss, each side of the river, presenting, at the former place, yellow and yellowish-green colors, and seldom regular forms; they often contain imbedded crystals of chrysoberyl and Columbite.

The emerald is supposed to derive its color from the presence of a minute quantity of oxyd of chrome, and beryl from a portion of oxyd of iron. This species affords some of the most splendid ornaments to the cabinet of the mineralogist, and in some of its varieties is among the richest of gems.

EUCLASE. Beryllus rhomboideus.

Prismatic Emerald, *M.* Euclas, *W.* Euclase, *H.*

381. *Primary form:* a right rhomboidal prism; M : T=130° 50′. *Cleavage* perfect parallel to M and T.

H.=7·5. G.=2·907, Lowrey; 3·098, Haidinger. *Lustre* vitreous. *Streak* white. *Color* pale mountain green, passing into blue and white. Transparent; occasionally subtransparent. *Fracture* conchoidal. Very brittle and fragile.

According to Berzelius, (Kong. Vet. Acad. Handl. 1819, p. 136,) it contains

Silica	43·22
Alumina	30·56
Glucina	21·78
Peroxyd of Iron	2·22
Peroxyd of Tin	0·70=98·48.

Strongly heated in the blowpipe flame, it intumesces and becomes white; also melts into a white enamel, if the temperature is still farther increased. It becomes electric by friction, and retains this property for several hours, when once excited. It exhibits double refraction.

Obs. Euclase was originally brought from Peru; it has since been obtained in the mining district of Villa Rica, in Brazil. It is said to occur in chlorite slate, resting on sandstone. It generally possesses an agreeable and uniform color, and will receive a high polish; but it is useless as an ornamental stone, on account of its extreme fragility. This property induced Haüy to give it the name it bears, from ευ, *easily*, and κλὰω, *to break*.

PHENACITE. Beryllus rhombohedrus.

Phenakite, *Nordenskiöld*. Poggendorf's Annalen, xxxi. 57.

382. *Primary form:* an obtuse rhombohedron; R : R=115° 25′, according to Nordenskiöld; 116° 40′, according to Beirich. *Secondary forms:* figs. 109 and 111, Pl. II.; also the two combined. *Cleavage*, according to Beirich, parallel to the primary faces.

H.=8. G.=2·969. *Lustre* vitreous. *Colorless;* also bright wine-yellow, inclining to red. Transparent—opaque. *Fracture* similar to that of quartz.

Hartwall obtained for its constitution, Silica 55·14, Glucina 44·47=99·61, with a trace of magnesia and alumina. It remains unaltered before the blowpipe, *per se*, but with borax fuses into a transparent glass. With carbonate of soda it affords a white enamel.

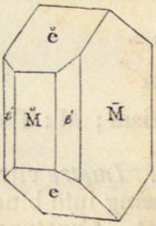
Obs. It occurs with emerald, imbedded in mica slate, in Perm, 85 wersts from Catherinenburg; also accompanied by quartz, in the brown ore of Framont. It was named by Nordenskiöld, its discoverer, from φεναξ, *a deceiver*, in allusion to its having been mistaken for quartz.

CHRYSOBERYL. Sapphirus rectangula.

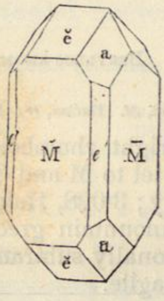
Prismatic Corundum, *M*. Cymophane, *H*. Krisoberill, *W*.

383. *Primary form:* a right rectangular prism. *Secondary forms:*

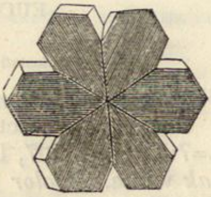
1.



2.



3.



M̆ : ĕ=120° 7′, ĕ : ĕ (adjacent planes) =119° 46′, M̆ : *e*=125° 20′, a : a (adjacent planes) =139° 53′, a : e=133° 8′. *Cleavage* parallel to M̆; less distinct parallel to M̄. *Compound crystals:* fig. 3; composition of the *second kind*, as explained in §§ 76, 77.

H.=8·5. G.=3·5—3·8; 3·597, specimen from Haddam, Conn.; 3·733, from Brazil. *Lustre* vitreous. *Streak* white. *Color* asparagus-green, grass-green, passing into greenish-white, and yellowish-green. Transparent—translucent. It sometimes presents a bluish opalescence internally. *Fracture* conchoidal, uneven.

It contains, according to Seybert (Silliman's Am. Journal, viii. 109) and Thomson, (Min. i. 401,)

	Haddam.	Brazil.		Brazil.
Alumina	73·60	68·666		76·752
Glucina	15·80	16·000		17·791
Silica	4·00	5·999		—
Protoxyd of Iron	3·38	4·733		4·494
Oxyd of Titanium	1·00	2·666		—
Moisture	0·40	0·666	Volatile Matter	0·480
	98·18, S.	98·730, S.		99·517, T.

It is unaltered by the blowpipe, *per se*, and with soda the surface is merely rendered dull. It fuses with great difficulty, when mixed with borax, or salt of phosphorus.

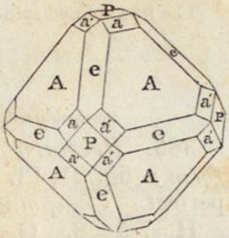
Obs. Chrysoberyl occurs in Brazil, and also Ceylon, in rolled pebbles, in the alluvial deposits of rivers. At Haddam, Conn., it occurs crystallized, in granite traversing gneiss, and is associated with turmaline, garnet, beryl automolite, and Columbite. It is found also in the same rock at Greenfield, near Saratoga, N. Y., accompanied by turmaline, garnet, and apatite.

When transparent and free from flaws, and of sufficient size, chrysoberyl is cut with facets, and forms a beautiful yellow gem. If opalescent, it is usually cut *en cabochon*. *Chrysoberyl* signifies *golden beryl*, (χρυσος, *golden*, βήρυλλος, *beryl*,) and was so named in allusion to its color. The same name was employed by the ancients for a different mineral, which possibly was chrysoprase. The name *Cymophane*, from κῦμα, *wave*, and φαινω, *to appear*, was applied to this species on account of the peculiar opalescence it sometimes exhibits.

SPINEL. Sapphirus octahedra.

Dodecahedral Corundum, *M.* and *J.* Ceylanite. Pleonaste. Spinelle Ruby. Balas Ruby. Almandine Ruby. Rubicelle. Candite, *Bournon.* Zeilanit, *W.* Alumine Magnésiée or Spinelle, *H.*

384. *Primary form:* the regular octahedron. *Secondary forms:* Pl. I. figs. 3, 7, 9, 3+9, 17, 21, and 3+9+17, as in the marginal figure, which represents a crystal from Hamburgh, N. J. *Cleavage* parallel to A, though obtained with difficulty. *Compound crystals:* fig. 128, Pl. II.; composition parallel with a face of the octahedron.



H.=8. G. (according to Haidinger) =3·523, of a red transparent variety; 3·575, of a black opaque variety called Ceylanite. *Lustre* vitreous; splendent——nearly dull. *Streak* white. *Color* red of various shades, passing into blue, green, yellow, brown, and black; occasionally almost white. Transparent—nearly opaque. *Fracture* conchoidal.

It contains, according to Berzelius, Thomson, Abich, and Descotils,

	Blue.	Dark green from U. S.	Black from U. S.	Red.	Pleonaste.
Silica	5·45	5·620	5·596	2·02	02
Alumina	72·25	73·308	61·788	69·01	68
Magnesia	14·63	13·632	17·868	26·21	12
Protox. Iron	4·26	7·420	10·564	0·71	16
Lime	—	trace	2·804	—	—
Water	—	—	0·980	{ protox. chrom. } 1·10	—
	96·59, Berz.	99·980, Th.	99·600, Th.	99·05, Ab.	98, D.

Before the blowpipe, *per se*, it is infusible; but the red varieties change to brown, and even black and opaque as the temperature increases, and on cooling become first green, and then nearly colorless, and at last reassume their red color. It fuses with difficulty mingled with borax, but somewhat more readily with salt of phosphorus. The black varieties yield a deep green globule owing to the large amount of iron it contains.

Obs. The specimens of this species have been denominated, according to their colors, as follows: *pleonaste* has been applied to the black varieties; *spinelle ruby* to the scarlet colored; *balas ruby* to the rose-red; *rubicelle* to the yellow or orange-red; and *almandine ruby* to the violet colored. The *oriental ruby* belongs to the species sapphire.

Spinel occurs imbedded in granular limestone, and with calcareous spar in serpentine and gneiss. It also occupies the cavities of volcanic rocks. In Ceylon, Siam, and other eastern countries, it occurs, of beautiful colors, in rolled pebbles in the channel of rivers. The pleonaste variety is found at Candy, in Ceylon, and hence was called *Candite*, by Bournon. At Aker, in Sudermannland, Sweden, it is found of a pale blue and pearl-gray color, in primitive limestone. Small black crystals of splendent lustre occur at Vesuvius, in the ancient scoria of Mount Somma, associated with mica and idocrase; also imbedded in compact Gehlenite, at Monzoni, in the Fassathal.

Amity, N. Y., affords magnificent specimens of black spinel. They occur there with calcareous spar and Crichtonite in sepentine, often lining the sides of partial veins. Crystals are occasionally found sixteen inches in diameter; twins are of frequent occurrence. The same neighborhood affords an abundance of smaller crystals of various shades of green, black, red, and brown, imbedded in granular limestone with Brucite, hornblende, and pyroxene. At Hamburg, N. J., it occurs in calcareous spar and quartz, associated with scapolite, in crystals of rich shades of blue and green; they are frequently transparent. Newtown, N. J., affords pearl gray crystals, imbedded in limestone with blue corundum, turmaline, and rutile. Black crystals have been obtained at Monroe, N. Y., and green, blue, and occasionally red varieties, at Bolton, Boxborough, and Littleton, Mass., imbedded in primitive limestone.

The fine colored spinels, when of large size, are highly esteemed as gems.

AUTOMOLITE. Sapphirus eutoma.

Octahedral Corundum, *N.* and *J.* Gahnite, *L.* Spinelle Zincifère, *H.*

385. *Primary form:* the regular octahedron. *Secondary form:* fig. 21, Pl. I. *Cleavage* parallel with the primary planes perfect. *Compound crystals* similar to fig. 129, Pl. II.

H.=7·5—8. G.=4·261, Ekeberg; often contains galena interspersed, and then gives a higher specific gravity. *Lustre* vitreous, inclining to resinous; commonly rather dull. *Streak* white. *Color* dark green, or black. Subtranslucent—opaque.

It contains, according to Ekeberg, (Afhand. i. 84,) and Abich, (Poggendorf's Annalen, xxii. 332,)

		Fahlun.	U. S.
Silica	4·75	3·84	1·22
Alumina	60·00	55·14	57·09
Magnesia	——	5·25	2·22
Oxyd of Zinc	24·25	30·02	34·80
Protoxyd of Iron	9·25=98·25, E.	5·85=100·10, A.	4·55=99·88, A.

From Abich's analysis it may be inferred, that automolite is composed of four atoms of alumina, and one of oxyd of zinc.

It is infusible, *per se*, before the blowpipe, and nearly so with borax or salt of phosphorus. With soda it melts imperfectly into a dark colored scoria, which, when fused again with the same reagent, deposits on the charcoal a ring of oxyd of zinc.

Obs. It occurs in talcose slate, at the mines of Nafversberg and Eric Matts, near Fahlun, in Sweden, and is associated with galena, blende, garnet, Gadolinite, &c. At Haddam, Conn., it is associated with chrysoberyl, beryl, garnet, and Columbite. This species was discovered by the celebrated Swedish chemist, Gahn, and was named in consequence Gahnite. It has since been denominated automolite by Haüy, from αυτομολος, *a deserter*, in allusion to the presence of oxyd of zinc in this mineral, which has no resemblance to an ore.

DYSLUITE. Sapphirus infusilis.

386. *Primary form:* the regular octahedron. *Secondary form:* fig. 9. Pl. I. *Cleavage* rather imperfect parallel with the primary faces. Surface rough.

H.=7·5—8. G.=4·551. *Lustre* vitreous, inclining to resinous. *Streak* paler than the color. *Color* yellowish-brown or grayish-brown. Subtranslucent—opaque. *Fracture* conchoidal.

Its constituents, according to Thomson, (Min. i. 221,) are Alumina 30·490, Oxyd of Zinc 16·8, Peroxyd of Iron 41·934, Protoxyd of Manganese 7·6, Silica 2·966, Moisture 0·4=100·19.

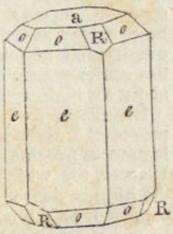
It assumes a red color before the blowpipe, which it loses on cooling without any change from its original appearance. It dissolves slowly in borax, and not at all in carbonate of soda or salt of phosphorus. The bead obtained with borax has a deep garnet red color, and is transparent.

Obs. It occurs in small quantity at Sterling, N. J., disseminated through laminated calcareous spar, and associated with Franklinite and Troostite.

SAPPHIRE. Sapphirus rhombohedra.

Rhombohedral Corundum, *M.* Corundum. Emery. Oriental Amethyst. Oriental Topaz, Ruby, Emerald, Amethyst. Adamantine Spar. Salemstein. Schmirgel. Korund. Demanthpath. Telésie. Corindon. Asteria, *of Pliny*.

387. *Primary form:* an acute rhombohedron; R : R=86° 6′. *Secondary form:* R : e=136° 57′. R : o=154° 1½′, a : o=118° 51′, o : e=151° 9′. *Cleavage* parallel with a, in some varieties, perfect, but interrupted by conchoidal fracture; imperfect commonly in the blue variety. *Imperfect crystallizations:* in layers parallel to R, frequent; granular, often impalpable.



H.=9. G.=3·909—3·979. *Lustre* vitreous; in some specimens inclining to pearly on the plane a. *Streak* white. *Color* blue, red, yellow, brown, gray, and nearly white. The transparent blue varieties possess the highest specific gravity, and the red the least. Several varieties, when cut *en cabochon*, in a direction perpendicular to the axis of the prism, exhibits a bright opalescent star of six rays, corresponding to the hexagonal form of the crystal. Transparent—translucent. *Fracture* conchoidal, uneven. When compact, exceedingly tough.

It is composed of pure Alumina, according to Muir. The silica that different analyses have appeared to detect in it, has probably been derived from the mortar in which the mineral was abraded. It is unaltered in the blowpipe flame, both *per se* and with soda; it fuses entirely with borax, though with great difficulty; and also if pulverized with salt of phosphorus. It is not attacked by acids. Friction excites electricity, and in the polished specimens the electrical attraction continues for a considerable length of time.

Obs. The species sapphire includes corundum and emery, in addition to the finely colored varieties that have always borne this name. Corundum includes the gray and darker colored opaque crystallized specimens; emery, all massive varieties. The *red* sapphire is sometimes called the *Oriental ruby;* the yellow, *topaz;* the green, *emerald;* violet, *amethyst;* and hair-brown, *adamantine spar.*

Sapphire is principally found in the beds of rivers, either in modified hexagonal prisms, or in rolled masses, and is accompanied by grains of magnetic iron ore, and several species of gems. Corundum occurs in crystals, in a rock composed, according to Bournon, of feldspar, fibrolite, and several species of gems; also in dolomite and magnetic iron ore. Adamantine spar occurs in a kind of granite, containing no quartz, associated with magnetic iron ore, and the fibrolite variety of kyanite. Emery occurs in talcose slate.

The finest ruby sapphires occur in the Capelan mountains, near Syrian, a city of Pegu, in the kingdom of Ava; smaller individuals occur near Billin and Merowitz, in Bohemia, and in the sand of the Expaillie river, in Auvergne. Blue sapphires are brought from Ceylon; this variety was called *Salamstein* by Werner. Corundum occurs in the Carnatic, on the Malabar coast, in the territories of Ava, and elsewhere, in the East Indies; also near Canton, China. At St. Gothard it occurs of a red or blue tinge in dolomite, and near Morzo, in Piemont, in white compact feldspar. Adamantine spar is met with in large coarse hexagonal pyramids on the Malabar coast. Emery is found in large boulders near Smyrna, also at Naxos, and several of the Grecian islands. It occurs in talcose slate, at Ochsenkopf, near Schneeberg, in Saxony. Its color at this locality is a dark blue, or black, and its appearance is nearly that of fine grained basalt. A fine blue variety of sapphire occurs at Newtown, N. J., in an aggregate composed of hornblende, mica, feldspar, turmaline, iron pyrites, talc, and calcareous spar, the whole of which is connected with an extensive bed of primitive limestone. It is found more abundantly in detached boulders in the soil, between two small limestone ridges. The crystals are often several inches long, but do not present an external regularity of form. Well defined crystals of a bluish and pink color are found in a similar situation at Warwick, N. Y., where they occasionally occupy the cavities of large crystals of spinel. Pale blue crystals are met with at West Farms, Conn., near Litchfield, associated with kyanite. Isolated crystals have been found imbedded in the soil in North Carolina.

The red sapphire is much more highly esteemed than the other varieties of this species. A crystal weighing four carats, perfect in transparency and color, has been valued at half the price of a diamond of the same size. They seldom exceed a half inch in length. Two splendid red crystals, however, having the form of the scalene dodecahedron, and "de la longueur du petit doigt," with a diameter of about an inch, are said to be in the possession of the king of Arracan.

Blue sapphires occur of much larger size. According to Allan, Sir Abram Hume possesses a distinct crystal, which is three inches in length; and in Mr. Hope's collection of precious stones there is one crystal, formerly the property of the Jardin des Plantes, for which he gave the value of £3000 sterling. The sapphire admits of the highest degrees of lustre. It is cut by means of diamond dust, and polished on copper or lead wheels with the powder of emery, the massive variety of this species.

Pulverized emery is very extensively employed for cutting and polishing gems and silicious stones, and also for grinding and burnishing metallic wares.

The word *sapphire* is derived from the Greek, σαπφειρος, the name of a blue stone, highly valued by the ancients. From the descriptions of it, it does not appear to have been the sapphire of the present day, but the lapis lazuli, which more nearly agrees with the character given it by Theophrastus, Pliny, Isidorus, and others. The latter remarks, "Sapphirus cœruleus est cum purpura, habens pulveres aureos sparsos," particles of iron pyrites, which are very frequently disseminated through lapis lazuli, having been mistaken for gold. Corundum is a word of Asiatic origin.

SAPPHIRINE.

388. In small foliated grains. H.=7—8. G.—3·4282, Stromeyer. *Lustre* vitreous. *Color* pale blue, or green. Translucent. *Fracture* subconchoidal.

It contains, according to Stromeyer, Silica 14·507, Alumina 63·106, Magnesia 16·848, Lime 0·379, Protoxyd of Iron 3·924, Protoxyd of Manganese 0·523, Loss by ignition 0·492=99·784. Before the blowpipe, both *per se* and with borax, it is infusible; it is not altered by a strong red heat.

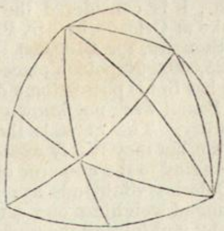
Obs. It is associated with mica and fibrous brown anthophyllite, at Fiskenaes, in Greenland, where it was discovered by Giesecké. It was distinguished from sapphire, which it somewhat resembles, by Stromeyer.

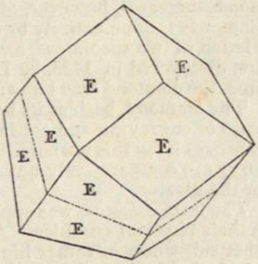
DIAMOND. Adamas octahedrus.

Octahedral Diamond, *M.* Adamant. Demant, *W.* Diamant, *L.* and *H.* 'Αδάμας.

389. *Primary form:* the regular octahedron. *Secondary forms:* figs. 3, 5, 6, 7, 8, 9, 20, 41, Pl. I. The faces are very often curved, as in the marginal figure, which is the trigonal hemi-trisoctahedron represented with straight edges in fig. 41. *Cleavage* highly perfect parallel to the primary faces. *Compound crystals:* fig. 129, Pl. II.; composition parallel to the face of the octahedron. Also the second of the annexed figures, in which composition is of the same kind, (that is, parallel to the face of the octahedron;) but the form of the crystal is the secondary dodecahedron.

H.=10. G.=3·5295, Thomson; 3·488, Lowry. *Lustre* brilliant adamantine. *Streak* white. *Color* white—colorless; occasionally tinged yellow, red, orange, green, brown, or black. Transparent; translucent when dark colored. *Fracture* conchoidal.





It consists simply of carbon. It burns, and is perfectly consumed at a temperature of 14° Wedgwood, producing carbonic acid gas. It is not acted upon by acids or alkalies. Exhibits vitreous electricity when rubbed. Some specimens, exposed to the light of the sun for a short time, give out light when carried into a dark place. It possesses the power of refracting light to a very high degree.

Obs. It is, as yet, uncertain what rock is the original repository of this precious stone. It has been found in India in a species of conglomerate, composed of rounded silicious pebbles, quartz, chalcedony, &c., cemented by a kind of ferruginous clay; and in Brazil, in a very similar situation. Diamonds are usually, however, washed out from loose alluvial soil. It has been of late reported, that diamonds occur in the Uralian mountains, and M. Parrot describes them (Mem. de l' Ac. Imp. de St. Petersbourg, iii. 21, 1835) as occuring under the forms represented in fig. 20. Two that he examined contained small black uncrystallized particles in fissures, which he supposes to be vegetable carbon. This rather favors the hypothesis of their vegetable origin. Dr. Brewster was led by the effects of the diamond in polarizing light, the cavities it often contains, and the nature of its matrix in India and elsewhere, to advance this opinion in the Lond. and Edin. Jour. Oct. 1835, in which he supposes, "that the diamond originates like amber from the consolidation of, perhaps, vegetable matter, which gradually acquires a crystalline form, from the influence of time and the slow action of corpuscular forces."

In India, the diamond is met with in the district between Golconda and Masulipatam; near Parma, in Bundelcund, where some of the most magnificent specimens have been found; also on the Mahanuddy, near Ellore. The locality on the island of Borneo, is at Pontiana. In Brazil, the diamond grounds are comprised within the district of Minas Geraes. The river Gunil, in the province of Constantine, in Africa, is reported to have afforded some diamonds. The diamond has not hitherto been found in the United States. The late report of the discovery of one in North Carolina, weighing one and a half carats, requires confirmation.

The largest diamond of which we have any knowledge is mentioned by Tavernier, as in possession of the Great Mogul. It weighed, originally, 900 carats, or 2769·3 grains, but was reduced by cutting to 861 grains. It has the form and size of a half hen's egg. It was found in 1550, in the mine of Colone. The diamond, which formed the eye of a Braminican idol and was purchased by the Empress Catharine II. of Russia, from a French grenadier, who had stolen it, weighs 193 carats, and is as large as a pigeon's egg. The Pitt or regent diamond is of less size, it weighing but 136·25 carats or 419¼ grains, but on account of its unblemished transparency and color; it is considered the most splendid of Indian diamonds. It was sold to the Duke of Orleans, by Mr. Pitt, an English gentleman, who was governor of Bencolen, in Sumatra, for £130,000. It is cut in the form of a brilliant, and is estimated at £125,000. Napoleon placed it in the hilt of his sword of state. The Rajah of Mattan has in his possession a diamond from Borneo, weighing 367 carats. The mines of Brazil were not known to afford diamonds, till the commencement of the 18th century. The crystals they yield are seldom large. Maure mentions one of 120 carats, but they rarely exceed 18 or 20. The famous diamond, weighing 1680 carats, belonging to the emperor of Brazil, is supposed to be a topaz.

Colorless diamonds are the most highly esteemed. When cut and polished, a diamond weighing one carat is valued at £8; and the value of others is calculated by multiplying the square of the weight in carats by 8. The value of large diamonds increases, however, at a much more rapid rate. The grinding and cutting of diamonds is done entirely by the hand, and is accomplished principally by the mutual friction of two specimens, assisted by the powder of the diamond. This method was first discovered in 1456, by Louis Berquen, a citizen of Bruges. Previous to his time, the diamond was known only in its native uncut state.

The diamond, besides its use as an ornament, is exceedingly valuable for the purposes of engraving and cutting glass. The curvature of the crystalline faces much improves it for this purpose. The edges obtained by cleavage, or formed by the lapidary, are comparatively quite ineffectual in their cutting powers, and are never set for the glazier.

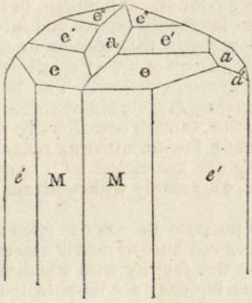
The term *Adamas*, was applied by the ancients to several minerals differing much in their physical qualities. A few of these are quartz, specular iron ore, emery, and other substances of rather high degrees of hardness, which cannot now be identified. It is doubtful whether Pliny had any acquaintance with the real diamond.

TOPAZ. TOPAZIUS RHOMBICUS.

Prismatic Topaz, *M.* and *J.* Fluosilicate of Alumina, *Thom.* Physalite, Pyrophysalite, *Hisinger.* Pycnite. Schorlous Beryl. Schorlite. Schorlartiger Beril, *W.* Silice Fluatée Alumineuse, Alumine Fluatée Siliceuse, *H.*

390. *Primary form:* a right rhombic prism; M : M=124° 19′. *Secondary forms:*

1.



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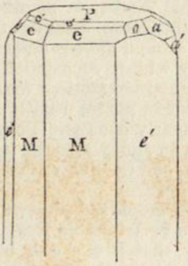


M : *e*=164° 24½′, *e* : *e* (adjacent planes) =86° 52′, M : e=135° 27½′, e : e=141° 7′, M : e′=124° 7′, e : e′=149° 38′, M : e″=116° 56′, e″ : e″=155° 37′, P : *a*=137° 29′, P : *a′*=117° 47′, *e′* : *o*=131° 4′, P : *e′*=138° 56′. *Cleavage* parallel to P highly perfect. *Imperfect crystallizations:* structure columnar—particles thin, long, and slightly coherent—lateral surfaces longitudinally striated; granular—particles of various sizes.

H.=8. G.=3·4—3·6. *Lustre* vitreous. *Streak* white. *Color* yellow, white, green, blue; pale. Transparent—subtranslucent. *Fracture* subconchoidal, uneven.

According to Berzelius, (Afhandlingar, iv. 236,) its different varieties consist of

	Saxon topaz.	Pyrophysalite.	Pycnite.
Silica	34·24	34·36	38·43
Alumina	57·45	57·74	51·00
Fluoric Acid	7·75=99·44.	7·77=99·87	8·84=98·27.

It is infusible alone, on charcoal, before the blowpipe, but when strongly heated the faces of crystallization are covered with small blisters, which crack as soon as formed. Some varieties assume a wine-yellow or pink tinge when heated. With borax it slowly forms a diaphanous glass. When pulverized it changes to green the blue solution of violets. Most topazes become electric by heat, and, if both terminations are perfect, exhibit polarity; the transparent varieties are, without difficulty, electrically excited by friction.

OBS. Pycnite has been separated from this species. It differs from topaz mainly in the state of aggregation of the particles, it presenting a thin columnar structure and forming masses imbedded in quartz. The *physalite* or *pyrophysalite* of Hisinger, is a coarse, nearly opaque variety, found in yellowish white crystals of considerable dimensions. This variety intumesces when heated, and hence its name from *φυσαω, to blow.*

Topaz is confined to primitive regions, and commonly occurs in granite, associated with turmaline, beryl, occasionally with apatite, fluor spar, and tin. With quartz, turmaline, and lithomarge, it forms the mixture called topaz rock by Werner.

Fine topazes are brought from the Uralian and Altai mountains, Siberia, and from Kamschatka, where they occur of green and blue colors. In Brazil they are found of a deep yellow color, either in veins or nests in lithomarge, or in loose crystals or pebbles. Magnificent crystals of a sky blue color, have been obtained in the district of Cairngorum, in Aberdeenshire. Jameson mentions a crystal from this locality, which weighed nineteen ounces. The tin mines of Schlaggenwald, Zinnwald, and Ehrenfriedersdorf in Bohemia, St. Michael's Mount in Cornwall, &c., afford smaller crystals. In the Mourne mountains it occurs in small limpid crystals, associated with beryl, albite, and mica, in the drusy cavities of granite. The physalite variety occurs in crystals of immense size, at Finbo, Sweden, in a granite quarry, and at Broddbo, in a boulder. A well defined crystal from this locality, in the possession of the College of Mines of Stockholm, weighs eighty pounds. Altenberg, in Saxony, is the principal locality of pycnite. It is there associated with quartz and mica.

Trumbull, Conn., contains the only known locality of this species in the United States. It seldom affords fine transparent crystals, except of a very small size. These are usually white; occasionally with a tinge of green or yellow. The large coarse crystals sometimes attain a diameter of several inches, (rarely six or seven,) but they are deficient in lustre, usually of a dull yellow color, though occasionally white, and often are nearly opaque. They sometimes present a few terminating planes of crystallization, in addition to the lateral faces. They are associated with magnetic pyrites, mica, and the chlorophane variety of fluor; also rarely with wolfram and tungstate of lime.

Topaz is employed in jewelry, and for this purpose its color is often altered by heat. The variety from Brazil assumes a pink or red hue, so nearly resembling the Balas ruby, that it can only be distinguished by the facility with which it becomes electric by friction. The finest crystals for the lapidary are brought from Minas Novas, in Brazil. From their peculiar limpidity, they are sometimes denominated *goutte d'eau*, and when cut with facets and set in rings, they are readily mistaken, if viewed by daylight, for diamonds. The coarse varieties of topaz may be employed as a substitute for emery in grinding and polishing hard substances.

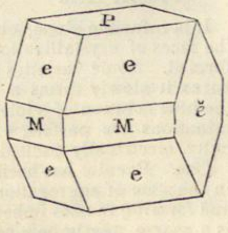
The ancient τοπαζιον was found on an island in the Red Sea, which was often surrounded with fog, and therefore difficult to find. It was hence named from τοπαζω, *to seek*. This name, like most of the mineralogical terms of the ancients, was applied to several distinct species. Pliny describes a statute of Arsinoe, the wife of Ptolemy Philadelphus, four cubits high, which was made of τοπαζιον, or topaz, but evidently not the topaz of the present day, nor chrysolite, which has been supposed to be the ancient topaz. It has been conjectured that it was a jasper or agate; others have imagined it to be prase, or chrysoprase.

FORSTERITE. Topazius Vesuvianus.

Levy. Ann. Phil. 2d series, VII. 61.

391. *Primary form:* a right rhombic prism; M : M=128° 54′. *Secondary form:* M : e=142° 54′, P : e=127° 6′, e : e= (adjacent planes) 139° 14′, M : ĕ=115° 33′. *Cleavage* perfect and easily obtained parallel with P.

Scratches quartz. *Lustre* vitreous, splendent. *Streak* white. *Colorless.* Translucent.



It contains, according to Children, Silica and Magnesia.

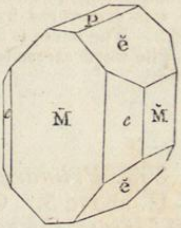
Obs. This species was first noticed by Levy in small crystals, accompanying spinel and olive-green pyroxene, on Mount Vesuvius. Its angles are nearly identical with those of chrysoberyl, but its cleavage parallel with P is quite peculiar.

CHRYSOLITE. Chrysolithus rectangulus.

Prismatic Chrysolite, *M* **and** *J.* **Anhydrous Silicate of Magnesia,** *Thom.* **Peridot,** *H.* **Olivine, Chusite, Limbelite,** *Saussure.* **Krisolith,** *W.*

392. *Primary form:* a right rectangular prism. *Secondary form:* P : ĕ=130° 27′, M̄ : ĕ=139° 33′, ĕ : ĕ=99° 7′, M̄ : *e*=155°, *e* : *e*=130° 2′. M̆ : *e*=114° 59′. *Cleavage* perfect parallel with M̆. *Imperfect crystallizations:* structure coarse or fine granlar—aggregated in irregular spheroidal masses, imbedded in rocks.

H.=6·5—7. G.=3·33—3·5; 3·41 of chrysolite, Haidinger; 3·3386—3·445 of olivine, Stromeyer; 3·3514 of chrysolite, Stromeyer. *Lustre* vitreous. *Streak* white. *Color* green, of various shades, commonly olive green; sometimes inclining to brown. Transparent—translucent. *Fracture* conchoidal.



Its different varieties contain, according to Stromeyer (Poggendorf's Annalen, iv. 194) and Walmstedt, (Kongl. Vet. Acad. Handl., 1824, p. 259,)

	Chrysolite.	Olivine.	Olivine.	Olivine.
Silica	39·73	40·09	38·48	40·83
Magnesia	50·13	50·49	48·42	47·74
Protox. Iron	9·19	8·17	11·19	11·53
Oxyd of Nickel	0·32	0·37	——	——
Oxyd of Manganese	0·09	0·20	0·34	0·29
Alumina	0·22	0·19	0·18	trace
	99·68, S.	99·51, S.	98·61, S.	100·39, W.

The two last are analyses of olivine from Siberian meteoric iron.

Chrysolite contains, therefore, an atom of each silica and magnesia, with a variable quantity of silicate of iron. From Mitscherlich's experiments, it appears that silicate of iron, and silicate of magnesia, are isomorphous.

Before the blowpipe chrysolite becomes somewhat darker, but does not fuse, or lose its transparency. With borax it forms a green transparent glass. The color of olivine is removed by nitric acid, the acid removing the iron, its coloring ingredient. It exhibits double refraction.

Obs. Those specimens of this species, which are perfectly crystallized, and present bright colors and high degrees of transparency, have been called pre-eminently *chrysolite;* while imbedded masses, less crystalline in their structure, and inferior in their diaphaneity and brightness of color, have been distinguished by the name *olivine.*

The perfectly crystallized chrysolite is brought from Constantinople: its locality is not known. Less distinct crystallizations occur imbedded in lava, at Vesuvius and the Isle of Bournon; imbedded in obsidian, at Real del Monte, in Mexico; among sand at Expaillie, in Auvergne, in pale green transparent crystals. Olivine is more abundant, being of frequent occurrence in basalt and lavas. Crystals, several inches in length, occur in greenstone at Unkle, near Boma, on the Rhine; spheroidal masses are met with at Kapferstein, in Lower Styria; and at Hecla and Vesuvius. It is a frequent ingredient of meteoric stones.

Olivine is commonly very fragile and often filled with cavities, and is therefore unfit for an ornamental stone. Chrysolite, also, is usually too much intersected by flaws to be valued as a gem; and when clear, is so soft as to require the greatest care to retain its polish.

The minerals *Chusite* and *Limbelite* of Saussure, from the volcanic district of Limbourg, appear to be decomposed varieties of this species.

Hyalosiderite is also commonly considered a variety of this species. According to Walchner, it occurs in crystals of a yellowish or reddish-brown color in amygdaloid, in the Kaiserstuhl, near Sasbach, in Brisgau. Its crystals are flat rectangular tables, with the terminal edges deeply replaced, ē : ē=99° 22′, ĕ : ĕ=77° 50′. Its streak is cinnamon-brown; internal lustre vitreous, external submetallic; subtranslucent. H.=5·5. G.=2·875. It is composed, according to Walchner, of Silica 31·634, Protoxyd of Iron 29·711, Magnesia 32·403, Alumina 2·211, Protoxyd of Manganese 0·480, Potash 2·788, and Chromium a trace=99·227. Before the blowpipe it becomes black, and then melts into a black bead, which is attracted by the magnet. It was discovered by Walchner, and described in Schweigger's Jahrbuch, ix. 65, 1823. The name is derived from ὑαλος, *glass*, and σιδηρος, *iron*.

The word *chrysolite* is derived from χρυσος, *gold*, and λιθος, *stone*, in allusion to its color.

LIGURITE. Chrysolithus obliquus.

393. *Primary form :* an oblique rhombic prism of 140° and 40°. H. above 5. G.=3·49. *Lustre* of the surface of fracture, between vitreous and resinous. *Streak* grayish-white. *Color* apple-green, sometimes speckled internally. Transparent—translucent. *Fracture* uneven.

It contains Silica 57·45, Alumina 7·36, Lime 25·30, Magnesia 2·56, Oxyd of Iron 3, Oxyd of Manganese 0·5=95·97, Viviani.

Obs. It occurs in a talcose rock, on the banks of the Stura, in the Apennines of Liguria. It does not become electric by heat, or by friction.

It is considered a superior gem to chrysolite, both in color, hardness, and transparency.

TAUTOLITE.

Philosophical Magazine, new series, III. 398.

394. *Primary form :* according to Mohs, trimetric. *Cleavage* only in traces.

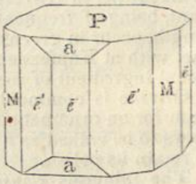
H.=6·5—7. G.=3·865. *Lustre* vitreous. *Streak* gray. *Color* velvet-black. Opaque. *Fracture* conchoidal, uneven. Very brittle.

Before the blowpipe it fuses into a black scoria, attractable by the magnet; with borax it forms a clear green glass. These and other reactions evince that the mineral contains silica, protoxyd of iron, magnesia, and alumina.

Obs. Occurs in the volcanic feldspathic rocks, in the vicinity of the Laachar-see, near Bonn, on the Rhine. It was first distinguished by Breithaupt, of Freiberg.

IOLITE. Hyalus bicolor.

Prismatic Quartz, *M.* Dichroite. Peliom. Steinheilite. Cordierite, *H.* Sapphire d'eau. Hard Fahlunite.



395. *Primary form :* a rhombic prism; M : M=120°. *Secondary form:* M : ē=150°, M : ĕ 120°. *Cleavage* parallel to P and ē, indistinct. *Imperfect crystallizations :* structure granular, strongly coherent; particles distinguished with difficulty.

H.=7—7·5. G.=2·5969, a Greenland specimen, Stromeyer; 2·651—2·6643, from Haddam, Conn., Thomson. *Lustre* vitreous. *Streak* white. *Color* various shades of blue, generally inclining to black; often deep blue, if viewed in the direction of the vertical axis, and brownish-yellow, or yellowish-gray, perpendicular to it. Transparent—translucent. *Fracture* subconchoidal.

It contains, according to Stromeyer and Thomson,

	Greenland.	Peliom, fr. Bodenmais.	Steinhilite.	Haddam, Conn.
Silica	49·170	48·352	48·525	49·620
Alumina	31·106	31·706	31·502	28·720
Magnesia	11·454	10·157	15·000	8·640
Lime	——	——	——	0·228
Protoxyd of Iron	6·338	8·316	1·610	11·580
Protox. Manganese	0·037	0·333	0·243	1·508
Water	1·204	0·595	1·705	——
	99·309, S.	99·459, S.	98·585, T.	100·296, T.

At a high heat before the blowpipe, it fuses on the edges into a blue transparent glass; with borax it slowly forms a clear bead. It is not acted on by acids.

Obs. Iolite is met with at Bodenmais, in Bavaria, occasionally in perfect crystallizations, but usually massive. It is associated with magnetic pyrites. The variety from this locality has been called *peliom*, from its peculiar smoky-blue color, from πελιος. It occurs in quartz, at Ujordlersoak, in Greenland; in granite, at Cape de Gata, in Spain; at Arendal, in Norway; at Orrijervi, in Finland; at Tunaberg, in Sweden, &c. Ceylon affords a transparent variety, in small rolled masses, of an intense blue color. At Haddam, Conn., it is associated with garnet and anthophyllite in gneiss.

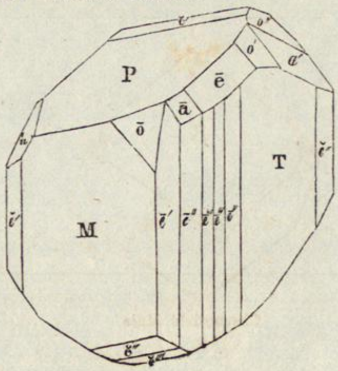
It is occasionally employed as an ornamental stone, and when cut, exhibits its dichroism, or different colors, in different directions.

The name *iolite*, is derived from *ιον*, *a violet*, and *λιθος*, *stone*, in allusion to its color. From its property of exhibiting different colors, according to the direction in which it was viewed, it has also been named *dichroite*, from *δις*, *double*, and *χρόα*, *color*.

A mineral, called *hydrous iolite*, has been analyzed by Bonsdorf, (Kong. Vet. Acad. Handl. 1827, p. 157,) which contains a considerable portion of water, in addition to the constituents of iolite; its constituents are as follows: Silica 45·05, Alumina 30·05, Magnesia 9·00, Protoxyd of Iron 5·30, Water 10·60=100. It occurs in modified six sided prisms, foliated parallel with the base, of a greenish-brown, or dark olive-green color; it presents the lustre of talc on its surface of fracture, but a waxy lustre on the surface of the plates; H.=3·75. It occurs in red granite, in the neighborhood of Abo, accompanied by a light bluish-gray iolite.

AXINITE. Hyalus acutus.

Prismatic Axinite, *M.* Thummerstein. Thumite. Yanolite.



396. *Primary form:* an oblique rhomboidal prism; P : M=134° 40′, P : T=115° 5′, M : T=135° 10′. *Secondary form:* M : ī′=179° 20′, M : ī″=174° 40′, P : ē=143° 20′, P : ō=133° 25′, P : *a*′=121° 30′, T : ĕ′=147° 55′, M : ĕ″=135° 12′. *Cleavage* indistinct and interrupted. *Imperfect crystallizations:* structure lamellar, lamellæ commonly a little curved; granular structure is occasionally observed.

H.=6·5—7. G.=3·271, Haidinger; a Cornish specimen. *Lustre* highly vitreous. *Streak* white. *Color* clove-brown, inclining to plum-blue and pearl-gray; occasionally green, from an admixture of chlorite; presents different colors viewed in two different directions. Transparent—subtranslucent. *Fracture* conchoidal. Brittle.

It contains, according to Vauquelin (Jour. des Mines, No. xxiii. 1) and Wiegman, (Schweig. Jour. xxxii. 462,)

Silica	44	45·00
Alumina	18	19·00
Lime	19	12·50
Magnesia	—	0·25
Protoxyd of Iron	14	12·25
Protoxyd of Manganese	4	9·00
Boracic Acid	—=99, V.	2·00=100, W.

It fuses readily before the blowpipe with intumescence, into a dark-green glass, which is blackened in the oxydating flame. Heat causes electrical excitement.

Obs. Axinite occurs in large clove-brown crystals, remarkable for the brilliancy of their lustre and perfection of form, at St. Cristophe, near Bourg d' Oisans, in Dauphiny, where it is associated with albite, Prehnite, and quartz. The silver mines traversing mica-slate, at Kongsberg, afford smaller crystals. It also occurs with hornblende, or magnetic iron ore, at Normark, in Sweden, and in rather complex crystals, of a dark color, at Botallack, in Cornwall; at this place it also occurs massive, forming a peculiar kind of rock, with garnet and turmaline. It is also met with at Thum, near Ehrenfriedersdorf, in Saxony, and hence has been called *Thumite*, and *Thummerstein*. Axinite was so called by Karsten, on account of the acuteness of the edges of its crystals, or their resemblance to an axe or hatchet, from 'αξίνη, *an axe*.

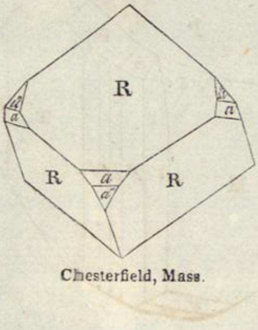
Axinite admits of a high polish, but is deficient in delicacy of color.

QUARTZ. HYALUS RHOMBOHEDRUS.

Rhombohedral Quartz, *M.* Flint. Silex. Chalcedony. Cacholong. Agate. Jasper. Hornstone. Cat's Eye. Amethyst. False Topaz. Rose Quartz. Prase. Chrysoprase Cantalite. Iron Flint. Heliotrope. Eisenkiesel. Berg-crystal. Kalzedon.

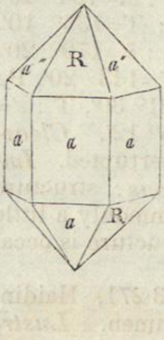
397. *Primary form:* an obtuse rhombohedron; R : R=94° 15′. *Secondary forms:* fig. 124, Pl. II., from Gouverneur, N. Y.; also the annexed figures:

1.



Chesterfield, Mass.

2.



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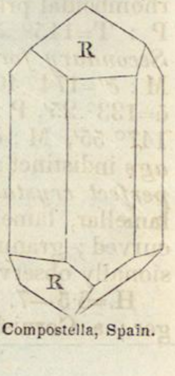
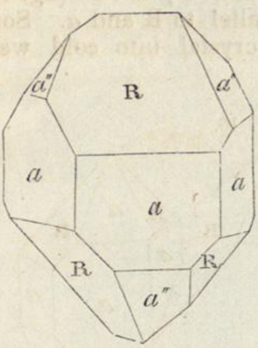
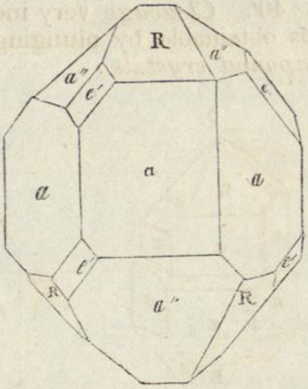


Compostella, Spain.

4

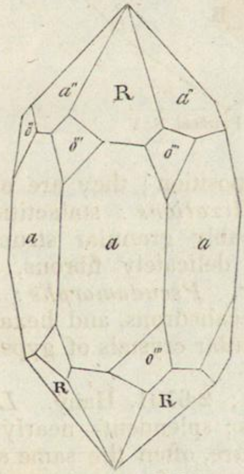


5.



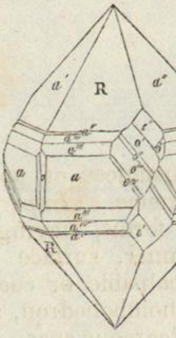
Fairfield, N. Y.

6.



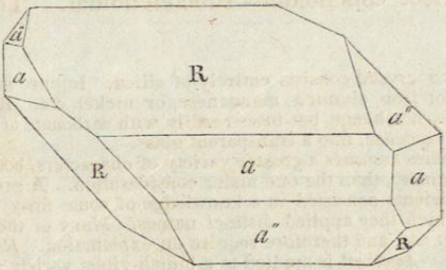
White Mts., N. H.

7.



Chamouny.

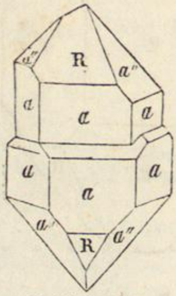
8.



Fairfield, N. Y.

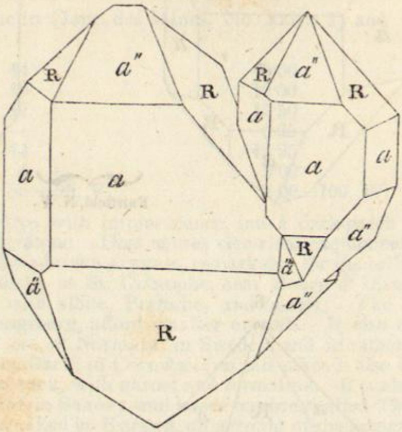
R : a=141° 47′, R : a''=133° 44′, R : e'=151° 5′, R : o''' (fig. 6,) = 148° 40′. *Cleavage* very indistinct, parallel to R and a. Sometimes obtainable by plunging a heated crystal into cold water. *Compound crystals :*

9.



Fairfield, N. Y.

10.



Fairfield, N. Y.

These are instances of postnatal composition ; they are of frequent occurrence. *Imperfect crystallizations :* stalactitic and mammillary forms, having an impalpably granular structure ; coarse columnar, surface crystalline ; delicately fibrous, rare ; massive, impalpable, or coarse granular. *Pseudomorphs :* imitative of the rhombohedron, scalene dodecahedrons, and hexagonal prisms of calcareous spar—of the lenticular crystals of gypsum—of cubes and octahedrons of fluor spar.

H.=7. G.=2·6413—2·6541, Beudant ; 2·6701, Haüy. *Lustre* vitreous, sometimes inclining to resinous ; splendent—nearly dull. *Streak* white, of pure varieties ; if impure, often the same as the color, but paler. *Color* white, when pure ; often various shades of yellow, red, brown, green, and blue. Transparent—opaque. *Fracture* perfect conchoidal—subconchoidal. Tough—brittle—friable.

The pure quartz crystal consists entirely of silica. Impure varieties contain variable quantities of iron, alumina, manganese, or nickel, &c. Before the blowpipe, *per se*, it undergoes no change, but fuses readily with carbonate of soda, accompanied with a brisk effervescence, into a transparent glass.

No mineral species assumes a greater variety of characters, both as respects color, lustre, and diaphaneity, than the one under consideration. A great part of the mineralogy of the ancients consisted in a knowledge of some forty or fifty varieties of this species, to which they applied distinct names. Many of their terms, and also others, are now in use, and therefore require an explanation. *Rock crystal* includes the limpid quartz. *Amethyst* is applied to a bluish-violet variety ; its color is due to the presence of a small quantity of manganese. *Smoky quartz* is a transparent, or translucent crystalline variety, having a smoky color. *Rose quartz* is a rose-red, translucent, massive variety. *Aventurine quartz* has a gray, brown, or reddish color, and contains interspersed scales of mica, producing, when polished, a spangle-like appearance. *Prase* is a dark leek-green, massive variety. *Ferruginous quartz* is a dull-yellow, or red, opaque variety; often in perfect and very regular crystals. *False topaz*, or *Cairngorum stone*, includes light yellow transparent crystals. *Milky quartz* has a milk-white color; it is called greasy quartz when its lustre is oily. *Chalcedony* is a translucent, or subtranslucent, massive, impalpably granular variety, often presenting imitative shapes. The color of the pure chalcedony is white, flesh-white, or bluish; when of other colors it is otherwise designated. *Chrysoprase* is a leek-green translucent Chalcedony: the color is owing to a small quantity of nickel; *Carnelian*, a clear red, or yellowish-red, sometimes grayish, translucent variety. *Jasper* is subtranslucent, or opaque, and may be either brown, yellow, or red, and is sometimes striped—it contains several per cent. of oxyd of iron, and a little alumina. *Cat's eye* is a light colored, usually greenish-gray, (sometimes yellow, red, or brown,) Chalcedony, containing filaments of asbestus, which give rise to an opalescent appearance when the stone is cut *en cabochon*. *Plasma* is of a dullish green color, with yellow and whitish dots, and a glistening lustre. *Heliotrope* has a deep green color, and contains interspersed blood-red spots. *Sard* is deep brownish-red, or blood-red by transmitted light. *Onyx* is composed of alternate layers of brown and opaque-white Chalcedony; when the layers consist of sard and milk-white Chalcedony, it is called *sardonyx;* when the layers are composed of various kinds of Chalcedony, and variously arranged, usually in concentric layers, it is called *agate:* if the Chalcedony contains dendrites of a brown or green color, it forms the *Mocha stone*,—so called from its Arabian locality. *Flint* is a dull-black, or grayish-black variety, (occasionally brown, yellow, or red,) and is commonly subtranslucent; fracture perfect conchoidal. *Hornstone* differs from flint in its splintery fracture, grayer color, and also in being more brittle; if the hornstone or flint exhibits a coarse slaty structure, it is called *flinty slate:* a very tough variety of flint, opaque, and of a grayish, or velvet-black color, has been distinguished by the name of *Lydian stone, touchstone*, or *basanite*. *Float stone*, or spongiform quartz, *quartz nectique*, of Haüy, is sufficiently light to swim on water; it consists of intermingled fibres, or acicular crystals, of a white or gray color, forming a spongy or porous mass.

Quartz, in some of its varieties, occurs in almost every rock-stratum. It is an essential constituent of granite, gneiss, and mica slate, and of the various silicious conglomerates and sandstones of a later period. It also forms extensive beds in primitive regions. The chalcedonic varieties occur principally in the vesicular cavities of trap, or basaltic rocks. Jasper is usually found as a rolled pebble. It also occurs in limestone, occupying the place of hornstone.

Switzerland, Dauphiny, Piedmont, the Carrara quarries, and numerous other foreign localities, afford fine specimens of the rock crystal. The most beautiful amethysts are brought from India, Ceylon, and Persia, where they occur in geodes, and as pebbles; inferior specimens occur in Transylvania, in large crystalline groups; in the vicinity of Cork, and on the island of May, in Ireland. The *false topaz* is met with in Brazil. *Rose quartz* occurs in a vein of manganese, traversing the granite of Rabenstein, near Zwiesel, in Bavaria. *Prase* is found in the iron mines of Breitenbrunn, near Schwartzenberg, in Saxony. The amygdaloids of Iceland, and the Faroe Islands, afford magnificent specimens of *Chalcedony;* also Huttenberg and Loben, in Carinthia, &c. A small blue variety, in hexahedral crystals, (pseudomorphs of fluor,) occurs at Treszytan, in Transylvania. The finest *carnelians* and *agates* are found in Arabia, India, Surinam, and Saxony. Perthshire, and other parts of Scotland, afford smaller, but handsome specimens. *Chrysoprase* occurs at Kosemutz, in Silesia. *Aventurine quartz*, at Cape de Gata, in Spain. *Cat's eye*, in Ceylon, the coast of Malabar, and also in the Hartz. *Plasma*, in India and China, whence it is usually brought in the form of beads. *Heliotrope*, in Bucharia, Tartary, Siberia, and the island of Rum, in the Hebrides. *Float stone*, in the chalk formation of Merril Montant, near Paris, and in some of the Cornish mines. The banks of the Nile afford the Egyptian jasper; the striped jasper is met with in Siberia, Saxony, and Devonshire. A fine *yellow jasper* is found at Vourla, bay of Smyrna, in a low ridge of limestone, to the right of the watering place, between the harbor and the high hills that commence their rise about a mile back. It is here associated with a beautiful opal, coarse carnelians, chrysoprase, and hornstone, and these minerals seem to occupy in the limestone the place of hornstone, which is found in various parts of the adjoining country, and also at Napoli di Romania, in Greece.

The Plains of Argos are strewed with pebbles of *red jasper*. A variety of sandstone occurs in thin layers at Villa Rica, remarkable for its flexibility, owing apparently to the dissemination of small scales of mica through the mass.

The black limestone of Quebec affords fine crystals of quartz. The smoky variety is obtained in large crystallizations in Nova Scotia. In the United States, beautiful specimens have been obtained in the primitive mountains of New Hampshire and Vermont; but they are rare. Small but remarkably clear and perfect crystals are found in various parts of the state of New York. At Middlefield, N. Y., on the banks of the West Canada Co., they occur in a calciferous sand rock, lying loose in large cavities, accompanied with a loose earth. Several hundred crystals are often obtained from a single cavity by prying open the rocks where fissured. The crystals are occasionally smoky, and often contain anthracite; rarely cavities occur filled with a fluid. They vary in size from the head of a pin to a length of four or six inches. Several parts of the adjoining country are strewed with crystals, which are turned up and exposed to view by the ploughman. Fine specimens of drusy quartz are obtained at the same locality. Gouverneur, N. Y., affords splendid dodecahedral crystals, similar to fig. 124, Pl. II., associated with an iridescent crystallized specular iron. They vary from three quarters to two inches in length, and commonly present prismatic faces, but in general, not more than a twentieth or sixteenth of an inch long. Diamond Island, Lake George, is an old locality of quartz crystals. Small unpolished crystals, nearly perfect rhombohedrons, (fig. 1,) occur in granite at Chesterfield, Mass. At the notch of the White mountains, N. H., and at the locality of turmaline, at Paris, Me., handsome crystals of brown or smoky quartz have been obtained. Druses of quartz, of a delicate apple-green color, occur with chrysoprase, at New Fane, Vt.; also of other colors at the same place.

Rose quartz occurs at Acworth, N. H., Paris, Me., and Southbury, Conn. Chalcedony, carnelian, and agates, occur occasionally in the trap region of Connecticut and Massachusetts; more abundandantly in the trap of Lake Superior, and also in rolled masses of much beauty, particularly at Keweena Point. The same locality affords smoky and amethystine quartz. Amethyst occurs also at the Pic Bay, and at Gargontwa, Lake Superior, crystallized in trap; also at Bristol, R. I., and occasionally throughout the trap region of Massachusetts and Connecticut. Red jasper is found in pebbles at Saugus, near Boston, and on the banks of the Hudson, at Troy; yellow jasper occurs with Chalcedony, at Chester, Mass.

Pseudomorphs, imitative of hexagonal and scalenohedral crystals of calcareous spar, occur at Williamsburg, Mass.

Quartz crystals occasionally occur of an enormous size. A group in the museum of the university at Naples, weighs nearly half a ton. A crystal, belonging to Sig. Rafelli, of Milan, measures three and a quarter feet in length, and five and a half in circumference, and is estimated at eight hundred and seventy pounds; another at Paris is three feet in diameter, and weighs eight cwt. Crystals often exhibit very beautiful internal iridescences, owing to fissures or fractures. This effect may be produced artificially, by heating the crystal nearly to redness and plunging it, while hot, into cold water. Foreign substances frequently penetrate or thoroughly permeate crystals of quartz. Iron has already been alluded to as one of these permeating substances. Chlorite is sometimes so thoroughly intermingled, that the crystals appear to be composed entirely of this material; their hardness, however, shows their silicious nature. Anthracite, asbestus, actinolite, rutile, turmaline, silver, and copper, are other penetrating substances.

Specimens containing acicular crystals of rutile, are often very beautiful. But the most interesting by far of the substances contained in quartz, are the fluids which occupy small cavities, and evince their presence on turning the specimens, by the motion of the accompanying air bubble, like the bubble in a spirit level. These cavities are sometimes of considerable size. Jacobson, of Copenhagen, possesses a geode of quartz, an inch and a quarter long, which contains at least half a cubic inch of fluid. This fluid is usually water; but occasionally it is a bituminous fluid resembling naphtha. Mr. Allan describes a crystal of amethyst in his collection, which contains four cavities partially filled with this peculiar fluid; at a temperature of 83°, the fluid dilates and entirely fills all the cavities, and as it reappears on cooling, an ebullition is apparent.

A very peculiar gelatinous substance, appearing to be silica in solution, has been observed on breaking open geodes; and the production of a species of Chalcedony from the subsequent evaporation has also been noticed. But the nature of the solvent of silica is not yet fully ascertained. It is, however, held in solution in the hot waters of the Geysers of Iceland, whose solvent power is supposed to be due to the presence of a small quantity of an alkali, and its high temperature. The Geysers have covered the part of Iceland in their vicinity, with a silicious sinter.

Several of the varieties of this species have long been employed in jewelry. The *amethyst* has always been valued as a gem of great beauty. Like most other stones, it is less brilliant by candle light, and at all times appears to best advantage, when surrounded with pearls and set in gold. The color of the amethyst is often irregularly diffused, as is well described by Pliny, "ad viciniam crystalli descendet albicante purpuræ defectu,"—purple, gradually fading into white. It was called *amethyst*, αμίθυστος, on account of its pretended preservative powers against intoxication, from α, *not*, and μεθυω, *to intoxicate*. This is not, however, the only *amethyst* of the ancients. The violet colored sapphire, the violet fluor spar, (scalpturis faciles, *Plin.*, *easily graven*,) and some other purple species, were designated by the same name; it has also been supposed, that garnet came under the same denomination.

On account of the arrangement of the colors of the onyx in layers, it is well adapted for the formation of cameos, and was the material formerly employed for this purpose. The most noted of the ancient cameos, is the Mantuan vase at Brunswick. It was cut from a single stone, and has the form of a cream pot, about seven inches high and two and a half broad; on its outside, which is of a brown color, there are white and yellow groups of raised figures, representing Ceres and Triptolemus in search of Proserpine. The Museo Borbonico, at Naples, contains an onyx measuring eleven inches by nine, representing the apotheosis of Augustus, and another, exhibiting the apotheosis of Ptolemy on one side, and the head of Medusa on the other; both are splendid specimens of the art, and the former is supposed to be the largest in existence.

The carnelian (sarda of Pliny) receives a fine polish, and is often rich in color; but is too common to be highly valued. When first obtained from the rock in which they occur, they are usually gray; they receive their fine colors from an exposure of several weeks to the sun's rays, and a subsequent heating in earthen pots. Agates (achates of the ancients) are very varied in their colors, and in the disposition of them. When arranged in zigzag parallel lines, the polished specimen presents delineations resembling a fortification; this variety is called the fortification agate. The Scotch pebble is usually of this kind. The colors of this stone are rendered more obvious by boiling it in oil, and afterwards in sulphuric acid; the latter carbonizes the oil absorbed by the apparently porous layers, and thus increases the contrast of the different colors. Agate are often made into mortars for chemical and pharmaceutical preparations, and according to Pliny, it was employed for the same purpose by the physicians of his day. In Germany it is made into cups and plates. The royal collection at Dresden contains a table service of German agate; and at Vienna, in the imperial cabinet, there is an oval dish 22 inches in length, formed from a single stone. The agate, or *achates* of the Greeks, was so called from the river Achates, in Sicily, whence, according to Theophrastus, these stones were originally brought. *Iaspachates* corresponded to our jasper agate; *Sardachates* contained layers of the sard, or carnelian; *Dendrachates* (from δενδρον, *a tree*, and achates) was our moss agate; *Hæmachates* (from ἁιμα, *blood*, and achates) was an agate, sprinkled with spots of red jasper.

The jasper admits of a brilliant polish, and is often formed into vases, boxes, knife-handles, &c. It is also extensively used in the manufacture of Florentine mosaics. The iaspis of the ancients, whence our word jasper is derived, appears to have included only the green or blue colored variety, together with some other stones, not of the jasper kind. Quartz is a necessary ingredient in the manufacture of glass and porcelain, and is also employed in the smelting of ores, particularly copper, and in other metallurgical operations. With lime it forms mortar. Its use in the state of flint is well known.

Porcelain jasper is sometimes referred to this species. It is, however, merely a clay, indurated by heat. It fuses readily, and is thus distinct from quartz. It occurs near Carlsbad, in Bohemia.

OPAL. HYALUS OPALINUS.

Uncleavable Quartz, *M.* Hyalite. Muller's Glass. Hydrophane. Menilite. Cacholong. Silicious Sinter. Pearl Sinter, Fiorite. Gyrasol. Eisenopal, *Haus.* Quartz Hyalin Concretionée, Quartz Résinite, *H.* Opalus, Pæderos, *Pliny.* ὀπάλλιος.

398. Impalpably granular structure; small reniform and stalactitic shapes, and large tuberose concretions. Pseudomorphs imitative of calcareous spar.

H.=5·5—6·5. G.=2·0—2·21. *Lustre* vitreous, frequently subvitreous, and often inclining to resinous, and sometimes to pearly. *Streak* white. *Color* white, yellow, red, brown, green, gray, generally pale; dark colors arise from foreign admixtures. Some specimens exhibit a rich play of colors; others present different colors by refracted and reflected light. The play of colors is destroyed by heat.

It consists of

	Hyalite.	Precious Opal.	Menilite.
Silica	92·00	90·0	85·5
Water	6·33=98·33.	10·0=100.	11·0=96·5.

Menilite often contains, also, small portions of iron, alumina, lime, and carbon. Before the blowpipe is infusible, but opal decrepitates readily, gives out water, and becomes opaque. Some varieties become red in consequence of the iron they contain.

The *precious opal* exhibits a delicately beautiful play of colors. *Fire opal*, or *girasol*, presents bright hyacinth-red and yellow tints. *Common opal*, and *semi-opal*, are common varieties, not exhibiting the opalescence of the precious or fire opal; they are distinguished from one another by their degrees of transparency and lustre. *Hydrophane* is a variety of opal which is not transparent, but becomes so when immersed in water. *Cacholong* is nearly opaque, and of a porcelain or bluish-white color; it adheres to the tongue, and contains a small portion of alumina. It is closely allied to, and often associated with hydrophane. *Hyalite*, or *Muller's glass*, occurs in small reniform botryoidal, and occasionally stalactitic shapes, either colorless or white. *Menilite* is a brown and opaque variety, occurring in compact reniform masses, occasionally presenting a slaty structure. *Opal jasper* contains several per cent. of iron, and is the analogue in this species of the jasper in the preceding. *Silicious sinter* is a loose silicious aggregate, deposited by the Geysers of Iceland, where it presents porous stalactitic, fibrous, "cauliflower-like," and occasionally compact concretions. *Pearl sinter*, or *fiorite*, occurs in the cavities of volcanic tufa, in smooth and shining globular and botryoidal masses, which have a pearly lustre. *Wood opal* has a peculiar ligneous structure.

Obs. Opal occurs in short irregular veins in porphyry; also in the vesicular cavities of amygdaloids. Common opal occurs in limestone, with hornstone. Menilite is met with in clayslate. Some varieties are found with galena and blende, in metalliferous veins. It also occupies the interior of fossils in sandstone.

The precious opal occurs in porphyry at Czervenitza, near Cashau, in Hungary, and at Gracias a Dios, in Honduras, S. A. Fire opal is brought from Zimapan, in Mexico, and from the Faroe Islands. The common opal exists abundantly in Hungary, in Faroe, Iceland, the Giants' Causeway, and the Hebrides. A very beautiful variety has been observed by the author within a half mile, and to the southwest of the watering-place at Vourla, the harbor of Smyrna. It occurs here with yellow jasper and hornstone, imbedded in a low ridge of compact limestone, of a light yellow or grayish-white color. Its colors are wax-yellow and grayish-green, occasionally white. Hungary affords also the hydrophane. The Giants' Causeway produces small masses resembling mountain cork, which, though opaque, become translucent on immersion in water. Cacholong occurs in loose masses on the river Cach, in Bucharia, whence its name. Hyalite occurs in amygdaloid at Schemnitz, in Hungary, and in clinkstone at Waltsch, in Bohemia. Menilite is found imbedded in adhesive slate, at

Menil Montant, near Paris. Wood opal forms large trees in the pumice conglomerates of Saiba, near Neusohl, and Kremnitz, in Hungary, in Faroe, and other trap countries. In Van Dieman's Land, forty miles above Hobart town, on the river Derwent, it is said to occur in large trunks. A magnificent specimen in the Liverpool Museum, from this locality, weighs between two and three hundred pounds.

Hyalite is the only variety of this species which has been discovered in the United States. It occurs in St. Lawrence Co., N. Y.; also in Burke and Scriven Cos., Georgia. At the latter place it lines cavities in a silicious shell-rock. The Suanna spring, in Florida, affords small quantities of the silicious sinter.

The precious opal, when large, and exhibiting its peculiar play of colors in perfection, is a gem of considerable value. It is cut with a convex surface. The largest mass of which we have any knowledge, is in the imperial cabinet of Vienna; it has almost the size of a man's fist, and weighs 17 ounces, but contains numerous fissures, and is not entirely disengaged from the matrix. This stone was employed as an ornament among the Greeks and Romans, and was called opalus; also *pæderos*, παιδερως, in allusion to its color and lustre, as expressed in the Orphic poem, ἱμεροτοῦ τέρενα χρόα παιδὸς, "having the delicate complexion of a lovely youth;"* an admirable, though poetical description of some varieties of opal.

OBSIDIAN. Hyalus Vulcani.

Empyrodox Quartz, *M.* Indivisible Quartz, Fusible Quartz, *J.* Pearlstone—Pitchstone. Pumice. Marekanite. Pechstein, Perlstein, Bimstein *of the Germans*. Petrosilex resinite. Feldspath resinite, *H.*

399. No regular forms or cleavage.

H.=6—7. G.=2·396, obsidian from Iceland; 2·212, pitchstone from Meisser. *Lustre* vitreous—pearly. *Streak* white—grayish white. *Color* black, brown, red, green, gray, white; none bright. Subtransparent—subtranslucent. *Fracture* conchoidal.

The species obsidian has been distributed into the four so called species, *obsidian*, *pitchstone*, *pearlstone*, and *pumice*. *Obsidian* more nearly resembles glass in its appearance, and is often called volcanic glass. *Pitchstone* has a resinous lustre and a splintery fracture. Its colors are principally brown, green, or red. It presents frequent transitions into obsidian on one side and pearlstone on the other. *Pearlstone* is a gray variety with a pearly lustre; it occurs in rounded balls, one to two inches in diameter, usually composed of thin concentric laminæ, and often containing, as a nucleus, a grain of obsidian. *Pumice* is a vesicular obsidian. It occasionally presents a fibrous structure, and its filaments have a peculiar silky lustre; at other times it has a more delicately glassy texture. Its vesicular structure renders it buoyant for a time on water. *Marekanite* is a peculiar pearl-gray translucent variety, from Marekan in Kamschatka.

Obsidian contains, according to Berthier, Thomson, and Descotils,

	Obsidian.	Pit. from Arran.	do. from Saxony.	Pearlstone.	Obsidian.
Silica	69·46	63·500	73·100	70·400	72·0
Protox. Iron	2·60	3·796	0·864	4·384	2·0
Alumina	2·60	12·736	13·560	11·600	12·5
Soda	5·08	6·220	6·320	——	10·0
Potash	7·12	——	——	5·200	—
Lime	7·54	4·260	1·484	3·000	—
Water	3·00	——	4·724	4·280	—
Magnesia	2·60	volatile, 8·000	——	——	—
	100·00, B.	98·512, T.	100·052, T.	98·864, T.	96·5, D.

These varieties fuse with more or less facility before the blowpipe, into a vesicular glass of a white or gray color.

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* Moore's Ancient Mineralogy, p. 153.

Obs. The several varieties of this species generally occur in rocks of igneous origin. They occasionally form the paste of porphyries. They have also been observed forming beds or irregular veins in sandstone. Pumice is a product of modern volcanoes.

Obsidian occurs in Iceland, the Lipari Islands, Island of Milo and other islands in the Archipelago; also at Ascension, Teneriffe, in Siberia, and Mexico. The hills around the valley of Tribisch, near Meissen, in Saxony, afford abundantly the *pitchstone* variety; at Arran, in the Isle of Man, it forms extensive beds in granite, and contains, according to Knox, 2 per cent. of bitumen. This bitumen is driven off by heat, and the pitchstone transformed into a vesicular glass. It occurs also at Newry, County Down, Irel., in smooth lamellar concretions, of a mountain or leek-green color. Pearlstone forms extensive beds in Hungary, between Tokay and Keresztur, at Glashutte, near Schemnitz, and elsewhere; also in Iceland, Spain, and Mexico. Pumice forms a hill eight hundred or one thousand feet in height, on the island of Lipari, termed from its scanty vegetation and peculiar whiteness, Il Campo Bianco. From this locality and the isles of Ponza, pumice is exported in large quantities for commerce. It occurs also in Hungary, at Teneriffe, &c., but in smaller quantities and of inferior quality. These different varieties often contain imbedded crystals of glassy feldspar, particularly those from Ischia; some obsidians occasionally include particles of olivine and traces of other volcanic minerals.

Some varieties of obsidian admit of a high polish, and have been employed for mirrors; the inhabitants of Mexico formerly made it into knives, arrowheads, and other war instruments. Some varieties present an olive-green opalescence, and are therefore valued by the lapidary. Pumice is very extensively employed for grinding and polishing, both in the solid and pulverized state. It is often a convenient filtering material.

The following species should probably be united with obsidian. It has not yet, however, been subjected to analysis.

SPHÆRULITE. HYALUS SPHÆRULUS.

400. Occurs in irregular spheroidal globules, with a rough or smooth surface; structure somewhat radiated fibrous: no cleavage.

H.=7. G.=2·416—2·452. *Lustre* pearly, inclining to resinous. *Streak* white or grayish white. *Color* various shades of brown, yellow, and gray. Subtranslucent—opaque. *Fracture* conchoidal.

Nearly infusible before the blowpipe, the edges merely becoming enamelled.

Obs. It occurs in pitchstone in round nodules, in Saxony; in radiated spheroidal globules at Glashutte, near Schemnitz, in Hungary; in roundish balls of a radiated structure, disposed in soft clay, which is evidently a decomposing rock, in the Shetland Islands, and in botryoidal masses of a bright yellow color in Brittany. Breithaupt first distinguished this species, and thus named it on account of the spheroidal shapes it commonly presents.

ISOPYRE. HYALUS FERRIFERUS.

Isopyric Quartz, *Haid.* Ed. New Phil. Jour. III. 263. Trachylite, *Breithaupt.*

401. Occurs in compact masses; no cleavage.

H.=6—6·5. G.=2·9—3. *Lustre* vitreous. *Streak* light greenish-gray. *Color* grayish or velvet black, occasionally spotted red, like heliotrope. Opaque—subtranslucent. *Fracture* flat conchoidal. Brittle. Acts slightly on the magnetic needle.

It contains, according to Dr. Turner, Silica 47·09, Alumina 13·91, Peroxyd of Iron 20·07, Lime 15·43, Oxyd of Copper 1·94=98·44.

It fuses before the blowpipe without the emission of any gaseous matter. Acids act upon it with difficulty; it is easily and completely decomposed by alkaline carbonates.

Obs. Isopyre forms compact masses, occasionally two inches in diameter, in the granite of St. Just, near Penzance, where it is associated with turmaline and tin. It much resembles obsidian, but was distinguished by Haidinger in consequence of its fainter and less vitreous lustre. Breithaupt's *trachylite* (Ed. New Phil. Jour. I. 364) appears to be identical with isopyre, it differing merely in its lower specific gravity. It occurs in small masses in basalt and wacke at Süsebühl, near Göttingen.

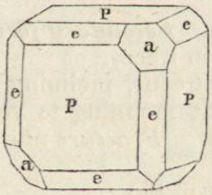
Isopyre is derived from ισος, *equal*, and πυρ, *fire*, from the similarity of its comportment under the blowpipe to that of many other mineral species.

BORACITE. Boracius hemihedrus.

Tetrahedral Boracite, *M.* Octahedral Boracite, *J.* Borate of Magnesia, *P.* Biborate of Magnesia, *Thom.* Borazit, Magnésie Boratée, *H.* Calcareus Boracites, *Wern.*

402. *Primary form:* the regular octahedron. *Secondary forms:* figs. 28 and 33, Pl. I.; also the annexed figures:

1.



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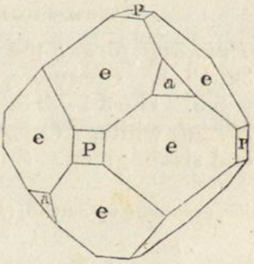


Cleavage in traces parallel to the faces of the octahedron.

H.=7. G.=2·974, Haidinger. *Lustre* vitreous, inclining to adamantine. *Streak* white. *Color* white, inclining to gray, yellow, and green. Subtransparent—translucent. *Fracture* conchoidal, uneven.

It contains, according to Stromeyer (Gilbert's Annalen, xlviii. 215) and Arfwedson, (Kong. Vet. Ac. Handl., 1822, p. 92,)

Boracic Acid	67	69·7
Magnesia	33=100, St.	30·3=100, Arf.

It intumesces before the blowpipe, and forms a glassy globule, which becomes crystalline, opaque, and white, on cooling. Heat excites four sets of electric poles, the four most highly modified angles becoming positive, and the diagonally opposite negative.

Obs. Boracite has been observed at only two localities, and in each is imbedded in gypsum, and associated with anhydrite. These localities are at Kalkberg, near Luneberg, and Segeberg, near Kiel, in the duchy of Holstein. At the former place it is also associated with common salt. It has been observed only in crystals, and these are invariably hemihedrally modified.

RHODIZITE.

G. Rose, Poggendorf's Annalen, XXXIII. 253.

403. *Primary form:* monometric. *Secondary forms:* figs. 7, 8, 9, Pl. I.

Hardness sufficient to resist the action of the knife. *Lustre* vitreous, splendent. *Color* white. Translucent.

Before the blowpipe, held in the platinum forceps, it fuses on the edges into a white opaque glass, tinging the flame at first green; then green below and red above, and finally red throughout. With borax, and salt of phosphorus, it fuses into a transparent glass, and appears to contain no silica. Dissolves with great difficulty in muriatic acid.

On account of the reactions of this species before the blowpipe, and also from its external characters, rhodizite is supposed to be closely allied to boracite.

Obs. This species was discovered by M. G. Rose, in very minute cystals on some of the red turmalines of Siberia, and was named from ῥοδιζειν, *to have the color of the rose*, in allusion to its tinging flame red.

HELVIN. Carbunculus hemihedrus.

Tetrahedral Garnet, *M.* Helvine, *Werner.*

404. *Primary form:* the octahedron. *Secondary form:* figs. 30 and 32, Pl. I. *Cleavage*, octahedral in traces.

H.=6—6·5. G.=3·1—3·3. *Lustre* vitreous, inclining to resinous. *Streak* white. *Color* wax-yellow, inclining to yellowish-brown, and siskin-green. Subtranslucent. *Fracture* uneven.

It contains, according to Gmelin, (Pogg. Annalen, iii. 55,)

Silica	33·258
Oxyd of Iron	5·564
Oxyd of Manganese	31·817
Sulphuret of Manganese	14·000
Glucina	12·029
Alumina	
Loss by ignition	1·155=97·823.

It fuses with effervescence in the reducing flame of the blowpipe, into an opaque globule of almost the same color as the mineral. With borax it forms a diaphanous globule, colored of an amethystine hue by manganese.

Obs. It occurs in gneiss at Schwartzenberg, in Saxony, associated with garnet, quartz, fluor, and calc spar. The only other known locality is at Hortekulle, near Modum, in Norway. It was named by Werner in allusion to its yellow color, from ἥλιος, *the sun*.

BRUCITE. Carbunculus obliquus.

Hemi-prismatic Chrysolite, *M.* Chondrodite, *Levy.* Condrodite, *H.* Maclurite, *Seybert*, (Silliman's Am. Journ. V. 336) Fluosilicate of Magnesia.

405. *Primary form:* an oblique rhombic prism; M : M=112° 12′? Haüy. It occurs also in short prisms, with replaced angles

and edges. *Cleavage* indistinct. *Imperfect crystallizations:* structure granular; particles of various sizes.

H.=6—6·5. G.=3·118, specimen from New Jersey, Thomson; 3·199, Finland variety, Haidinger. *Lustre* vitreous—resinous. *Streak* white, or very slightly yellowish. *Color* yellow, brown, red, rarely apple-green. Transparent—subtranslucent. *Fracture* subconchoidal, uneven.

It contains, according to Seybert, (Silliman's Am. Jour. V. 336,) Thomson, (Min. i. 184,) and D'Ohsson, (Kong. Vet. Ac. Handl., 1817, p. 206,)

	New Jersey.	New Jersey.	Finland.
Silica	32·666	36·00	38·00
Fluoric Acid	4·086	3·75	—
Magnesia	54·000	54·64	54·00
Peroxyd of Iron	2·333	3·97	5·10
Potash	2·108	—	0·86
Alumina	—	—	1·50
Water	1·000=96·193, S.	1·62=99·98, T.	—=99·46, D'O.

It fuses with extreme difficulty, *per se*, before the blowpipe; it, however, loses its color and becomes opaque, and exhibits traces of fusion on the thinnest edges. With carbonate of soda, on charcoal, it fuses with difficulty into a light gray slag. With borax there is a little effervescence attending a ready fusion into a yellowish-green glass. With salt of phosphorus there is a silicious residue.

Obs. Brucite has been found only in calcareous spar. Its foreign localities are near Abö, in the parish of Pargas, in Finland, and at Aker and Gulsjö, in Sweden.

It is found in greater abundance, and greater perfection of form, in the adjoining counties of Sussex, N. J., and Orange, N. Y., where it is associated with spinel, and rarely pyroxene and bronzite.

This mineral was first described and analyzed by Count D'Ohsson, in the Memoirs of the Stockholm Academy, for 1817, p. 206. The American locality was first observed by Dr. Bruce. The name chondrodite, which it bears in foreign countries, is derived from χονδρος, *a grain*, alluding to its granular structure. Seybert's name, Maclurite, was given in compliment to Mr. Wm. Maclure, distinguished for his scientific researches, and his unbounded liberality as a patron of science.

HUMITE. Carbunculus acrotomus.

406. *Primary form:* a right rhombic prism; M : M=120°. Occurs in minute and very highly modified crystals, often presenting compound forms. *Cleavage* apparent parallel to M and ĕ, (shorter diagonal.)

H.=6·5—7. G.=3·1—3·2. *Lustre* vitreous. *Streak* white. *Color* various shades of yellow, occasionally almost white, passing into reddish-brown. Transparent—translucent. *Fracture* subconchoidal.

Before the blowpipe it becomes opaque, but is infusible. With borax it forms a transparent glass.

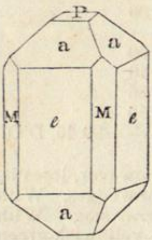
Obs. It occurs among the ejected masses of Monte Somma, associated with mica, pleonaste, and other minerals. Monticelli arranges it under Brucite.

IDOCRASE. CABEUNCULUS DIMETRICUS.

Pyramidal Garnet, *M.* **Vesuvian. Egeran. Loboit, Frugardit, Idokras,** ***of the Germans.*** **Idocrase,** ***H.*** **Wiluite. Cyprine. Xanthite.**

407. *Primary form:* a right square prism. *Secondary forms:* fig. 1, of a crystal from Amity, N. Y., and elsewhere; figs. 2 and 3, of crystals from Vesuvius.

1.



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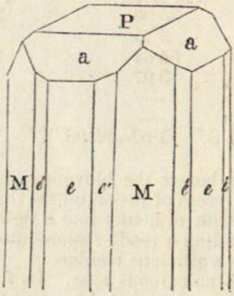
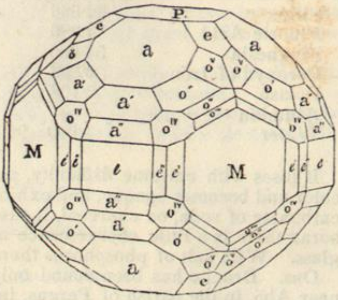


3.



P : a=142° 53′, M : *e*=135°, M : *e*′=153° 26′, M : *e*″=161° 34′, *e* : a′=146° 33′, *e* : a″=161° 43′, a : e=154° 44½′, o^{v} : o^{v}=146° 25′, o′ : o′=139° 54′, o″ : o″=134° 45′, P : e=151° 56′. *Cleavage* parallel with M not very distinct, still less distinct parallel with P. *Imperfect crystallizations:* columnar structure rare—particles straight and divergent, or irregular; occasionally granularly massive.

H.=6·5. G.=3·349—3·399. *Lustre* vitreous; often inclining to resinous. *Streak* white. *Color* brown, passing into various shades of green; green colors frequently bright and clear; occasionally sulphur-yellow. In some varieties, the color appears oil-green in the direction of the axis, and pistachio-green at right angles with it. Subtransparent—faintly translucent. *Fracture* subconchoidal—uneven.

It contains, according to Magnus, (Pogg. Annalen, xxi. 50,)

	Vesuvius.	Slatoust.	The Bannat.
Silica	37·359	37·178	38·519
Alumina	23·530	18·107	20·063
Protoxyd of Iron	3·992	4·671	3·420
Lime	29·681	35·791	32·411
Magnesia	5·208	0·773	2·987
Protox. Mang.	=99·77	1·495=98·015.	0·018=97·418.

It is consequently composed of equal parts of silicate of alumina and silicate of lime. In the blowpipe flame it fuses with some effervescence into a translucent yellow globule, and forms, with borax, a diaphanous glass, tinged by iron.

Obs. Idocrase was first discovered in the ancient Vesuvian lavas, and was thence called Vesuvian. It has since been discovered in serpentine, gneiss, and primitive limestone. The Vesuvian idocrase is of a hair-brown or an olive-green color, and is asociated with ice spar, garnet, mica, and nepheline. The crystals are commonly small; several have been found, however, which exceed an inch in each direction. The finest specimens occur at Ala, in the Val di Brozzo, in Piedmont; they are usually subtransparent, of brilliant lustre, and have green or brown colors; rarely perfectly black. Egge, near Christians and in Norway; Wilui river, Lake Baikal; Monzoni, in the Fassa valley, are other localities. Crystals of a sulphur-yellow color have been found at the latter place. Liver-brown diverging groups, are brought from Eger, in Bohemia, whence the name *Egeran*, for specimens of this species. Crystals of a blue tint, called *cyprine*, have been described by Berzelius, from the vicinity of Tellemarken, in Norway. The color is supposed to be owing to the presence of a minute portion of copper.

At Worcester, Mass., idocrase occurs similar to the Egeran variety, forming seams and veins in a quartzose rock; it is here associated with pyroxene and garnet. It also occurs at Amity, N. Y., both granular and in crystals, disseminated through limestone, with pyroxene and hornblende; the crystals are occasionally an inch in diameter.

Idocrase is derived from ειδω, *I see*, and κράσις, *mixture;* because its crystalline forms have much resemblance to that of several other species.

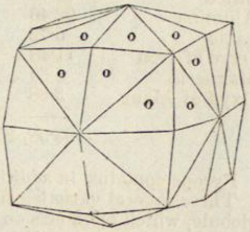
The species xanthite (*Thomson*, Ann. of N. Y. Lyceum; *Mather*, Silliman's Journ. xviii. 359) is closely similar in composition to idocrase. The following is its composition, as obtained by Thomson:

Sillca	37·708	35·092
Lime	36·308	33·080
Alumina	12·280	17·428
Peroxyd of Iron	12·000	6·368
Protoxyd of Manganese	3·680	2·801
Magnesia	——	2·001
Water	0·600=102·576.	1·680=98·450.

The second analysis is stated by Thomson to have been performed on the purer specimen. According to Mather, however, it exhibits cleavages parallel to the faces of an oblique rhomboidal prism of the following angles: 97° 30′; 94°; 107° 30′. It usually consists of a congeries of very small rounded grains, of a grayish-yellow color, easily separable, and thus presenting low degrees of hardness. Specific gravity 3·201—3·221, Thomson. With borax it forms a glass, which is yellow while hot, but becomes colorless on cooling.

GARNET. CARBUNCULUS DODECAHEDRUS.

Dodecahedral Garnet, *M.* and *J.* Melanite. Pyrope. Grossularite. Topazolite. Almandine. Aplome. Essonite, Cinnamon stone. Greenlandite. Pyrenaite. Colophonite. Allochroite. Granat. Pirop. Kolophonit. Romanzovit, *Nordenskiöld.* Braunsteinkiesel, *W.* Grenat, *H.* Carbunculus.



408. *Primary form:* the rhombic dodecahedron. *Secondary forms:* Pl. I., figs. 11, 16, 18, 27; also several of these in combination; also the annexed figure, which is similar to fig. 25, a hexoctahedron. *Cleavage* indistinct parallel with the faces of the dodecahedron. Planes E often striated parallel to their common intersections, and occasionally parallel to the faces of the cube, (P, fig. 6, Pl. I.) *Imperfect crystallizations:* structure lamellar—laminæ thick and bent; structure granular—particles of various sizes, sometimes impalpable; strongly coherent—friable.

H.=6·5—7·5. G.=3·5—4·3. *Lustre* vitreous—resinous. *Streak* white. *Color* red, brown, yellow, white, green, black; none bright, except some red colors. Transparent—subtranslucent. *Fracture* subconchoidal, uneven.

The several varieties of this species are quite different in their composition. They all contain Silicate of Alumina, and variable proportions of the Silicates of Lime, Iron, or Manganese, which substances have the property of replacing one another without causing a change of crystalline form. These varieties have often been classed as distinct species, and, therefore, require some particular explanations.

Garnet includes the red and brownish-red specimens; these have been called *precious* or *common*, according as they were nearly transparent or opaque. The precious garnet is again divided into *Almandine* and *pyrope*, according to its transparency. The pyrope is described as presenting a dark blood-red color by reflected light, but yellow by transmitted. *Pyrope* was so called from *πυρ*, *fire*, *οπτομαι*, *to see*, in allusion to its color.

Cinnamon stone, *essonite* or *canehlstein* of the Germans, is intermediate in its color between hyacinth-red and orange-yellow, and was called by the first and last of the above names, because of its resemblance to the color of cinnamon. *Colophonite* is composed of coarse roundish particles easily separated, presenting reddish-brown, yellowish-brown, oil-green, and honey-yellow colors, and often a fine iridescence. When the particles are impalpable and strongly coherent, it is called *allochroite*. *Melanite* (from *μελας*, *black*) occurs in black dodecahedrons, sometimes modified. *Pyrenaite* is found in minute black symmetrical dodecahedrons, and was so called from its locality in the Pyrenees, at the Pic Eres Lids, near Barêges. *Grossular* or grossularite, has a pale gooseberry green color, (whence its name,) and invariably has the form of fig. 16, Pl. I. *Topazolite* occurs in small yellow crystals. *Aplome* presents the form of the dodecahedron, but the faces are striated parallel to the shorter diagonal; its color is brown, sometimes greenish. G.=3·44, otherwise it resembles garnet. *Romanzovite* of Nordenskiöld, from Kimito, in Finland, is apparently a variety of cinnamon stone.

The composition of these varieties has been determined as follows:—

	Prec. Garnet.	Essonite.	Melanite.	Grossular.
Silica	35·75	39·826	42·450	40·55
Alumina	27·25	20·141	22·475	20·10
Lime	——	30·574	6·525	34·86
Oxyd of Iron	36·00	9·459	9·292	5·00
Magnesia	——	——	13·430	——
Oxyd of Mang.	0·25	——	6·273	0·48
	99·25, Klap.	100·000, Leh.	100·445, Wächtmeister.	100·99, Do.

	Pyrope.	Colophonite.	Allochroite.	Pyrenaite.
Silica	43·70	37·0	35·0	43
Alumina	22·40	13·5	8·0	16
Lime	6·72	29·0	30·0	20
Oxyd of Iron	11·48	7·5	17·0	16
Magnesia	5·60	6·5	—	—
Oxyd of Mang.	3·68	4·8	3·5	Water 4
	93·58, Kobell,	98·3, Simon.	93·5, Vauq.	99, Vauq.

Pyrope contains, in addition, 7·68 per cent. of chromic acid.

These several varieties fuse with some difference of facility into a black vitreous globule, which often acts on the magnet.

Obs. Garnet occurs imbeded in mica slate, granite, and gneiss, and occasionally in limestone, chlorite slate, serpentine, and lava. The precious garnet occurs in the greatest perfection in Ceylon and Greenland. Common garnet is met with in dodecahedrons from three to four inches in diameter, at Fahlun, in Sweden, Arendal and Kongsberg, in Norway, and the Zillerthal. It occurs abundantly in crystals of less size, in mica slate, in the island of Mull, the shires of Perth and Inverness, Shetland. Green crystals are met with at Schwartzenberg, in Saxony. Melanite is found in the Vesuvian lavas, and also near Rome. *Grossularite* occurs near the Wilui River, in Siberia. *Cinnamon stone* is met with in masses of considerable size in the primitive rocks of Ceylon. *Aplome* occurs on the banks of the river Lena in Siberia, and at Schwartzenberg, in Saxony.

Several beautiful varieties of this species occur in the United States. Hanover, N. H., affords small but beautifully symmetrical crystals, transparent, and of a rich brownish-red color; they are there disseminated in hornblende gneiss. Dark blood-red, and highly splendent dodecahedrons, with beveled and truncated edges, occur at Franconia, N. H., in geodes, in massive garnet, calcareous spar, and magnetic iron ore. At Carlisle, Mass., beautiful geodes of crystals, of a transparent, cinnamon-brown color, similar to fig. 18, Pl. I., accompany scapolite in white limestone; Boxborough, in the same region, affords similar but less remarkable specimens. Crystals of melanite, sometimes an inch in diameter and of rare beauty, occur in geodes at Franklin furnace, in New Jersey, in limestone, associated with quartz and greenish feldspar. At Monroe, Conn., are obtained very perfect and highly lustrous trapezohedral crystals, from a half to one inch in diameter, imbedded in mica slate. Haddam affords large but brittle and irregular trapezohedrons, associated with chrysoberyl, beryl, automolite, and Columbite. Large dodecahedral crystals, sometimes two inches or more in diameter, of a dark brownish-red color, are found at New Fane and Marlborough, Vt., in chlorite slate; also in mica slate, in Chesterfield, Mass. The limestone, at Lyme, Conn., affords a blackish-brown variety in large crystals, similar to fig. 18, Pl. I. *Colophonite*, composed of large particles, constitutes a powerful vein in gneiss, at Willsborough, N. Y., on Lake Champlain. A finer grained variety, of yellow and red colors, is met with on Roger's Rock, Lake George. Compact garnet occurs at Franconia, N. H. Yellow and reddish-brown varieties occur with Franklinite, at Franklin furnace, N. J., in limestone.

Pyrope is often highly esteemed as a gem. The cinnamon stone from Ceylon is also highly prized, when large, finely colored, and transparent. Pulverized garnet is sometimes employed as a substitute for emery.

The garnet was, in part, the carbunculus of the ancients. This term was probably applied also to the spinel and Oriental ruby. The Alabandic carbuncles of Pliny were so called because cut and polished at Alabanda.* Hence the name Almandine, now in use. Pliny describes vessels of the capacity of a pint, formed from carbuncles, "non claros ac plerumque sordidos ac semper fulgoris horridi," devoid of lustre and beauty of color, which probably were large common garnets. The garnet is also supposed to have been the hyacinth of the ancients.

A mineral has been lately described by M. Hess, of St. Petersburg, under the name of *Ouwarowite*, which bears a very close resemblance to the green garnet. It occurs in transparent emerald-green dodecahedrons, having a hardness of 7·5. When heated it does not give out water, nor decrepitate, nor change its color. With borax it fuses with difficulty into a clear chrome-green glass. With salt of phosphorus it is decomposed only when in powder; the bead, when cold, has a fine green color, and is muddy from interspersed silica. It appears to be of more difficult fusion than the garnet, and also to have a superior hardness. It occurs at Bissersk, Russia.

ZIRCON. CARBUNCULUS QUADRATUS.

Prismatic Zircon, *M* and *J*. Hyacinth. Jargon. Zirconite. Silicate of Zirconia. Zirkon.

409. *Primary form:* a right square prism. *Secondary forms:* The first, and the second excepting the planes o′, occur as modifications of the zircon of Buncombe Co., N. C. Fig. 2, with the terminal edges of the pyramid truncated, occurs at Middlebury, Vt.

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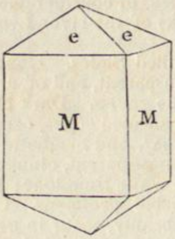
* Moore's An. Min. p. 156.

1.



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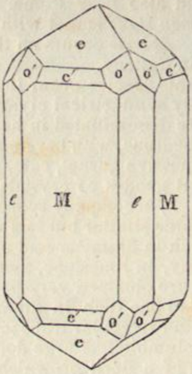

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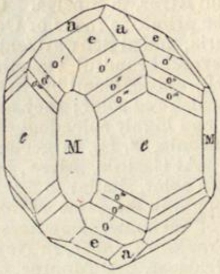

Fig. 3 represents a crystal from the Sau Alpe; M : *e*=135°, M : e=132° 10′, e : e=123° 19′, M : e′=159° 47′, o′ : o′=147° 3′, a : *e* =122° 39′, a : e=151° 39′. *Cleavage* parallel to M; also less distinct parallel to e. It occurs also in irregular forms and grains.

H.=7·5. G.=4·5—4·75; 4·505, Haidinger; 4·681, Thomson; 4·721, Lowry; 4·453, a crystal from Buncombe Co., N. C., Vanuxem. *Lustre* more or less perfectly adamantine. *Streak* white. *Color* red, brown, yellow, gray, white. Transparent—subtranslucent. *Fracture* conchoidal, and brilliant.

It contains, according to Vauquelin, Muir, Berzelius, and Vanuxem,*

	Ceylon.			North Carolina.
Silica	31	33·32	33·48	32·08
Zirconia	66	66·00	67·16	67·07
Oxyd of Iron	2	trace	—	—
	99, Vau.	99·32, Muir.	100·64, Berz.	99·15, Van.

It loses its color, but is infusible, *per se*, and also with carbonate of soda and salt of phosphorus. With borax it melts into a diaphanous glass.

Hyacinth includes those individuals which present bright colors, considerable transparency, and whose crystals have smooth and shining surfaces. *Zirconite* presents grayish or brownish tints, and is frequently rough and opaque. The variety from Ceylon, which is colorless, or has a smoky tinge, and is therefore sold for inferior diamonds, is sometimes called *jargon*.

Hyacinth occurs in the sand and alluvial deposits of certain rivers in Ceylon, at Expaillie, near Puy de France; at Ohlapian, in Transylvania; occasionally in volcanic tufa in Auvergne, and at Vesuvius. Siberia affords crystals as large as walnuts. Splendid specimens occur also in Greenland, and in the zircon-sienite of Frederickswarn, in Norway.

In Buncombe Co., N. C., on the road leading from the Saluda Gap to Ashville, upon the first elevation, after passing Green river, very beautiful crystals of zircon are found loose in the soil, and sometimes attached to feldspar and quartz. Fine specimens occur at Warwick, N. J., in gneiss; at Monroe, in magnetic iron ore; and at Edenville, in scapolite. Specimens have also been obtained near Trenton, New Jersey, in gneiss. Loose masses of sienite at Middlebury, Vt., have afforded some spe-

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* Journal of the Acad. of Nat. Sci. of Philad., III. 59.

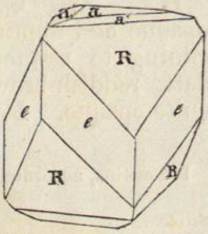
cimens; also the talcose slate at Easton, Penn. The chrysoberyl locality at Haddam has yielded some small but very perfect crystals.

Hyacinth rarely occurs of sufficient dimensions to be valued as a gem.

It is very doubtful whether the modern hyacinth is one of the number of stones that were called hyacinth (ὑάκινθος) by the ancients. Jameson seems to have supposed that they applied this name to the amethyst or sapphire.

EUDIALYTE. CARBUNCULUS RHOMBOHEDRUS.

Rhombohedral Almandine-Spar, ***Haid.*** **Eudyalite,** ***improper orthography.***



410. *Primary form:* an acute rhombohedron; R : R=73° 40′, and 106° 20′. *Secondary form:* R : *e*=143° 10′. R : a=112° 33′, R : a′=143° 44′. a : *e*=90°. *Cleavage* parallel with a, very perfect. Occurs very massive.

H.=6. G.=2·9036. *Lustre* vitreous. *Streak* white. *Color* brownish-red, rose-red. Opaque—slightly translucent. *Fracture* subconchoidal or splintery.

Stromeyer obtained in two analyses, (Untersuchungen, p. 438,)

Silica	52·47	53·325
Zirconia	10·89	11·102
Lime	10·14	9·785
Soda	13·92	13·822
Protoxyd of Iron	6·85	6·754
Protoxyd of Manganese	2·57	2·062
Muriatic Acid	1·03	1·034
Water	1·80=99·67.	1·801=99·685.

It fuses before the blowpipe into a leek-green scoria. When pulverized it gelatinizes with acids.

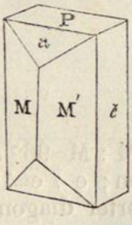
OBS. The only known locality is at Kangerdluarsuk, in West Greenland, where it is either associated with hornblende and sodalite, or imbedded in compact white feldspar. The crystals are usually small, but sometimes occur an inch or more in length. It was first described by Stromeyer, who gave it the above name on account of its easy solubility in acids, from ευ, *easily*, and διαλυω, *to dissolve.*

STAUROTIDE. CARBUNCULUS DECUSSATUS.

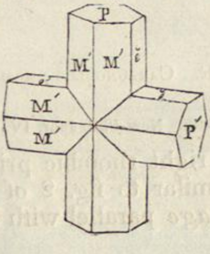
Prismatoidal Garnet, ***M.*** **Grenatite. Staurotide,** ***H.*** **Staurolith,** ***W.***

411. *Primary form:* a right rhombic prism; M : M=129° 31′. *Secondary forms:*

1.



2.



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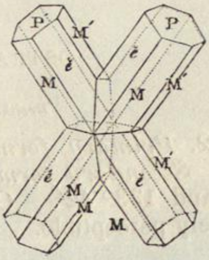


P : a=125° 16′, M : ĕ=115° 15′. *Cleavage* parallel to ĕ, but interrupted; parallel to M less distinct. Surface P, often quite rough and concave. *Compound crystals:* fig. 3 has proceeded from a nucleus composed of four molecules, and is an example of composition parallel to a plane e, on a terminal edge. Fig. 2 represents a compound crystal, in which composition is of the *third* kind, and parallel to a plane on the acute solid angles. This peculiar position has arisen from the concurrent action of four molecules. (See §§ 76, 77.) These forms are of very common occurrence. *Imperfect crystallizations* have not been observed.

H.=7—7·5. G.=3·693, Thomson; 3·724, Haidinger; 3·273. an opaque and impure specimen, Thomson. *Lustre* subvitreous, inclining to resinous. *Streak* white, or grayish-white. *Color* dark reddish-brown—brownish-black. Translucent—nearly or quite opaque. *Fracture* conchoidal.

It contains, according to Klaproth, Thomson, and Vauquelin,

			Brittany.
Silica	37·50	36·696	33·00
Alumina	41·00	39·880	44·00
Protoxyd of Iron	18·25	18·144	13·00
Protoxyd of Manganese	0·50	4·046	1·00
Magnesia	0·50	0·686	Lime 3·84
Moisture	——	0·080	——
	97·75, Klap.	99·532, Thom.	94·84, Vauq.

Before the blowpipe it darkens, but does not fuse.

Obs. It occurs imbedded in mica slate and gneiss, at St. Gothard, in Switzerland, and the Greiner mountain, Tyrol, affords simple crystals of this species, associated with kyanite. Their connection with kyanite is sometimes very peculiar: they occur, apparently, as a continuation of its crystals, and also parallel with them. It has been stated (§ 79) that there is a kind of crystallogenic induction, which influences the relative position of crystals of the same substance, and often causes them to unite in the formation of postnatal twins. This appears to be an instance of a similar influence between the crystallogenic attraction of different substances. Twin crystals of a large size, occur in Bretagne; also at Oporto and St. Jago de Compostella, &c.

Staurotide is very abundant throughout the mica slate of New England. Franconia, Vt., affords large brownish-red opaque crystals, often presenting compound forms; also a brownish-black variety. Chesterfield, Mass., Hartwell and Winthrop, Me., Bolton and Tolland, Conn., and New York, 3½ miles from the city, are other localities. It also occurs abundantly, in single crystals, of a dark reddish-brown color, on the Wichichon, about 8 miles from Philadelphia.

Staurolite is so called from σταυρος, *a cross*, and λιθος, *stone*.

OSTRANITE. Carbunculus rhombicus.

Breithaupt, Edin. New Phil. Jour. IV. 186.

412. *Primary form:* a right rhombic prism; M : M=96° and 84°. *Secondary form:* similar to fig. 2 of Zircon; e : e=128° 14′, and 133° 42′. *Cleavage* parallel with ĕ, (shorter diagonal,) scarcely perceptible.

H.=7—8. G.=4·32—4·4. *Lustre* vitreous. *Color* clove-brown. Very brittle.

It does not fuse before the blowpipe, but its color becomes paler. With borax, it melts with difficulty into a transparent glass. It is insoluble in nitric acid.

Obs. This mineral occurs in Norway, and it is supposed in the zircon-sienite of Fredrickswarn. It resembles zircon, but differs in crystallization.

ORDER VII. SCAPTINEA.

RED ZINC ORE. Rutilus Brucii.

Prismatic Zinc Ore, *M.* Red Zinc, Red Oxyd of Zinc. Manganesian Oxyd of Zinc. Zinkoxyd, *L.* Zinc Oxydé Ferrifère Brun Rougeatre, *H.*

413. *Primary form:* a right rhombic prism; foliated parallel to the base of the prism. *Imperfect crystallizations:* structure foliated; granular—particles strongly coherent.

H.=4—4·5. G.=5·432—5·523. *Lustre* subadamantine. *Streak* orange-yellow. *Color* deep red, also inclining to yellow. Translucent—subtranslucent. *Fracture* subconchoidal. Brittle.

It contains, according to Berthier, Oxyd of Zinc 88, and Sesquoxyd of Manganese 12. It is infusible, *per se*, before the blowpipe; with borax it yields a yellow transparent glass. It dissolves without effervescence in nitric acid. On exposure to the air, it suffers a partial decomposition at the surface, and becomes invested with a white coating, which is carbonate of zinc.

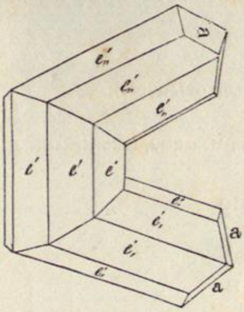
Obs. It occurs with Franklinite, and also with calcareous spar, at Franklin and Sterling, N. J. It was first noticed, described, and analyzed, by Dr. Bruce, (Bruce's American Mineralog. Journ., vol. i. p. 96.) Mitscherlich has observed some minute six sided prisms, in the iron furnaces of Konigshutte, in Silesia, which he believes to be identical with this species.

RUTILE. Rutilus quadratus.

Peritomous Titanium Ore, *M.* Titanite. Nigrine. Crispite. Gallizinite. Sagenite, *Saussure.* Titane Oxydé, *H.* Titanic Acid, *Thom.*

414. *Primary form:* a right square prism. *Secondary forms:* fig. 51, Pl. I, with the planes a, so extended as to form a four sided pyramid at each extremity of the crystal. Also the annexed figures:

1.



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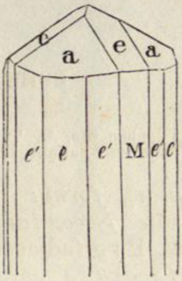


M : *e*=135°, M : *e′*=161° 34′, *e* : *e′*=153° 26′, a : a=117° 2′, a : e=148° 31′, M : e=123° 59′, e : e=128° 41′. *Cleavage* parallel to M distinct; to *e* less so. M, *e* and *e′*, are usually vertically striated. Crystals often acicular. *Compound crystals:* they occur under the form of singly and doubly geniculated crystals; one of the latter kind is represented in fig. 1. For an explanation of these forms, see § 78. *Imperfect crystallizations:* structure granular, particles of various sizes, and strongly coherent.

H.=6—6·5. G.=4·18, Klaproth; 4·249, Mohs; a dark variety from Ohlapian. *Lustre* metallic-adamantine. *Streak* very pale brown. *Color* reddish-brown, passing into red; sometimes yellowish. Subtransparent—opaque. *Fracture* subconchoidal, uneven. Brittle.

If pure titanic acid, it is composed of Titanium 66·05, and Oxygen 33·95; but Nigrine contains about 14 per cent. of Oxyd of Iron. Before the blowpipe it remains unaltered. With borax it forms a hyacinth-red bead. It communicates a pale-red color to salt of phosphorus, but does not fuse with it.

Obs. Rutile is generally found in imbedded crystals, in masses of quartz or feldspar, and often occurs in acicular crystals, penetrating quartz crystals. It has also been met with on specular iron. In this situation it occurs in the Grisons. Brazil affords the acicular crystallizations in limpid quartz. At Yrieix, in France, and in Castile, geniculated crystals are obtained, often of large size. At Ohlapian, in Transylvania, it is found in pebbles, of a black color, and hence called Nigrine. A massive variety occurs at Arendal, in Norway; also at Karingbricka, in Sweden; the latter is said to contain 3 per cent. of chrome, and is the *Titane oxidé chromifère* of Haüy. At Windsor, Mass., crystallized rutile occurs thickly disseminated through narrow veins of feldspar, traversing an extensive ledge of chlorite slate. Large compound crystals, of a dark color, are occasionally found at Lane's Mine, Monroe, Conn., also in the neighboring town of Huntington. The mica slate of Hampshire, Berkshire, and Franklin counties, Mass., contains this species, but no where in considerable quantity. It occurs in beautiful translucent and subtranslucent crystals, in a feldspar quarry near Middletown. It is met with in small brilliant crystals, in white limestone, with spinel, serpentine, talc, mica, &c., at Amity, N. Y., and with blue sapphire, turmaline, and spinel, in a similar rock at Newton, N. J. Loose crystals have been found in North Carolina and Virginia.

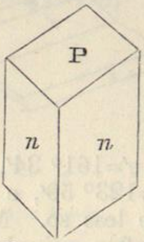
The finer specimens of this species from Middletown, Conn., when cut and polished, form a gem of rare beauty. The oxyd of titanium is employed in painting porcelain.

Rutile is so named, in allusion to its color, from the Latin rutilus, which signifies both *red* and *resplendent.* Saussure named a reticulated variety *sagenite*, from σαγήνη, *a net.*

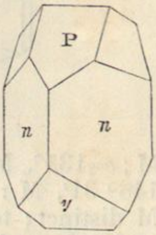
SPHENE. Rutilus obliquus.

Hemi-prismatic Titanium Ore, *M.* Titanite. Braun-Menakerz, Gelb Menacherz, Menachine Ore, *Wern.* Sphène Titane Silico-calcaire, *H.*

415. *Primary form:* an oblique rhombic prism. *Secondary forms:* $n : n$=136° 8′, P : y (adjacent planes) =60° 24. *Cleavage* parallal to n and P; not easily obtained. *Imperfect crystallizations:* lamellar and granular structure; particles in the latter strongly coherent.



Norway,—Roger's Rock, Lake George.



Gouverneur, N. Y.

H.=5—5·5. G.=3·468, Haidinger. 3·2378, of a specimen from St. Gothard, Cordier. *Lustre* adamantine—resinous. *Streak* white. *Color* brown, gray, yellow, green, and sometimes black. Transparent—opaque. Brittle.

It contains, according to Klaproth, (Beitrage i. 251,) and Cordier, (Jour. des Mines, xiii. 70,)

Silica	35	28·0
Titanic Acid	33	33·3
Lime	33=101, K.	32·2=93·5, C.

Before the blowpipe the yellow varieties are not altered in color; the others become yellow. They slightly intumesce, and fuse on the edges into a dark enamel. With borax they afford a yellowish-green glass. They dissolve in heated nitric acid, with the exception of a silicious residue.

Obs. This species was formerly divided into *titanite* and *sphene*, the former included the brown or black varieties, the latter the lighter colored and translucent.

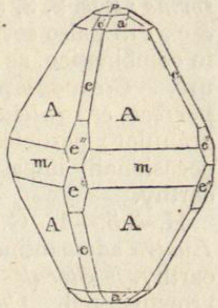
Sphene occurs interspersed among primary rocks, in gneiss, granite, mica slate, primitive limestone; also in sienite, and beds of iron ore. Titanite occurs with pyroxene, in beds of iron ore, at Arendal, in Norway, in granite at Sartut, in Greenland. Sphene in complicated compound crystals, of a pale green color and transparant, occurs at Graubinden, in the Grisons, associated with feldspar and chlorite, on mica slate at St. Gothard; also at Mont Blanc, and elsewhere, in the Alps. Small crystals occur in sienite at Strontian, in Argyleshire, and Criffle, in Galloway. Occasionally it is found among volcanic rocks, as at the Laachar See, and Andernach on the Rhine.

In Canada, at Grenville, and in Bucks Co. Penn., three miles west of Attleboro', it is associated with tabular spar and plumbago. At Roger's Rock, on Lake George, it occurs very abundantly in small brown crystals, disseminated through an aggregate of feldspar and pyroxene. A similar variety occurs both crystallized and massive, at Bolton, Mass., in limestone, accompanied with pyroxene and petalite. In small black shining crystals it is met with at Gouverneur, N. Y., imbedded in primitive limestone and associated with apatite and scapolite. It occurs also in rounded grains and imperfect crystals disseminated through limestone with hornblende, &c., at Edenville and Amity, N. Y., and at Trumbull, Conn.

The name *sphene* was applied to this mineral in allusion to the form of the crystal, from σφην, *a wedge.*

ANATASE. Rutilus pyramidalis.

Pyramidal Titanium-Ore, *M.* Octahedrite, *J.* Oisanite. Titane Anatase, *H.*



416. *Primary form:* a square octahedron; A : A (in the same pyramid) =97° 56′, A : A (adjacent, but in different pyramids) =126° 22′. *Secondary form:* A : e=138° 58′, A : m=153° 11′, A : p=116° 49′, a : m=116° 33′, e″ : e″= 148° 23′. *Cleavage* parallel to A and *p*, perfect.

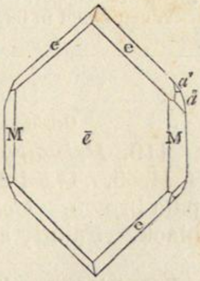
H.=5·5—6. G.=3·857, Haüy; 3·826, Mohs. *Lustre* metallic-adamantine. *Streak* white. *Color* various shades of brown, passing into indigo-blue; greenish-yellow by transmitted light. *Fracture* subconchoidal, scarcely observable.

According to Vauquelin, it is a pure Oxyd of Titanium, and before the blowpipe exhibits the phenomena of that substance. When heated it gives out a reddish-yellow phosphorescent light, which appears suddenly like a flame and is soon over; a peculiarity, according to Sir D. Brewster, not met with in any other species.

Obs. Anatase occurs most abundantly at Bourg d' Oisans, in Dauphiny, accompanying feldspar, axinite, and Crichtonite. It is also found in mica slate in the Grisons; at Tavatsch, in the Tyrol. In Brazil it occurs both imbedded in quartz and in detached crystals of so splendent lustre, as to be sometimes mistaken for diamonds.

BROOKITE. Rutilus Brookianus.

Prismatic Titanium-Ore, *Haid.* Jurinite, *Soret.* Brookite, *Levy.*



417. *Primary form:* a right rhombic prism; M : M=100°. *Secondary form:* M : ē=140°, e : e=101° 37′. *Cleavage* parallel to M indistinct; parallel to P still more so.

H.=5·5—6. *Lustre* metallic-adamantine. *Streak* yellowish-white. *Color* hair-brown, passing into deep orange-yellow and some reddish tints. Translucent—opaque. Brittle.

It contains Oxyd of Titanium, with traces of Oxyd of Iron and Manganese, but has not yet been analyzed.

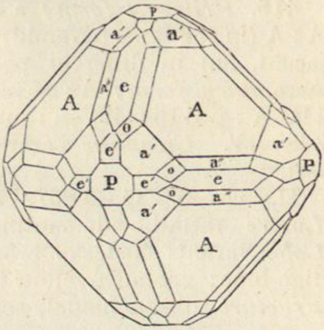
Obs. Brookite was first observed among some minerals accompanying titanite from Dauphiny, by Mr. Soret, of Geneva. It has since been discovered in finer crystals at Snowdon, Wales. It was named by Mr. Levy, in honor of Mr. Brooke.

RED COPPER ORE. Rutilus octahedrus.

Octahedral Copper Ore, *M.* Red Oxyd of Copper. Oxydulated Copper, *P.* Tile Ore. Rothkupfererz, Ziegelerz, *W.* Cuivre Oxidé Rouge, Cuivre Oxidulé, *H.*

418. *Primary form:* the regular octahedron. *Secondary forms:* figs. 2, 3, 5, 6, 7, 8, 9, 10, 11, &c., Pl.I., also several of these forms in combination, as in the annexed figure. *Cleavage* parallel to A. *Imperfect crystallizations:* structure granular; particles of various sizes occasionally impalpable. Sometimes earthy.

H.=3·5.—4. G.=5·992, Haidinger. *Lustre* adamantine, or submetallic—earthy. *Streak* several shades of brownish-red. *Color* red, of various shades, particularly cochineal-red; occasionally crimson-red by transmitted light. Subtransparent—subtranslucent. *Fracture* conchoidal, uneven. Brittle.



It contains Copper 88·88, (two atoms,) and Oxygen 11·12, (one atom.) Before the blowpipe, in the reducing flame, on charcoal, it affords a globule of copper. It dissolves with effervescence in nitric acid.

Obs. *Tile ore* formerly included the earthy varieties. These usually present a brick-red, or reddish-brown color, and are frequently mixed with oxyd of iron. They occur in the Bannat, at Camsdorf and Saalfield, in Thuringia, and in Cornwall. Fine translucent crystals of red copper ore occur with native copper and quartz at Wheal Gorland, and other Cornish mines. Isolated crystals, sometimes an inch in diameter, are found imbedded in lithomarge at Chessy, near Lyons: they are generally coated with malachite. Splendid specimens are brought from the Bannat and Ekatherinenberg, in Siberia. Cornwall and Rheinbreitback, on the Rhine, affords the *capillary* variety, which occurs in extremely slender crystals, reticularly and confusedly aggregated, often appearing fibrous and flocculent.

It has been observed massive at Schuyler's mine, N. J., associated with chrysocolla and native copper.

When found in large quantities, this species is valuable as an ore of copper.

PYROCHLORE. Rutilus dystomus.

Octahedral Titanium-Ore, *M.* Pyrochlore, *Brewster's* Journ. VI. 358.

419. *Primary form:* the regular octahedron. *Cleavage* none. H.=5. G.=4·2—4·25. *Lustre* vitreous or resinous. *Streak* pale brown. *Color* dark reddish-brown; the fresh fracture almost black. Faintly subtranslucent—opaque. *Fracture* conchoidal.

It contains, according to Wöhler, Titanic Acid 62·75, Lime 12·85, Protoxyd of Uranium 5·18, Oxyd of Cerium 6·80, Protoxyd of Manganese 2·75, Oxyd of Tin 0·61, Oxyd of Iron 2·16, and Water 4·20=97·30; also a trace of fluoric acid and magnesia.

Before the blowpipe it becomes pale brownish-yellow, but retains its lustre, and with great difficulty fuses into a blackish-brown scoria. It is perfectly dissolved in borax, affording a reddish-yellow transparent globule in the oxydating flame, which, on flaming, becomes opaque. When a considerable portion of the assay is added, the glass on cooling assumes the form of a white enamel. In salt of phosphorus it dissolves completely, and at first with some effervescence. The glass in the oxydizing flame is yellow while hot, but becomes grass-green on cooling.

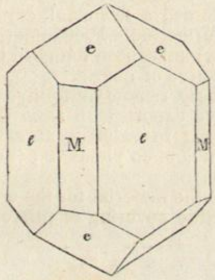
Obs. It occurs imbedded in sienite at Frederickswarn and Laurvig, in Norway, associated with zircon, to which it has considerable resemblance; and also polymignite and phosphate of yttria. It was named by Berzelius in allusion to its property of becoming yellowish-green under the blowpipe, from πυρ, *fire*, and χλωρος, *green*.

TIN ORE. Jovius quadratus.

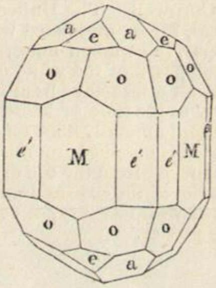
Pyramidal Tin-Ore, *M.* Oxyd of Tin. Peroxyd of Tin, *Thom.* Tin Stone. Wood Tin. Stream Tin. Kornisch Zinerz, Zinstein, *W.* Etain Oxydé, *H.*

420. *Primary form :* a right square prism. *Secondary forms :*

1.



2.



figs. 1 and 2, of crystals from Cornwall. M : e=133° 38′, e : e=121° 35′, *e* : a=124°, e : a=150° 47′, o : o=159° 6′ and 118° 16′, *e′* : *e′*=112° 37′ and 157° 23′. *Cleavage* indistinct parallel with M and *e*. *Compound crystals :* fig. 2, p. 43, composition of the *third kind*, or parallel to the plane a ; fig. 12, Pl. IV., composition of the third kind ; effected subsequent to the commencement of the formation of the crystals. (For remarks on this crystal, and this kind of compound form, see § 78.) *Imperfect crystallizations :* structure fibrous divergent, small reniform shapes ; granular—particles of various sizes, sometimes impalpable.

H.=6—7. G.=6·5—7·1 ; 6·96, crystallized variety ; 6·514, thin columnar variety. *Lustre* adamantine. *Streak* pale gray ; in some varieties, pale brown. *Color* principally brown or black ; sometimes red, gray, white, or yellow. Nearly transparent—opaque. *Fracture* subconchoidal, uneven. Brittle.

It contains, according to Klaproth, Thomson, and Berzelius,

		Cornwall.	Finbo.
Peroxyd of Tin	99.5	96·265	93·6
Oxyd of Columbium	—	——	2·4
Peroxyd of Iron	0·5	3·395	1·4
Sesquoxyd of Manganese	—		0·8
Silica	—	0·750	—
	100·0, K.	100·410, T.	98·2, B.

Before the blowpipe, on charcoal, it is reducible, but with difficulty; reduction takes place more rapidly if it is mixed with borax and carbonate of soda. It is infusible in acids. Fused with caustic potash it yields a mass which is mostly soluble in water; hydriodic acid throws down from the solution a yellow precipitate.

Obs. Tin ore is met with in veins traversing granite, gneiss, and mica slate.

Cornwall affords the finest and most remarkable simple crystals, associated with fluor, apatite, topaz, blende, wolfram, &c. The singular compound crystals come mostly from Bohemia and Saxony. The twin forms from Zinnwald and Schlackenwald often weigh several pounds. It is, however, found in the greatest abundance at Cornwall, though in smaller individuals, and under a great variety of crystalline forms, different veins affording distinct modifications. It also occurs in Galacia, Greenland, Sweden, the peninsula of Malacca, and the island of Banca, in Asia. Some specimens from the vicinity of Fahlun, where it occurs associated with topaz, albite, and quartz, contain, according to Berzelius, several per cent. of the oxyd of columbium. This is the Columbiferous oxyd of tin described by Phillips.

The *fibrous* or *wood tin* occurs in botryoidal and reniform shapes of a radiated structure, and composed of concentric coats. It occurs at Cornwall and Brazil. *Toad's eye tin* is the same, on a small scale. *Stream tin* is the alluvial debris of tin veins, separated from the deposits of gravel by washing. It occurs in the low grounds of Cornwall. The United States have afforded a few small crystals of tin at Chesterfield, Mass., associated with albite and turmaline. Pseudomorphs, imitative of feldspar, (a common mineral in the region,) have been found in Cornwall; and others composed of the white oxyd of tin, imitative of quartz.

The Cornwall mines have been worked from a very remote antiquity. The Tyrians, as early as the time of Moses, appear to have exported tin from this region. They now afford annually 4000 tons of tin, amounting in value to £300,000. The purest grain tin is obtained from the stream ore, which often yields 70 per cent. The block-tin is smelted from the ore dry from the veins.

Tin is employed for coating iron, and thus forms the material for the ordinary tin ware. Mixed with mercury, it composes the metallic covering of mirrors. With lead it forms pewter.

CERITE. Ceritus rhombohedrus.

Rhombohedral Cerium-Ore. Siliciferous Oxyd of Cerium, Silicate of Cerium. Ochroite.

421. *Primary form:* tetraxonal. Massive; structure granular. H.=5·5. G.=4·912, Haidinger. *Lustre* adamantine. *Streak* grayish-white. *Color* between clove-brown and cherry-red, passing into gray. Slightly subtranslucent. *Fracture* splintery.

According to Hisinger and Vauquelin, it contains

Oxyd of Cerium	68·59	67
Silica	18·00	17
Oxyd of Iron	2·00	2
Lime	1·25	2
Water and Carbonic Acid	9·60=99·44, H.	12=100, V.

It is infusible, *per se*, before the blowpipe; with borax it forms a yellow globule, which becomes almost colorless on cooling.

Obs. It occurs at Bastnaes, near Riddarhyttan, in Westmanland, Sweden, forming a bed in gneiss, and associated with mica, hornblende, copper pyrites, cerine, &c. It bears considerable resemblance to the red granular variety of corundum, but is readily distinguished by its hardness.

THULITE. Ceritus rhombicus.

422. *Primary form:* a rhombic prism of 92° 30′, and 87°

30′, according to Brooke, who also supposes it to be oblique. *Cleavage* parallel with M distinct. Occurs usually granular.

H.=5·5—6. G.=3·1055. *Lustre* vitreous. *Streak* grayish-white. *Color* rose-red. Translucent—subtranslucent. Particles of granular varieties easily separable.

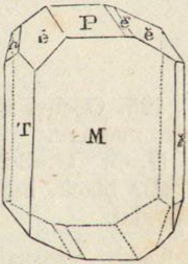
It contains, according to Thomson, (Min. i. 415,) Silica 46·10, Peroxyd of Cerium 25·95, Lime 12·50, Peroxyd of Iron 5·45, Potash 8·00, Moisture 1·55=99·55. The silica, as is stated by Thomson, was probably, in part, derived from the gangue, which he found it impossible to separate. Before the blowpipe, with carbonate of soda, it fuses into a colorless transparent bead, which, with the addition of saltpetre, assumes a sensibly violet color, indicating the presence of a trace of manganese.

OBS. It occurs at Souland, in Tellemark, Norway, in a rock consisting chiefly of quartz.

ALLANITE. MELANOPHÆUS TRICLINATUS.

Anorthitic Melane-Ore, *Haid.* Prismatic Cerium Ore, *P.* Cerine.

423. *Primary form:* an oblique rhomboidal prism; M : T=116°. *Secondary form:* M : ĕ=129°, T : ĕ (adjacent planes) =115°, P : ē=156° 45, P : ĕ=151°, P : ĕ′ =164° 30, Haidinger, with the common goniometer. *Cleavage* in traces parallel to M and T. Occurs also in acicular aggregations. *Imperfect crystallizations:* structure impalpably granular.



H.=6. G.=4·001, when pure; if mixed with mica, as is often the case, it varies from 3·199—3·797. *Lustre* submetallic—resinous, occasionally massive varieties are vitreous; not of high degrees. *Streak* greenish-gray; sometimes inclining to brown. *Color* brownish or greenish-black; brown in thin splinters. Subtranslucent—opaque. *Fracture* subconchoidal. Brittle.

According to Stromeyer, (Poggendorf's Annalen, xxxii. 292,) it contains

	Allanite.	Cerite.
Silica	33·021	30·17
Alumina	15·226	11·31
Protoxyd of Cerium	21·600	28·19
Protoxyd of Iron	15·101	20·72
Protoxyd of Manganese	0·404	trace
Lime	11·080	9·12
Water	3·000=99·432.	——=99·51.

In the blowpipe flame it intumesces, and imperfectly fuses into a black scoria. It gelatinizes in nitric acid.

OBS. Cerine and orthite have been united with this species. It is preferable to retain the latter separate until further investigations explain more fully their relative characters.

Allanite occurs at Alluk, near the southern extremity of East Greenland, imbedded in granite. It usually appears in black vitreous-like masses, and is rarely crystallized. It was named in honor of Mr. Allan. Cerine is associated with cerite at Bastnaes, in Sweden.

THORITE. Melanophæus Thoriferus.

Berzelius, Kong. Vet. Acad. Handl. 1829, p. 1.

424. Massive and compact.

Not scratched by the knife. G.=4·63. *Lustre* of the surface of fresh fracture, vitreous; of exposed surface, resinous and dull. *Streak* dark brown. *Color* black, sometimes inclining to brown. *Fracture* conchoidal. Easily frangible.

It contains, according to Berzelius, Thoria 57·91, Silica 18·98, Lime 2·58, Peroxyd of Iron 3·40, Oxyd of Manganese 2·39, Magnesia 0·36, Water 9·50, with small portions of Oxyds of Lead and Tin, Peroxyd of Uranium, Potash, Soda, and Alumina.

Before the blowpipe it gives out water and becomes pale brownish-red, but does not fuse. Calcined in a tube it gives slight indications of fluoric acid. With carbonate of soda on platinum foil, it becomes green. It fuses easily with borax into a glass colored by iron.

Obs. It was found in sienite by M. Esmark, near Brevig, in Norway. It is stated to resemble Gadolinite in external characters. The new metal Thorium, was first discovered in this mineral by Berzelius.

ORTHITE. Melanophæus acicularis.

Orthite, *Berzelius*. Brews. Jour. III. 333.

425. Occurs in long acicular crystals, sometimes two feet long; also massive.

H.=5. G.=3·288. *Lustre* vitreous. *Streak* brownish-gray. *Color* black, inclining to ash-gray. Opaque. *Fracture* subconchoidal.

It contains, according to Berzelius, (Afhandlingar, v. 32,)

	Finbo.	Gottlich's vein.
Silica	36·25	32·184
Protoxyd of Cerium	17·39	20·510
Protoxyd of Iron	11·42	12·380
Alumina	14·00	14·810
Lime	4·89	7·960
Yttria	3·80	2·870
Protoxyd of Manganese	1·36	3·360
Water	8·70=97·81.	5·360=99·434.

Before the blowpipe it froths, becomes yellowish-brown, and melts with effervescence into a black vesicular globule. With borax it fuses easily into a clear glass, which in the reducing flame becomes greenish, and in the oxydizing flame blood-red; the last color mostly disappears on cooling.

Obs. Orthite occurs in quartz, in acicular crystals, sometimes exceeding a foot in length, at Finbo, near Fahlun, in Sweden. At Skeppholm it is disseminated in black vitreous masses through granite. Orthite also occurs at Lindenaes, in Norway, and was brought from Greenland by Giesecké. The name, *orthite*, is derived from ορθος, *straight*, in allusion to the straight acicular form of the crystals.

PYRORTHITE. Melanophæus flammans.

426. In long thin imbedded crystals, without any distinct form; usually aggregated.

H. below 3. G.=2·15—2·25. *Lustre* resinous. *Streak* and *color* brownish-black; if weathered, yellowish-brown. Opaque. *Fracture* conchoidal, splintery, earthy.

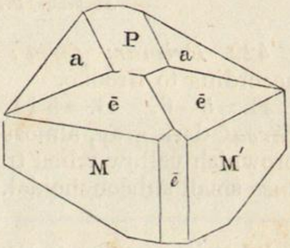
It contains, according to Berzelius, (Afhandlingar, v. 49,) Silica 10·43, Protoxyd of of Cerium 13·92, Carbon 31·41, Water 26·50, Protoxyd of Iron, 6·08, Yttria 4·87, Alumina 3·59, Lime 1·81, Protoxyd of Manganese 1·39=98·39.

It takes fire when gently heated, and burns without either flame or smoke. Subsequently it whitens, and fuses into a black enamel. With borax it affords a transparent glass. In heated acids it dissolves with the exception of a black powder.

Obs. It occurs in a vein of granite, traversing gneiss, at Karafvet, near Fahlun, in Sweden, associated with Gadolinite. It resembles the orthite of the same region, except in its low degree of lustre.

GADOLINITE. Melanophæus obliquus

Prismatic Melane-Ore, *Haid.* Gadolinit, *W.*



427. *Primary form:* an oblique rhombic prism; M : M (according to Phillips) =115°, as determined with the common goniometer; according to Haüy it equals 109° 28′. *Secondary form:* M : ē=153°, ē : ē=120°. *Cleavage* very indistinct. Massive; structure impalpably granular.

H.=6·5—7. G.=4·14—4·3; 4·1795, Thomson; 4·238, Haidinger. *Lustre* vitreous, inclining to resinous. *Streak* greenish-gray. *Color* black or greenish-black. Subtranslucent—opaque. *Fracture* conchoidal.

It contains, according to Thomson and Steel, and Richardson, (Thomson's Min. i. 410,)

Silica	24·330	24·65
Yttria	45·330	45·20
Protoxyd of Cerium	4·333	4·60
Glucina	11·600	11·05
Protoxyd of Iron	13·590	14·55
Manganese	trace	——
Moisture	0·986=100·169, T. and S.	0·50=100·55, R.

It decrepitates in the blowpipe flame, and when in thin splinters is fused: heated with caution on charcoal, it exhibits a vivid glow, and the color becomes paler. It loses its color in heated nitric acid, and is converted into a jelly.

Obs. Gadolinite occurs principally in the quarries of Karafvet and Finbo, near Fahlun, in Sweden; also at Ytterby, near Stockholm. At each locality it occurs indistinctly crystallized, and in rounded masses, which are often encircled with a yellow crust and imbedded in a coarse grained granite. At Karafvet, crystals have been obtained four inches long. It has also been met with at Disko, in Greenland, and imbedded in granite, in Ceylon.

This mineral was first noticed by Capt. Arhenius, at Ytterby, and analyzed by M. Gadolin, who discovered in it a new earth, which afterwards was named *yttria*, from its locality, Ytterby.

TITANIFEROUS CERITE. MELANOPHÆUS LAUGIERI.

Laugier, Ann. de Chim. et de Phys. XXVII. 313.

428. H.=6·5—7. *Lustre* vitreous. *Color* blackish brown. *Fracture* conchoidal. It contains Oxyd of Cerium 36, Oxyd of Iron 19, Lime 8, Alumina 6, Water 11, Oxyd of Manganese 1·8, Silica 19, Oxyd of Titanium 8; the excess above 100 of the sum of these quantities, has arisen from a change of the protoxyd of cerium to a peroxyd, during the analysis. It swells up when heated, and is attacked both by acids and alkalies.

OBS. It has been found on the Coromandel coast.

ÆSCHYNITE. MELANOPHÆUS MENGIANUS.

Æschenite, *Brooke.* Ann. of Phil. x. 188. *Leonhard.*

429. *Primary form:* an oblique rhombic prism of about 127°, according to Brooke.

H.=5—6. G.=5·14—5·55. *Lustre* resinous—submetallic. *Streak* dark gray, almost black. *Color* nearly black, inclining to brownish yellow when translucent. Translucent—opaque. *Fracture* small subconchoidal.

It contains, according to Hartwall, (Poggend. Ann. xvii. 483,) Titanic Acid 56, Zirconia 20, Peroxyd of Cerium 15, Lime 3·8, Peroxyd of Iron 2·6, Peroxyd of Tin 0·5. Before the blowpipe, on charcoal, it swells and becomes yellow; with borax it readily forms a dark-yellow glass; with salt of phosphorus it yields a transparent colorless bead.

OBS. This mineral was brought by Menge from Minsk, in the Ural, where it occurs imbedded in feldspar, and associated with mica and zircon. The name of this mineral is derived from αισχυνη, *modesty*.

ŒRSTEDITE. MELANOPHÆUS QUADRATUS.

430. *Primary form:* a right square prism. *Secondary form:* the primary with the angles and edges replaced; a : a=123° 16½′.

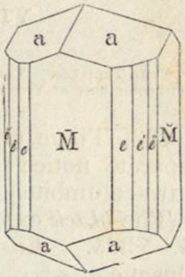
H.=5·5. G.=3·629. *Lustre* splendent. *Color* brown.

It contains Titanate of Zirconium 68·965, Silica 19·708, Lime 2·612, Magnesia 2·047, Protoxyd of Iron, 1·136, Water 5·332=99·80.

OBS. It occurs in brilliant highly modified crystals at Arendal, Norway, and is commonly found upon crystals of pyroxene. This species was discovered by Forchhammer, and named in honor of Œrsted.

POLYMIGNITE. Melanophæus rectangulus.

Berzelius, Kong. Vet. Acad. Handl. 1824, p. 388; Brewster's Jour. III. 329.



431. *Primary form:* a right rectangular prism. *Secondary form:* a : a=136° 28′, M : *e* =154° 8′, (calculated.) *Cleavage* in traces parallel to M and T. The crystals are generally slender and thin, and striated longitudinally.

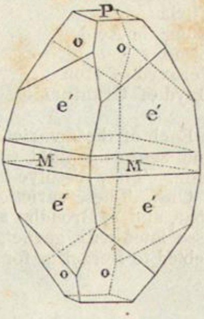
H.—6·5. G.=4·77—4·85. *Lustre* submetallic, but brilliant. *Streak* dark-brown. *Color* black. Opaque. *Fracture* perfect conchoidal, presenting, like the surface, a brilliancy almost metallic.

Berzelius obtained the following for its composition, in an analysis of 10·16 grains: Titanic Acid 46·3, Zirconia 14·4, Peroxyd of Iron 12·2, Lime 4·2, Sesquoxyd of Manganese 2·7, Peroxyd of Cerium 5·0, Yttria 11·5. *Per se*, the blowpipe produces no effect; with borax it fuses readily into a glass, colored by iron. The addition of more borax renders it opaque and orange-colored.

Obs. It occurs at Fredericswarn and Stavearn, in Norway, imbedded in feldspar and zircon sienite. Its crystals sometimes exceed an inch in length. It was named by Berzelius, in allusion to the number of substances that enter into its composition, from πολὺς, *many*, and μιγνύω, *to mix*.

FERGUSONITE. Columbus hemiquadratus.

Haidinger, Edin. Trans. X. 274.



432. *Primary form:* a right square prism. *Secondary form:* o : o=100° 28′.

H.=5·5—6. G.=5·838, Allan; 5·800, Turner. *Lustre* externally dull, on the fracture brilliantly vitreous. *Streak* very pale brown. *Color* brownish black; in thin scales it is pale liver-brown, or yellowish-brown. Subtranslucent—opaque. *Fracture* perfect conchoidal.

It contains, according to M. Victor Hartwall, (Kong. Vet. Acad. Handl. 1828, p. 167,)

Columbic Acid	47·75
Yttria	41·91
Protoxyd of Cerium	4·68
Zirconia	3·02
Oxyd of Tin	1·00
Oxyd of Uranium	0·95
Peroxyd of Iron	0·34=99·65.

It is infusible before the blowpipe, but loses its color; with borax it fuses with difficulty, and forms a glass which is yellow while hot, with some interspersed white spots of undissolved matter. With carbonate of soda it is decomposed and fuses, leaving a reddish slag.

Obs. It was discovered by Giesècké, at Kikertaursak, near Cape Farewell, in Greenland, disseminated in quartz. It was named in compliment to Robert Ferguson, Esq., of Raith.

YTTRO-COLUMBITE. Columbus Berzelii.

Yttro-Tantalite. Tantale Oxidé Yttrifère, *H.* Discolumbate of Yttria, Triscolumbate and Tetracolumbate of Yttria, *Thomson.*

433. There are three varieties of this species, which require a separate notice; the *black*, the *yellow*, and the *brown* or *dark* yttro-columbite.

The *black* exhibits indistinct traces of crystallization. H.=5·5. G.=5·395. *Lustre* submetallic. *Streak* gray. *Color* black. Opaque.

The *yellow* never exhibits a crystalline form, but occurs in laminæ in the fissures of feldspar. H.=5. G.=5·882, Ekeberg. *Lustre* resinous on the surface, vitreous in the fracture. *Streak* white. *Color* yellowish-brown—greenish. Opaque.

The *brown* occurs with the yellow, in thin plates, or rarely grains, presenting no trace of crystallization. H.=4·5—5. *Lustre* vitreous, inclining to resinous. *Streak* white. *Color* black, with a very light shade of brown, slightly yellow when in thin plates by transmitted light.

These varieties contain, according to Berzelius, (Afhandlingar, iv. 268, 272,)

	Black.	Yellow.	Brown.
Columbic Acid	57·00	60·124	51·815
Yttria	20·25	29·780	38·515
Tungstic Acid	8·25	With Tin 1·044	With Tin 2·592
Lime	6·25	0·500	3·260
Peroxyd of Iron	3·50	1·155	0·555
Oxyd of Uranium	0·50=95·75.	6·622=99·225.	1·111=97·848.

Each of these varieties is infusible alone before the blowpipe, but they decrepitate and assume a light color. The black variety froths, and fuses with carbonate of soda. They dissolve in borax, but are not acted upon by acids.

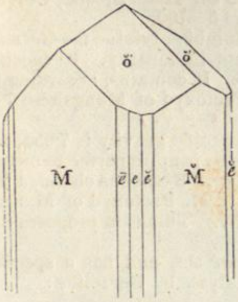
Obs. These varieties of yttro-columbite occur in Sweden at Ytterby, in red feldspar, and at Broddbo and Finbo, near Fahlun, imbedded in quartz and albite, and associated with garnet, mica, and the pyrophysalite variety of topaz. We are indebted to Berzelius for the discovery and description of these several varieties.

COLUMBITE. Columbus rectangulus.

Prismatic Tantalum-Ore, *J.* and *M.* Tantalit *of the Germans.* Tantale Oxidé, *H.* Columbite, *Hatchett.*

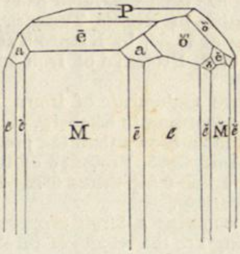
434. *Primary form:* a right rectangular prism. *Secondary forms:*

1.



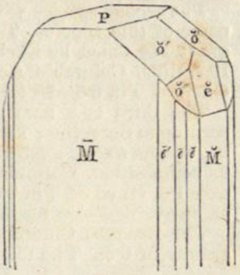
Middletown, Conn.

2.



Middletown, Conn.

3.



Bohemia.

M̄ : *e*=140° 20′, M̆ : *e*=129° 40′, M̄ : *ē*=157° 29′, M̆ : *ĕ*=158° 6′, M : *ē*=112° 31′, P : ē=160° 34′, P : ĕ=119° 40′, M̄ : ē=109° 26′, M : ĕ=150° 20′, P : a=126° 2′, a : a (over ŏ′) =102° 58,′ a : *e*=143° 58′, P : ŏ′=136° 36′, ŏ′ : ŏ′=150° 17′, a : ŏ′=156° 20½′, ŏ′ : *ĕ*=133° 24′, P : ŏ″=119° 13′, ŏ″ : ŏ″ (over ĕ) =160° 29′, ĕ : ŏ″=170° 14½′. The above angles, the most of which have been calculated, agree very closely with observation. The following are the values of the above angles, obtained by Brooke with the common goniometer, from a specimen supposed to have been found at Bodenmais, in Bavaria: M̆ : *ĕ*=158° 6′, M̆ : *ē*=114° 30′, P : ĕ=120°, P : *ŏ′*=136° 30′. Dr. Torrey found the angle M̆ : *ĕ*, of a crystal (fig. 1) from Haddam (Ann. New York Lyc. I. 89) to equal 157°, and M̆ : *e*= 129° 50′. *Cleavage* parallel with M̄ and M̆ rather distinct, the former the most so ; parallel with P indistinct. Occurs also massive ; structure granular.

H.=5—6. G.=5·9—7·9. *Lustre* submetallic. *Streak* dark-brown, slightly reddish ; brownish-black ; a little shining. *Color* iron-black, brownish-black, grayish-black. Opaque. *Fracture* subconchoidal, uneven. Brittle.

From the unusual variation in the specific gravity of the different specimens of Columbium ore, it is probable that the subdivision of this species, which has been proposed, will prove necessary. Agreeably to this subdivision, the American and Bodenmais specimens, from their identity in crystallization, compose the species Columbite. Their *specific gravity* varies from 5·9—6·04. In two successive trials, with a specimen from Middletown, Conn., I obtained 5·95 and 5·948. The *hardness* of the Middletown specimens is often as low as 5, and does not exceed 5·5: that of the Bodenmais specimens is stated at 6.

Specimens from Haddam and Middletown frequently present the blue or reddish tints of the steel tarnish.

The following is the composition of this division of this species, according to Borkowsky, Vogel, and Thomson:

	Bodenmais.	Bodenmais.	Middletown, Conn.	Bodenmais.
Columbic Acid	74·0	75	73·90	79·65
Protox. Iron	20·0	17	15·65	14·00
Protox. Manganese	4.6	5	8·00	7·55
Oxyd of Tin	0·4	1	—	0·50
Water	—	—	0·35	0·05
	99·0, B.	98, V.	97·90, T.	101·75, T.

Dr. Wollaston obtained from four grains of the original specimen in the British Museum, sent out from Connecticut by Gov. Winthrop to Sir Hans Sloane, Columbic Acid 80, Protoxyd of Iron 15, Protoxyd of Manganese 5=100.

The second species which has been separated from Columbite, retains the German name of this species, *Tantalite*, or *Kimito Tantalite*, from its locality. Its specific gravity is stated by Ekeberg at 7·236, by Klaproth at 7·3. It contains, according to Berzelius, Columbic Acid 83·2, Protoxyd of Iron 7·2, Protoxyd of Manganese 7·4, Oxyd of Tin 0·6=98·4.

The third is a nearly pure Columbate of iron. Its specific gravity is 7·655, according to Berzelius; 7·963, according to Ekeberg. Its lustre is more perfectly metallic, and its streak a purer reddish-brown than the preceding. Berzelius obtained for its composition, Columbic Acid 85·85, Protoxyd of Iron 12·97, Protoxyd of Manganese 1·6, Oxyd of Tin 0·80, Lime 0·56, Silica 0·72=102·51. Thomson proposes the name *ferrotantalite* for this variety.

The Broddbo Columbite contains a large proportion of tin, and has a specific gravity of 6·5. The following are the results of three analyses by Berzelius:

Columbic Acid	66·66	68·22	66·345
Oxyd of Tin	8·02	8·26	8·400
Tungstic Acid	5·78	6·19	6·120
Oxyd of Iron	10·64	9·58	11·070
Oxyd of Manganese	10·20	7·15	6·600
Lime	— =101·30.	1·19=100·59.	1·500=100·035.

Before the blowpipe alone, on charcoal, Columbite is infusible. With borax, in powder, fusion is slowly but perfectly effected.

Obs. The Columbite of Bodenmais, Bavaria, and also of Rabenstein, near Zweisel, in Bohemia, occurs in granite; the Kimito tantalite, Finland, in red feldspar; and the specimens which occur near Fahlun, in Sweden, in albite and quartz.

The occurrence of Columbite in this country was first made known by Mr. Hatchett's examination of a specimen, sent by Gov. Winthrop to Sir Hans Sloane, then President of the Royal Society, which was labelled as found at Nautneauge. Dr. S. L. Mitchill stated, (Med. Repos. vol. VIII.) that it was taken from a spring at New London, Conn. No locality has since been detected at that place. But the rediscovery of it at Haddam, first published by Dr. Torrey, (Silliman's Amer. Jour. IV. 52,) has led to the belief, that the latter was its original locality. It has since been discovered more abundantly near Middletown, Conn.

At Haddam it occurs in a granite vein, associated with chrysoberyl, beryl, Pinite, and automolite. Much finer and larger crystals have been afforded by the Middletown locality, where it occurs in a feldspar quarry. The above figure, 2, represents one of these crystals three quarters of an inch long; its faces are sufficiently brilliant to permit the use of the reflecting goniometer. A crystal from this locality has lately been described (Silliman's Amer. Journ. XXX. 387) by Professor Johnston, of the Wesleyan University of Middletown, which weighed, before it was broken, 14 pounds. The part figured weighed 6 lbs. 12 oz. avoirdupois, and exceeded 7 inches in length and breadth. It exhibits the faces $\tilde{M}$, $\breve{M}$, e, $\bar{e}'$, $\breve{e}$, $\check{e}$, and another imperfect plane, which appears to be $\breve{o}'$. Chesterfield, Mass., has afforded some fine crystals, associated with blue and green turmalines, and beryl, in granite; also quite large and perfect crystalline individuals have been found at Acworth, N. H., but the locality is now apparently exhausted.

PITCHBLENDE. Uranius amorphus.

Uncleavable Uranium Ore, *M.* Uranium-Ore, *M.* Uran-Ochre, *P.* Protoxyd of Uranium, Pecherz, *W.* Pechuran, *Haus.* Urane Oxydulé, *H.*

435. Massive and botryoidal; also in grains.

H.=5·5. G.=6·468. *Lustre* submetallic, or dull. *Streak* black, a little shining. *Color* grayish, brownish, or velvet-black. Opaque. *Fracture* conchoidal, uneven.

It contains, according to Klaproth, (Beitrage ii. 221,) Protoxyd of Uranium 86·5, Protoxyd of Iron 2·5, Silica 5·0, Sulphuret of Lead, 6·0.

Alone, before the blowpipe, it is infusible; but with borax it melts into a gray scoria. In the state of powder, it dissolves slowly in nitric acid, attended with the formation of the red fumes of nitrous acid. It is not attractable by the magnet.

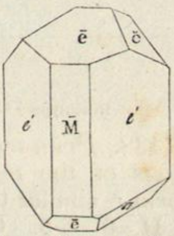
Obs. Pitchblende accompanies various ores of silver and lead at Johanngeorgenstadt, Marienberg, and Schneeberg, in Saxony; at Joachimsthal and Przibram, in Bohemia; also at Rezbanya, in Hungary; it is associated with uranite in some of the Cornish mines.

It is employed in porcelain painting, affording an orange-color in the enameling fire, and a black one in that in which the porcelain is baked.

WOLFRAM. Wolframius rectangulus.

Prismatic Scheelium Ore, *M.* Tungstate of Iron. Tungstate of Iron and Manganese, Scheelate of Iron and Manganese. Scheelin Ferruginé, *H.*

436. *Primary form:* a rectangular prism. *Secondary form:* $e' : e' = 101° 5'$, $\bar{e} : \bar{e}$ (over the apex) $= 125° 20'$. *Cleavage* perfect parallel with M. *Compound crystals:* composition parallel to M; other twins occur in which composition takes place parallel to ĕ, or is of the *second kind.* *Imperfect crystallizations:* structure irregular lamellar; also coarse divergent columnar; granular—particles strongly coherent. *Pseudomorphs* imitative of tungstate of lime.



H.=5—5·5. G.=7·1—7·4. *Lustre* submetallic. *Streak* dark reddish-brown. *Color* dark grayish or brownish-black. Opaque.

According to Berzelius and Vauquelin, it contains

Tungstic Acid	74·666	73·511
Protoxyd of Iron	17·594	20·745
Protoxyd of Manganese	5·640	5·744
Silica	2·100=100, B.	——=100, V.

It decrepitates before the blowpipe, and melts at a high temperature into a globule, whose surface is covered with crystals, having a metallic lustre. With borax it forms a green bead. With salt of phosphorus it fuses into a clear globule of a deep red color.

Obs. Wolfram is often associated with tin ores; also with galena, in veins traversing gray-wacke; also in quartz, with native bismuth, tungstate of lime, pyrites, galena, blende, &c.

It occurs at Cornwall, much to the detriment of the tin ores; in fine crystals at Schlackenwald, Zinnwald, Ehrenfriedersdorf; also at Limoges, in France, and in the island of Rona, one of the Hebrides.

In the United States it occurs at Lane's mine, Monroe, Conn., in quartz, associated with native bismuth, and the other minerals above mentioned. Pseudomorphs, of the form of tungstate of lime, are often observed at this locality. It has also been met with in small quantities in Trumbull, Conn., in the topaz vein.

HAUSMANNITE. Manganus acrotomus.

Pyramidal Manganese Ore, *M.* Foliated Black Manganese Ore, *J.* Black Manganese. Red Oxyd of Manganese. Blättriger Schwartz-Braunstein, *Haus.* Manganèse Oxydé Hydraté, *H.*

437. *Primary form:* a square octahedron. *Secondary form:* fig. 57, Pl. I.; $a : a = 105° 25'$, $a : a$ (in different pyramids) $= 117°$

54′, a′ : a′=139° 56′. *Cleavage* rather perfect parallel to the base of the octahedron. *Compound crystals :* somewhat similar to fig. 129 : the same kind of composition sometimes takes place between four individuals. *Imperfect crystallizations :* structure granular, particles strongly coherent.

H.=5—5·5. G.=4·722. *Lustre* submetallic. *Streak* chesnut-brown. *Color* brownish-black. Opaque. *Fracture* uneven.

It contains, according to Turner, (Edinb. Trans. xi.) Red Oxyd of Manganese 98·098, Oxygen 0·215, Water 0·435, Baryta 0·111, Silica 0 337=99·196.

In the oxydating flame of the blowpipe it affords an amethystine globule. It dissolves in heated muriatric acid, yielding an odor of chlorine.

Obs. It occurs in porphyry, with other manganese ores, near Ilmenau, in Thuringia, and at Framont, in Alsatia, in fine crystals. It has been observed at Lebanon, Pennsylvania.

BRAUNITE. MANGANUS PERITOMUS.

Brachtypous Manganese-Ore, *M.* Anhydrous Sesqui-oxide of Manganese, *Thom.*

438. *Primary form :* a square octahedron of nearly the dimensions of the regular octahedron ; A : A=109° 53′. *Secondary form :* similar to the last species. Occurs also massive.

H.=6—6·5. G.=4·818. *Lustre* submetallic. *Streak* and *color* dark brownish-black. *Fracture* uneven. Brittle.

It contains, according to Turner, (Edinb. Trans. xi.) Protoxyd of Manganese 86·94, Oxygen 9·851, Water 0·949, Baryta 2·260, and a trace of Silica. It is, therefore, a sesquoxyd of manganese. It dissolves in muriatic acid, leaving a silicious residue.

Obs. It occurs both crystallized and massive, in veins traversing porphyry at Oehrenstock, near Ilmenau, at Elgersburg, and elsewhere, in Thuringia ; also with red epidote, at St. Marcel, in Piedmont. This species was named in compliment to Mr. Braun, of Gotha.

PSILOMELANITE. MANGANUS INFORMIS.

Uncleavable Manganese-Ore, *M.* Compact and Fibrous Manganese Ore. Black Hematite. Compact Gray Oxyd of Manganese. Black Iron Ore. Psilomelanite. Schwarzeisenstein, *W.* Fasriger and Dichter Schwarzbraunstein, *Haus.* Dichtes Schwarz-Manganerz, *L.* Manganese Oxidé Hydraté Concretionné.

439. Crystalline form has not been observed. Occurs massive and botryoidal.

H.=5—6. G.=4—4·328. *Lustre* submetallic. *Streak* reddish, brownish-black, shining. *Color* black, passing into dark steel-gray. Opaque. *Fracture* not observable.

It contains, according to Turner, (Edinb. Trans. xi.) Red Oxyd of 69·795, Oxygen 7·364, Baryta 16·365, Silica 0·260, Water 6·216=100.

It gives a violet color to borax, and is completely soluble in muriatic acid, excepting a small quantity of silica.

Obs. This is one of the most generally diffused ores of manganese. It frequently occurs in alternating layers of different thicknesses, with pyrolusite. It occurs in botryoidal and stalactitic shapes, in Devonshire and Cornwall; at Ihlefield, in the Hartz; also in Hessia, Saxony, &c.

This species occurs also in mammillary and botryoidal masses, at Chittenden, Vt. The name psilomelanite, is derived from ψιλος, *smooth* or *naked*, and μελας, *black*, and was given it on account of its smooth botryoidal forms and black color. The manganèse oxidé noir barytifère, from Romanèche, has a somewhat higher specific gravity, but in other respects resembles this species.

CUPREOUS MANGANESE. MANGANUS CUPRIFERUS.

Kufermangan *of the Germans.*

440. Massive, in small reniform and botryoidal groups.

H.=1·5. G.=3·15—3·25. *Lustre* resinous. *Streak* and *color* bluish-black. Opaque.

It contains, according to Lampadius, Black Oxyd of Manganese 82, Brown Oxyd of Copper 13·50, Silica 2, and, according to Berzelius, a considerable quantity of water. Before the blowpipe it becomes brown, but does not fuse; to borax and salt of phosphorus it communicates amethystine and green colors, and the other characteristic indications of copper and manganese.

Obs. This rare mineral occurs in the tin mines of Schlaggenwald, in Bohemia; it was distinguished by Breithaupt and Lampadius.

MANGANITE. MANGANUS RHOMBICUS.

Prismatoidal Manganese-Ore, *M.* Gray Manganese-Ore. Gray Oxide of Manganese. Hydrous Sesquoxyd of Manganese, *Thom.* Grauer Braunstein, *W.* Manganese Oxydé, *H.*

441. *Primary form:* a right rhombic prism; M : M=99° 40′. *Secondary form* and *twin crystal*, fig. 15, Pl. III.; crystals longitudinally striated. In this crystal composition is of *the third kind*, and has been effected parallel to the plane *a* on the acute solid angle. Other twins occur, composed of two individuals united by their acute lateral edges. *Imperfect crystallizations:* structure columnar; also granular.

H.=4—4·5. G.=4·3—4·4. *Lustre* submetallic. *Streak* reddish-brown, sometimes nearly black. *Color* dark steel-black—iron-black. Opaque; minute splinters cleaved off sometimes exhibit a brown color by transmitted light, when exposed to the direct light of the sun. *Fracture* uneven.

It contains, according to Turner and Gmelin,

Red Oxyd of Manganese	86·85	87·1
Oxygen	3·05	3·4
Water	10·10=100, T.	9·5=100, G.

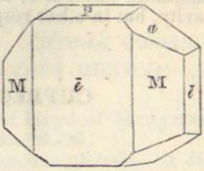
Before the blowpipe alone it is infusible; with borax it yields a violet-blue globule. It is insoluble in nitric acid; in muriatic acid it gives off chlorine and dissolves without a residue.

Obs. It occurs in veins traversing porphyry, associated with calcareous spar and heavy spar, at Ihlefield, in the Hartz; also in Bohemia, Saxony, Aberdeenshire. The gray oxyd from Undenaes, in West Gothard, analyzed by Arfwedson, is a similar compound. It is important in the manufacture of glass, and in bleaching operations.

PYROLUSITE. Manganus prismaticus.

Prismatic Manganese-Ore, *M.* Gray Ore of Manganese. Wad. Anhydrous Binoxide of Manganese, *Turner.*

442. *Primary form:* a right rhombic prism; M : M=93° 40′. *Secondary form:* M : ē=136° 50′, M : ĕ=133° 10′. *Cleavage* parallel to M and ē, ĕ. *Imperfect crystallizations:* structure columnar—often divergent; also granular; frequently in reniform coats; often soils when massive.



H.=2—2·5. G.=4·819, Turner; 4·97 when pure. *Lustre* metallic. *Streak* black. *Color* iron-black, sometimes bluish. Opaque. Rather sectile.

It contains, according to Turner and Thomson,

Red Oxyd of Manganese	84·05	85·62	99·242
Oxygen	11·78	11·60	
Water	1·12	1·56	—
Baryta	0·53	0·55	Perox. Iron 0·130
Silica	0·51	0·66	0·840
	97·99, Turn.	99·99, Turn.	100·212, Th.

With borax it affords an amethystine globule; heated in a matrass it yields no water.

Obs. This ore is extensively worked at Elgersburg, Ilmenau, and other places in Thuringia; also at Ehrensdorf, near Maehrish, Triebau, in Moravia, which place annually affords many hundred tons of this ore. At each of these places it is associated with psilomelanite. The finest crystals occur at Schimmel and Oslerfreude, near Johanngeorgenstadt, and at Hirschberg, in Westphalia.

In the United States it occurs, associated with psilomelanite, abundantly in different parts of Vermont, at Bennington, Monkton, Chittenden, &c., both crystallized similar to the above figure, and massive. It is also found at Conway, Mass., in a vein of quartz; at Winchester, N. H.; at Salisbury and Kent, Conn., forming velvet-like coatings on brown iron ore.

Pyrolusite parts with its oxygen at a red heat, and is, therefore, extensively employed for discharging the brown and green tints of glass. It hence received its name from πυρ, *fire,* and λυω, *to wash;* and for the same reason is whimsically entitled by the French, *le savon de verriers.* It is easily distinguished from psilomelanite by its inferior hardness.

Berthier has described a species of manganese ore differing from pyrolusite in composition, by containing one atom of water in two atoms of the mineral.

It occurs in rounded pieces in sand and clay at Groroi, Cautern, and Vecdessos, in France. *Color* brownish-black. *Lustre* dull, submetallic. *Streak* light-chocolate. It dissolves slowly in concentrated sulphuric acid, and colors that acid a fine violet-red. By ignition it loses 24 per cent. of its weight in water and oxygen, without changing its form, but acquires a reddish color.

EARTHY COBALT. Manganus cobaltiferus.

Earthy Cobalt, *P.* Erdkobold, *W.* Schwarzer Erdkobalt, *Haid.* Cobalt Oxidé Noir, *H.*

443. Massive botryoidal, earthy and granular.

Soft. G.=2·24. *Lustre* somewhat resinous. *Streak* shining. *Color* bluish and brownish-black. Opaque. Sectile.

According to Döbereiner, it contains Oxyds of Cobalt and Manganese 76·9, and Water 23·1. Before the blowpipe it emits the odor of arsenic, but does not fuse. It colors glass of borax blue.

Obs. It occurs in sandstone, associated with lead and copper, at Alderly Edge, in Cheshire; with green malachite at Nertschinsk, in Siberia; with several species of cobalt pyrites at Reichelsdorf, in Hessia, and Saalfield, in Thuringia.

It is employed in the manufacture of smalt.

Its brilliantly shining *streak* is an important peculiarity, and may assist in distinguishing it.

WAD. Manganus terrenus.

Earthy Manganese.

444. In reniform, botryoidal, and arborescent shapes, and in froth-like coatings on other minerals; also massive.

H.=0·5. G.=3·7. *Lustre* dull, earthy. *Streak* and *color* brown or black. Opaque. *Fracture* earthy. Very sectile. Soils.

It contains, according to Klaproth, Oxyd of Manganese 68, Oxyd of Iron 6·5, Water 17·5, Carbon 1·0, Baryta and Silica 9·0. Heated in the matrass it gives off much water. Berzelius considers it a hydrate of manganese. Mixed with linseed oil it undergoes spontaneous combustion.

Obs. On account of the porous nature of this mineral, it appears to be very light when held in the hand; but on immersing it in water it imbibes water rapidly, and gives the above specific gravity. This species has been found principally in the manganese pits, near Exeter, in Devonshire, Cornwall, the Hartz, and Piedmont. It is supposed to be the coloring ingredient of the common dendritic delineations upon limestone, steatite, and other substances.

VARVACITE.

445. Occurs in thin plates and fibres, often radiating; crystalline form not apparent.

H.=2·5—3. G.=4·283—4·623. *Lustre* submetallic. *Streak* black. *Color* steel-gray, iron-black. Opaque.

According to Mr. R. Phillips, it contains Protoxyd of Manganese 81·12, Oxygen 13·48, Water 5·40.

Obs. It occurs in the country of Warwick, and was therefore named as above. It has also been observed in the Hartz.

NEWKIRKITE.

446. Occurs in small needles, under the microscope apparently rectangular prisms.

H.=3—3·5. G.=3·824. *Lustre* metallic splendent. *Color* a brilliant black. Opaque. Rather sectile.

It contains, according to W. Muir, Deutoxyd of Manganese 56·30, Peroxyd of Iron 40·35, Water 6·70=103·35.

Obs. It occurs forming a coating on red Hæmatite, at Newkirchen, in Alsace, and was named by Thomson from its locality.

CHROMIC IRON. Siderus Chromicus.

Octahedral Chrome Ore, *M.* Chromate of Iron. Chromiron Ore. Chromeisenstein. Eisen Chrom Fer Chromatè.

447. *Primary form:* the regular octahedron. *Secondary*

form: fig. 9, Pl. I., from Hoboken, N. J., and Bare Hills, near Baltimore. Occurs usually massive—structure granular—particles strongly coherent.

H.=5·5. G.=4·321 of crystals, Thomson; 4·498, a variety from Stiria. *Lustre* submetallic. *Streak* brown. *Color* between iron-black and brownish-black. Opaque. *Fracture* uneven. Brittle.

It contains, according to Klaproth, Thomson, and Abich,

		Baltimore.		
Green Oxyd of Chromium	55·5	52·95		60·04
Protoxyd of Iron	33·0	29·24		20·13
Alumina	6·0	12·22		11·85
Water	—	0·70		——
Silica	2·0	trace		——
White substance undetermined	—	3·09	Magnesia	7·45
	96·5, Klap.	98·20, Thom.		99·47, Abich.

It is infusible alone before the blowpipe. With borax it fuses with difficulty, but completely, into a beautiful green globule. In small fragments it is attracted by the magnet.

Obs. Chromate of Iron occurs only in serpentine rocks, forming veins, or in imbedded masses. It assists in giving the variegated color of verd-antique marble.

It occurs in the Gulsen mountains, near Kraubat, in Styria; also in the islands of Unst and Fetlar, in Shetland; in the Department du Var in France, Silesia, Bohemia, &c.

At Baltimore, Md., in the Bare Hills, it occurs in large quantities in veins or masses in serpentine; also in Montgomery county, six miles north of the Potomac. It occurs both massive and in crystals, at Hoboken, N. J., imbedded in serpentine and dolomite; also at Milford and West Haven, Conn.; also in large masses in the southwestern part of the town of New Fane, Vt.

This ore affords the oxyd of chrome, which, both alone and in combination with the oxyds of other metals, is extensively used in oil-painting, dyeing, and in coloring porcelain.

CROCIDOLITE. Siderus fibrosus.

Krokidolite, *Hausmann.* Blue Iron Stone, *Klaproth.*

448. Fibrous—fibres long but very minute and easily separable; also massive.

H.=4. G.=3·2—3·265. *Streak* and *Color* lavender-blue or leek-green. Opaque. Fibres somewhat elastic.

According to Stromeyer, (Poggendorf's Annalen, xxiii. 156,) the fibrous variety contains

Silica	50·81	51·64
Protoxyd of Iron	33·88	34·38
Protoxyd of Manganese	0·17	0·02
Magnesia	2·32	2·64
Lime	0·02	0·05
Soda	7·03	7·11
Water	5·58=99·81.	4·01=99·85.

When heated to redness, it melts easily into a black shining, opaque, and somewhat frothy glass, which is attractable by the magnet. The single fibres readily fuse in the flame of a spirit lamp. With borax it forms a green transparent bead, which, by adding salt petre, is changed to brown.

Obs. It occurs at Orange river, near the Cape of Good Hope. Stavern, in Norway, is stated as another locality; but the mineral it affords does not precisely resemble the African variety. The name of this species is derived from κροκις, *woof*, in allusion to its wool-like fibrous structure.

HISINGERITE. Siderus Hisingeri.

Hisingerit, *Berz.* Thraulite, *Kobell.* Hydrous Sesqisilicate of Iron.

449. Imperfectly crystallized. *Cleavage* distinct in one direction. Soft. G.=3·045. *Streak* greenish-gray or brownish-yellow. *Color* black. Opaque. Cross fracture earthy. Sectile.

It contains, according to Berzelius, Hisinger, and Kobell,

Oxyd of Iron	51·50	49·869	50·86
Silica	27·50	31·775	31·28
Alumina	5·50	——	——
Oxyd of Manganese	0·77	——	——
Volatile matter	11·75	Water 20·700	Water 19·12
Magnesia	trace=97·02, B.	——=102·344, H.	——=101·26, K.

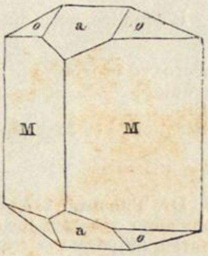
Heated in a glass tube it gives out water. Before the blowpipe it becomes magnetic, and at a high temperature melts into a dull opaque black globule; with borax it forms a yellowish-green glass.

Obs. It occurs in the cavities of calcareous spar, in the parish of Svärta, in Sudermanland, Sweden; also at Bodenmais, in Germany.

YENITE. Siderus rhombicus.

Di-Prismatic Iron Ore, *M.* Yenite, Ilvait, *Haus.* Fer Calcareo-Silicieux, *H.*

450. *Primary form:* a right rhombic prism; M : M=112° 37′. *Secondary form:* a figure of a crystal from Elba. In other crystals the plane a, is wanting; a : *o*=158° 49′, *o* : *o*=139° 37′, M : *o*=128° 38′. Lateral faces usually longitudinally striated. *Cleavage* parallel to $\bar{c}$, indistinct. It occurs also massive, columnar, and granular. When the latter, the structure is often nearly impalpable. H.=5·5—6. G.=3·8—4·1; 3·994, Haidinger; 3·9796, Stromeyer; 3·825—4·061, Lelievre. *Lustre* submetallic. *Streak* black, inclining to green, or brown. *Color* iron-black, or dark grayish-black. Opaque. *Fracture* uneven. Brittle.



It contains, according to Vauquelin (Jour. des Mines, xxi. 70) and Stromeyer, (Untersuchungen, p. 374,)

	Elba.	Elba.
Silica	29	29·278
Lime	12	13·779
Protoxyd of Iron	57	52·542
Protoxyd of Manganese		1·587
Alumina	—	0·614
Water	—=98, Vauq.	1·268=99·068, Strom.

Before the blowpipe, on charcoal, it fuses into a black globule, which becomes vitreous in the external flame. In the interior flame the surface becomes dull, and provided the globule has not been heated to redness, it is attractable by the magnet. With borax and carbonate of soda, it fuses into glass, nearly or perfctly black. It is soluble in muriatic acid.

Obs. This mineral was first discovered on the Rio la Marina, in Elba, by M. Lelievre, in 1802, where it occurs in solitary crystals of considerable dimensions, and aggregated crystallizations in compact augite. It has also been observed at Fassan, in Norway, in Siberia, and Silesia.

At Cumberland, R. I., it occurs in long slender black or brownish-black crystals, traversing quartz, and associated with magnetic iron ore and hornblende. The name *Lievrite* was given this mineral in compliment to its discoverer; *Ilvaite* is derived from the name of the island, Elba, on which it was first found; Yenite, or Jenite, was applied by the French in commemoration of the battle of Jena, in 1806.

BROWN IRON ORE. SIDERUS HÆMATICUS.

Prismatic Iron Ore, *M.* and *J.* Brown Hematite. Brown Iron Ore. Hydrous Peroxyd of Iron. Stilpnosiderite. Brown Ochre. Brown Clay. Iron Stone. Bog Iron Ore. Göthite. Pyrosiderite. Onegite. Yellow Clay Iron Stone. Rubinglimmer. Brauneisenstein, Thoneisenstein, *W.* Eisenoxyd-Hydrat, *L.* Fer Oxydé, *H.* Fer Hydro-Oxidé, *Levy.*

451. *Primary form:* a right rhombic prism; M : M=130° 40′. *Cleavage* parallel to $\breve{c}$, or the shorter diagonal. Perfect crystals are of rare occurrence. This species usually presents stalactitic and botryoidal, or mammillary forms, having a fibrous structure; also massive, and occasionally earthy. Pseudomorphs, imitative of calcareous spar and iron pyrites, have been observed.

H.=5—5·5. G.=3·922, Haidinger; 4·04, crystals from St. Just. *Lustre* adamantine, submetallic; sometimes dull and earthy. *Streak* yellowish-brown. *Color* various shades of brown, commonly dark, and none bright. Crystals often subtransparent, and exhibiting a blood-red tint; in crystallized varieties, opaque.

It contains, according to Thomson, Ulmann, and D'Aubuisson,

	Crystals.	Stilpnosiderite.	Hematite.	Brown Ochre.
Peroxyd of Iron	91·7	80·50	79	83
Water	8·5	16·00	15	12
Silica	—	2·25	2	5
Sesquoxyd of Manganese	—	trace	3	trace
	100·2, Th.	98·75, Ul.	99, D'A.	100, D'A.

Dr. Thomson supposes the crystals form a distinct species; they contain but half an atom of water, instead of one, as in the ordinary brown hematite, and is therefore a dihydrate of iron, whereas the latter is a simple hydrate.

Before the blowpipe it blackens and becomes magnetic; with borax it fuses into a green or yellow glass. It dissolves in warm nitro-muriatic acid, and gives out water when heated in a matrass.

Obs. This species is very varying in its external appearance, and as abundant in the appellations by which it has been designated. The crystallized variety has been called *Onegite*, *rubinglimmer*, *pyrosiderite*, and *Göthite;* the first from its locality, the last in compliment to the celebrated poet and mineralogist, Göthe. *Brown hematite* includes the ordinary imitative shapes. *Scaly* and *ochrey brown iron ore*, are more or less decomposed varieties, composed of slightly cohering particles. *Bog iron ore* arises from the decomposition of other species, and occurs in low marshy grounds. The pisiform and reniform clay iron ores, consist of concentric globular concretions, imbedded either in friable or compact brown hematite.

Brown iron ore occurs both in primitive and secondary rocks, in beds and veins, associated at times with spathic iron, heavy spar, calcareous spar, Arragonite, and quartz; and more particularly when in veins, it is often associated with ores of manganese.

The crystallized variety occurs in the cavities of sandstone, at Clifton, near Bristol; near Lostwithiel, in Cornwall, and at Lake Onega, in Siberia. Other varieties occur in Cornwall, at Clifton, at Sandloge in Shetland, in Carinthia and Bohemia, at Siegen near Bonn, and at Villa Rica, in Brazil. The bog ore forms considerable repositories in Germany, Poland, and Russia.

Extensive beds of brown iron ore, accompanied by the ochrey iron ore, exist at Salisbury and Kent, Conn., in mica slate; also in the neighboring towns of Beekman and Amenia, N. Y., and in a similar situation north at Richmond and Lenox, Mass. At Hinsdale it is the cement in a conglomerate quartz rock. It is very abundant at Bennington, Vt., also at Monkton, Pittsford, Putney, and Ripton, of the same state. Nantucket and Martha's Vineyard are other localities; also near Tinder's Gold Mine, Louisa Co., Va., there is an abundant deposit. The argillaceous varieties are abundant in Pennsylvania, near Easton, and through the Lehigh range in Fayette Co., at Armstrong, Upper Dublin, and in Washington Co. In nodules, from one inch to a foot in diameter, it is met with at Bladensburg, Maryland; also in gravel hills, near Marietta, in Ohio. An argillaceous ore is also found on Mount Alto, in the Blue Ridge, in Shenandoah Co., Va., and in Chatham and Nash Co., N. C.

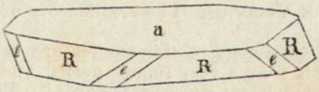
Brown iron ore is one of the most important ores of iron. The pig iron, from the purer varieties, obtained by smelting with charcoal, is readily convertible into steel. That yielded by bog ore, is what is termed *cold short*, and cannot therefore be employed in the manufacture of wire, or even of sheet-iron, but is valuable for casting. The hard and compact nodular varieties are employed in polishing metallic buttons, &c.

SPECULAR IRON. SIDERUS RHOMBOHEDRUS.

Rhombohedral Iron Ore, *M.* Rhomboidal Iron Ore, *J.* Red Iron Ore. Oligiste Iron. Micaceous Iron Ore. Red Hematite. Red Clay Ironstone. Red Ochre. Iron Foam. Eisen Glanz, Rotheisenstein, *W.* Blutstein, *Haus.* Eisenoxyd, *L.* Fer Oligiste, *H.*

452. *Primary form:* an acute rhombohedron; R : R=85° 58′, and 94° 2′. *Secondary forms:* figs. 1 and 2, of a crystal from Vesuvius; fig. 3, a crystal from Elba.

1.



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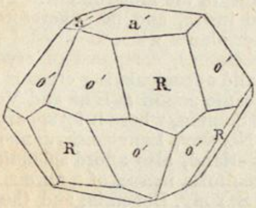

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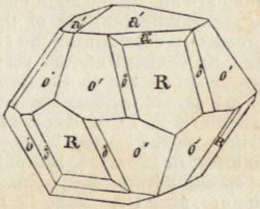


R : *e*=137° 1′, *o*′ : *o*′=128° and 122° 29′, R : *o*′=151° 14′, a′ : a′= 142° 56′. *Cleavage* parallel to a and R; often indistinct. *Com-*

pound crystals. Composition of the first kind or parallel to R; also of the third kind, in which it takes place parallel to a, the truncating plane of the vertical angle. *Imperfect crystallizations:* structure columnar—globular, reniform, botryoidal, and stalactitic shapes, and also amorphous; structure lamellar—laminæ joined parallel to a, and variously bent—thick or thin; structure granular—particles often nearly impalpable—slightly coherent—at other times strongly coherent; pseudomorphs occur, imitative of calcareous spar, fluor spar, &c.

H.=5·5—6·5. G.=4·5—5·3. Some compact varieties are as low as 4·2. *Lustre* metallic and occasionally splendent—massive varieties sometimes earthy. *Streak* cherry-red or reddish-brown. *Color* dark steel-gray or iron black; impure varieties, red and unmetallic. Opaque, except when in very thin laminæ, which are faintly translucent and of a blood-red tinge. *Fracture* sub-conchoidal, uneven. Sometimes it is slightly attractable by the magnet; the volcanic varieties occasionally exhibit polarity.

It contains, when pure, 69·34 of Iron, and 30·60 of Oxygen, being a pure peroxyd of iron. D'Aubuisson found red hematite to contain Peroxyd of Iron 94, Silica 2·0, Lime 1·0, Water 3. Dr. Henry found in *Iron froth*, Peroxyd of Iron 94·5, Silica ? 4·25, Alumina 1·25.

It is infusible, *per se*, before the blowpipe; with borax it fuses into a green or yellow glass. It dissolves in heated muriatic acid.

Obs. This species includes the old species, specular iron and red iron ore, which are identical in chemical composition, and differ only in the state of aggregation of the particles. *Specular iron* includes the varieties of a perfect metallic lustre; if the structure is micaceous, it is the *micaceous specular iron*. The varieties of a sub-metallic or non-metallic lustre, were included under the name of *red hematite*, *fibrous red iron*, or if consisting of impalpable weakly coherent particles, *red ochre*, and when of slightly coherent scales, *scaly red iron*, or *red iron froth*. Under this species must also be included the different clay iron ores, many of which contain but small portions of iron; *reddle* or *red chalk*, the common drawing material, which has an earthy appearance and a flat conchoidal fracture; *jaspery clay iron*, more firm in its structure than the preceding, and having a large and flat conchoidal fracture; *columnar* and *lenticular clay iron*, distinguished by their columnar or flattish granular structure. Specular iron occurs most commonly in primitive rocks; it also occurs among the ejected lavas of Vesuvius. The argillaceous ores form beds in secondary rocks.

The most magnificent specimens of this species are brought from the island of Elba, which has afforded it from a very remote period, and is described by Ovid, as the "Insula inexhaustis chalybdum generosa metallis." The surfaces of the crystals often present a very splendid irised tarnish, and, connected with the most brilliant lustre, they are among the finest objects in the cabinet of the mineralogist. The faces a and a′ are usually destitute of this tarnish and lustre, and may therefore assist, when present, in determining the situation of other planes when the crystal is quite complex. St. Gothard affords very beautiful specimens, composed of crystallized plates grouped together in the form of rosettes, and accompanying crystals of feldspar. Fine crystallizations are the result of volcanic action at Etna and Vesuvius, and particularly in Fossa Kankarone, on Monte Somma, where it forms crystalline incrustations on the ejected lavas. Arendal, in Norway, Langbanshyttan, in Sweden, Framont, in Lorraine, Dauphiny, and Switzerland, also afford splendid specimens of specular iron. Red hematite occurs in reniform masses of a fibrous concentric structure, near Ulverstone in Lancashire, in Saxony, Bohemia, and the Hartz. In Westphalia, it occurs as pseudomorphs of calcareous spar. Iron mica comes principally from Cattas Atlas, in the Brazils.

Handsome irisedly tarnished crystallizations of specular iron are found at Fowler, St. Lawrence Co., N. Y., in cavities in granular micaceous iron ore, and associated often with splendid groups of quartz crystals presenting the form of the isosceles dodecahedron. Uncrystallized metallic varieties are common in other parts of the same country. It occurs also in the Blue Ridge, in the western part of Orange Co., Va. Micaceous iron in large masses, composed of irregular curved laminæ, occurs at Hawley, Mass.; also eight miles above Falmouth, Stafford Co., Va., on the Rappahannock river. Red hematite is found at Ticonderoga, upon Lake George. Lenticular argillaceous ore is abundant at Utica and Clinton. At these places it forms a layer about a foot thick in a fine silicious gray-wacke, and extends west, of the same thickness, to the west end of Lake Ontario. The layer, according to Eaton, is about twenty miles wide and two hundred and forty miles long.

This ore affords a considerable portion of the iron manufactured in different countries. These varieties, especially the specular, require a greater degree of heat than other ores, but the iron obtained is nevertheless of good quality. Pulverized red hematite is employed in polishing metals, and also is a coloring material. Specular iron is readily distinguished from magnetic iron ore, by it reddish streak.

Hematite, a word in use among the ancients, was applied to this and the preceding species on account of the red color of the powder, from *ἅιμα*, *blood*. The term *specular*, alludes to the brilliant lustre it often presents.

MAGNETIC IRON ORE. SIDERUS OCTAHEDRUS.

Octahedral Iron Ore, *M.* Oxydulated Iron. Ferroso-ferric Oxyd. Manganeisenstein, *of the Germans.* Fer Oxydulé, *H.*

453. *Primary form:* the regular octahedron. *Secondary forms:* most of the forms represented in the first twenty figures of Pl. I.; also fig. 25, Pl. I. *Cleavage* parallel to the primary form; perfect—imperfect. The dodecahedral faces are commonly striated parallel to the longer diagonal. *Compound crystals:* fig. 129, Pl. II.; also the same kind of composition with the secondary modifications. *Imperfect crystallizations:* structure granular—particles of various sizes, sometimes impalpable.

H.=5·5—6·5. G.=6·094. *Lustre* metallic—submetallic. *Streak* black. *Color* iron-black. Opaque. *Fracture* subchonchoidal, shining. Brittle. Strongly attracted by the magnet, and sometimes possessing polarity.

It is composed, as determined by Berzelius, of two atoms of peroxyd of iron, and one of protoxyd. Before the blowpipe it becomes brown, and loses its influence on the magnet; but it does not fuse. With borax, in the oxydizing flame, it fuses into a dull-red glass, which becomes clear on cooling, and often assumes a yellow tint; in the reducing flame it becomes bottle-green. It dissolves in heated muriatic acid, but not in nitric acid.

Obs. Magnetic iron ore occurs in beds, in primitive rocks, generally in gneiss; but also in clay slate, hornblende slate, chlorite slate, greenstone, and occasionally in limestone.

The beds of ore at Arendal, and nearly all the celebrated iron mines of Sweden, consist of massive magnetic iron. Dannemora, and the Täberg, in Smäland, are entirely formed of it. Still larger mountains of it exist at Kurunavara and Gellivara, in Lapland. Fahlun in Sweden, and Corsica, afford octahedral crystals, imbedded in chlorite slate. Splendid dodecahedral crystals occur at Normark, in Wermeland. The most powerful native magnets are found in Siberia, in the Hartz. They are also obtained on the island of Elba.

Very extensive beds of this ore occur at different places upon the western side of Lake Champlain, and in the Highlands of New York; also in the mountainous districts of New Jersey and Pennsylvania, and on the eastern side of Willis Mountain, in Buckingham Co., Virginia, &c. Dodecahedral crystals occur at Franconia, N. H., imbedded in epidote and quartz. At Marlborough, Vt., it is found in octahedral crystals, imbedded in chlorite, and at Bridgewater, Vt., in chlorite slate.

The black streak of this species distinguishes it from other ores of iron.

FRANKLINITE. Siderus Zinciferus.

Dodecahedral Iron Ore, *M.*

454. *Primary form:* the regular octahedron. *Secondary forms:* fig. 9, and others, Pl. I. *Cleavage* very indistinct parallel to the primary planes. It occurs also massive, with a coarse or fine granular structure—particles strongly coherent.

H.=5·5—6·5. G.=5·069, Thomson; 5·091, Haidinger; 4·87, Berthier. *Lustre* metallic. *Streak* dark reddish-brown. *Color* iron-black. Opaque. *Fracture* conchoidal. Brittle. Acts slightly on the magnet.

It contains, according to Berthier and Thomson,

Peroxyd of Iron	66	66·100
Sesquoxyd of Manganese	16	14·960
Oxyd of Zinc	17	17·425
Silica	—	0·204
Water,	—=99, B.	0·560=99·249, T.

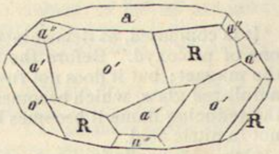
At a high temperature zinc is driven off. It dissolves without effervescence in heated muriatic acid.

Obs. Franklinite is stated to occur in amorphous masses at the mines of Altenberg, near Aix la Chapelle. But a more abundant locality is at Franklin furnace, in Hamburg, N. J., where it is accompanied by red oxyd of zinc and garnet, in calcareous spar. The most perfect crystals are imbedded in red zinc ore; those occurring in calc spar have their angles rounded. A still more remarkable deposit exists at Sterling, in the same region, where it is associated with Troostite, in a powerful vein, in which cavities occasionally contain crystals from one to three inches in diameter.

CRICHTONITE. Siderus acrotomus.

Axotomous Iron Ore, *M.* Iserine. Ilmenite. Menaccanite.

455. *Primary form:* an acute rhombohedron; R : R=61° 20′. *Secondary form:* the annexed figure. *Cleavage* parallel to the plane a, which truncates the vertical solid angle. Commonly in angular grains, and irregular masses; sometimes forming a coating on other species.



H.=5—5·5. G.=4·4—4·8; 4·427—4·491, Thomson; 4·5—4·650, Klaproth. *Lustre* submetallic. *Streak* metallic. *Color* dark iron-black. Opaque. *Fracture* conchoidal. Slightly affects the magnetic needle.

It contains, according to Mosander, Rose, and Kobell,

	Miask.		Gastein.
Titanic Acid	46·67	50·12	59·00
Oxyd of Iron	47·08	49·88	40·25
Oxyd of Manganese	2·39	—	1·65
Magnesia	0·60	—	—
Lime	0·25	—	—
Oxyd of Chrome	0·38	—	—
Silica	2·80=100·17, M.	—=100, R.	—=100·90, K.

It is infusible, *per se*, before the blowpipe; with fluxes its action is similar to that of oxyd of iron. It is readily soluble in concentrated muriatic acid.

Obs. The variety Menaccanite occurs in irregular crystals and masses, imbedded in serpentine at Inglesberg, in the valley of Gastein, Saltzburg, and is associated with apatite and sparry iron ore. At Eggersend, in Norway, it occurs massive and compact, and imperfectly crystallized at Ilmensee and Ekatherinenberg, in Siberia. It was first observed near Menaccan, Cornwall. The name *Iserine* is derived from the river Iser, in Bohemia, where it occurs in rolled masses. It occasionally forms a coating on rutile, and is sometimes mistaken for nigrine, a variety of rutile; but it is distinguished by its inferior hardness and black streak. At Amity, N. Y., it occurs in black crystals, imbedded in serpentine, and white limestone, and associated with spinel, Brucite, rutile, &c. It also occurs in broad laminated masses at Washington, Conn., imbedded in a vein of quartz, traversing primitive rocks.

Crichtonite is sometimes made a distinct species, separate from the other varieties of this species; but its distinctness has not yet been proved by an analysis, or by crystallographic considerations. It is described as having a brilliant metallic lustre, and occurring in small acute rhombohedrons, with truncated vertical solid angles. With salt of phosphorus it affords a glass which becomes red on cooling. Its only locality is St. Christophe, near Oisians in the department of the Isère, where it occurs with anatase, quartz, and chlorite.

Another titanate of iron has been analyzed by Berthier, and found to contain Titanic Acid 41, Peroxyd of Iron 56·2, Quartz 2·5=99·7, with a trace of Oxyd of Manganese. It occurs in dark gray compact granular masses, with little or no lustre, in Brazil, where, according to M. Montlevade, it constitutes mountains or thick banks of considerable extent, alternating with transition rocks.

MOHSITE. Siderus Mohsianus.

Levy, Ann. of Phil. March, 1827.

456. *Primary form:* an acute rhombohedron; R : R=73° 43′. Occurs mostly in compound crystals, in the form of flat and nearly circular crystals, with alternate re-entering and salient angles on their edges. *Cleavage* not apparent.

Scratches glass. *Lustre* metallic; brilliant. *Color* iron-black. Opaque.

Obs. It is supposed to have come from Dauphiny, It is distinguished from the preceding species by the indistinctness of its cleavage, and its superior hardness. It was named Mohsite by Mr. Levy; in honor of the very distinguished mineralogist, Professor Mohs.

BREISLAKITE.

457. Occurs in delicate capillary crystals of a reddish-brown or chesnut-brown color, bent and grouped like wool; fibres flexible. *Lustre* metallic.

It contains Silica, Alumina, Iron, and a considerable portion of Copper. With salt of phosphorus it affords a green globule, which is red in the reducing flame.

Obs. It forms coatings in the cavities of lavas, and accompanies nepheline and pyroxene. It has been observed at Vesuvius and Capo di Bove, near Rome.

ORDER VIII.—METALLINEA.

IRON. FERRUM OCTAHEDRUM.

Octahedral Iron, *M.* and *J.* Meteoric Iron. Gediegen Eisen, *W.* and *L.* Fer Natif, *H.* Mars, *Alchem.*

458 *Primary form:* the regular octahedron. *Cleavage* apparent parallel to the faces of the octahedron.

H.=4·5. G.=7·3—7·8; 7·318, a partially oxydized fragment of a crystal from Guilford Co., N. C. *Lustre* metallic. *Color* iron-gray. *Streak* shining. *Fracture* hackly. Ductile. Acts strongly on the magnet.

Native iron, undoubtedly of terrestrial origin, has been observed at Canaan, Conn., and in Guilford Co., N. C. At the former place it occurred in the form of a vein, or plate two inches thick, attached to a mass of mica slate rock; at the latter locality was found an octahedral crystal weighing about 7 ounces, which is reported to have been detached from a mass weighing 28 pounds, and which a blacksmith wrought into nails. These specimens are now in the Yale College cabinet.

Foreign specimens are also reported to have been found. Cramer describes one weighing 4 pounds, obtained in the mine of Hackenburg. Other Saxon localities are Steinbach and Eibestock.

Meteoric iron usually contains nickel, and small quantities of other metals.

The following analyses of meteoric iron have been lately published by Berzelius, in Kongl. Vet. Acad. Handlingar. Stockh. 1834, p. 115.

	From Blansko.	From Siberia.		From Elnbogen.
Iron	93·816	88·042		88·231
Nickel	5·053	10·732		8·517
Cobalt	0·347	0·455		0·762
Manganese	——	0·132	Sulphur and Mang.	trace
Tin and Copper	0·460	0·066		——
Sulphur	0·324	trace		——
Phosphorus	trace	——	Metallic Phosphurets	2·211
Magnesium	——	0·050		0·279
Carbon	——	0·043		——
Insoluble part	——=100.	0·480=100.		——=100.

The *first* specimen fell near Blansko, on the 25th November, 1833. The metallic iron constituted only ·1715 part of it. The *second* was discovered by Pallas on a mountain, between Krasnojarsk and Abekansk, in Siberia. It contained imbedded olivine. The *third* specimen is supposed to have fallen towards the close of the fourteenth century; it is preserved at Vienna.

One of the most extraordinary of these iron meteorites, preserved in any collection, is now in the Yale College cabinet. It weighs 1635 lbs.; length 3 feet 4 inches; breadth 2 feet 4 inches; height 1 foot 4 inches. It has been analyzed by C. U. Shepard, (Silliman's Amer. Jour. XVI. 217,) and found to contain Iron 90·02, Nickel

9·674=99·694. It was brought from Red river. Still more remarkable masses exist in South America; one was discovered by Don Rubin de Celis, in the district of Chaco-Gualamba, whose weight was estimated at 30,000 pounds; and another was found at Bahia, in Brazil, whose solid contents are at least 28 cubic feet, and weight 14,000 pounds. The Siberian meteorite, discovered by Pallas, weighed originally 1600 pounds, and contained imbedded crystals of chrysolite. Smaller masses are quite common. Meteoric iron is perfectly malleable, and is readily worked into cutting instruments, and may be put to the same uses as manufactured iron.

PLATINUM. PLATINUM CUBICUM.

Native Platina, *M.* and *J.* Hexahedral Platina, *Haid.* Platina. Gediegen Platina, *W.* and *L.* Polyxen, *Haus.* Platine Natif Ferrifère, *H.*

459. *Primary form :* the cube. In irregular forms and grains. *Cleavage* none.

H.=4—4·5. G.=16—19 ; 17·332 is the average or most usual specific gravity. *Lustre* metallic. *Streak* and *color* perfect steel-gray ; shining. Opaque. Ductile. *Fracture* hackly.

It contains, according to Berzelius, (Kong. Vet. Acad. Handl., 1828, p. 113,)

	Nischne Taglisk.	Nischne Taglisk.	Goroblagodat.
Platinum	78·94	73·58	86·50
Iridium	4·97	2·35	——
Rhodium	0·86	1·15	1·15
Palladium	0·28	0·30	1·10
Copper	0·70	5·20	0·45
Iron	11·04	12·98	8·32
Osmium and Iridium	1·96	undetermined 2·30	1·40
	98·75	97·86	98·92

It is soluble only in heated nitro-muriatic acid. Not fusible in the flame of the common blowpipe. It acts slightly on the magnet; this property depends on the amount of iron it contains.

Obs. Platinum was first found in pebbles and small grains, associated with iridium, rhodium, osmium, palladium, gold, copper, and chrome, in the alluvial deposits of Brazil, Choco, and Barbacoa, in South America, where it received its name, *platina*, from *plata*, *silver*, of which word platina is a diminutive. It has of late years been discovered in considerable abundance at Nischne Tagilsk, and Goroblagodat, in the Uralian mountains, and has been formed into coins by the Russians. They are not a legal tender, but pass conventionally, and are principally current in the southern provinces of the empire.

Although platinum generally occurs in quite small grains, masses are sometimes found of considerable magnitude. A mass, weighing 1088 grains, was brought by Humboldt from South America, and deposited in the Berlin museum. Its specific gravity was 18·94. In the year 1822 a mass of platinum from Condoto was deposited in the Madrid museum, measuring two inches and four lines in diameter, and weighing 11,641 grains. A still more remarkable specimen was found in the year 1827, in the Ural, not far from the Demidoff mines, which weighed $10\frac{54}{96}$ Russian pounds, or 9·522 lbs. avoirdupois. It specific gravity was 16.

The infusibility of this metal, and its property of resisting the action of air and moisture, and nearly all chemical agents, render it highly valuable for the construction of philosophical and chemical apparatus. The vessels employed in the concentration of sulphuric acid are now made of platinum, which is unaffected by an acid generally so corrosive. Platinum is also employed for covering other metals, and for painting on porcelain. It admits of being drawn into wire of extreme tenuity. Dr. Wollaston succeeded in obtaining a wire not exceeding the two thousandth part of an inch in diameter.

IRIDIUM. IRIDIUM HEXAGONUM.

Rhombohedral Iridium, *Haid.* Native Iridium. Iridosmine. Alloy of Iridium and Osmium.

460. *Primary form:* a hexagonal prism. *Secondary form:* fig. 125, Pl. II. *Cleavage* parallel with P, easily obtained; parallel with M, indistinct. Commonly in irregularly flattened grains.

H.=6—7. G.=19·5, Wollaston; 19·471, Rose, a crystal at 52°; 21·118, a crystal from Nischne Tagilsk, in Siberia. *Lustre* metallic. *Color* tin-white, and light steel-gray. Opaque. Malleable with difficulty.

There are three or four distinct varieties of this species, which have been described by Berzelius as occurring in Siberia, (Pogg. Ann. xxxii.) The first consists of flat plates, possessing no regular form, and a hardness sufficient to scratch glass. G.=19·25. They contain, according to Berzelius, Iridium 46·77, Osmium 49·34, Rhodium 3·15, Iron 0·74, which is nearly equivalent to an atom each of Iridium and Osmium.

The second variety is found in plates. G.=18·645—19·25.

The remaining varieties occur in six sided plates. G.=21·118. One contains Iridium 25·1, and Osmium 74·9, or one atom of the former to three of the latter; the other, Iridium 20, and Osmium 80, or one atom of Iridium to four of Osmium.

At a high temperature some of these varieties give out a little osmium, but undergo no further change. With nitre, the characteristic odor of osmium is soon afforded, and a mass obtained soluble in water, from which a green precipitate is thrown down by nitric acid.

Obs. It occurs with platinum in the province of Choco, in South America, and in the Ural mountains. It was first distinguished by Dr. Wollaston, who discovered that the specimens were an alloy of iridium and osmium.

PALLADIUM. PALLADIUM OCTAHEDRUM.

Octahedral Palladium, *Haid.* Native Palladium.

461. *Primary form:* supposed to be the regular octahedron. Occurs mostly in grains apparently composed of diverging fibres.

H. above 4·5. G.=11·8, Wollaston; 12·14, Lowry. *Lustre* metallic. *Color* steel-gray, inclining to silver white. Opaque. Ductile and malleable.

It consists of palladium, alloyed with a little platinum and iridium. It is infusible, *per se*, before the blowpipe, but it fuses readily with sulphur. By continuing the heat, the sulphur is driven off, and a globule of palladium obtained.

Obs. Palladium occurs with platinum, in Brazil. Its divergent structure distinguishes it from the latter metal. It was first made known by Wollaston.

SELENPALLADITE. PALLADIUM RHOMBICUM.

Seleniet of Palladium.

462. *Primary form:* a hexagonal prism. Occurs in six sided tables, which have a foliated structure, and cleave parallel to the base of the prism.

Lustre metallic. *Color* white—grayish-white. Opaque. Brittle. If heated in a tube, it gives a red ring of selenium. Heated strongly before the blowpipe it becomes colored, and fuses into a brittle metallic globule; with borax it forms a transparent glass.

Obs. It exists in considerable quantities at Tilkerode, in the Duchy of Anhalt-Bernborg, in the Hartz, associated with selenid of lead and native gold, where it was first detected by M. Zinken.

GOLD. Aurum cubicum.

Hexahedral Gold, *M.* Native Gold. Gediegen Gold, *W.* Electrum, *Haus.* Or Natif, *H.* Sol. *Alchym.* Rex Metallorum.

463. *Primary form:* the cube. *Secondary form:* figs. 2—11, inclusive, of Pl. I., also figs. 14, 15, 16. *Cleavage* none. *Compound crystals:* composition similar to that represented in fig. 129, but occurring in the form exhibited in fig. 16, Pl. I., or the tetragonal trisoctahedron. *Imperfect crystallizations:* filiform, reticulated and arborescent shapes—also in thin laminæ; also in imbedded grains and rolled masses.

H.=2·5—3. G.=12—20. *Lustre* metallic. *Streak* and *Color* various shades of gold yellow, sometimes inclining to silver-white. Opaque. Very ductile and malleable.

The ores of gold in nature, usually contain silver in different proportions. The largest proportion of silver is found in the *electrum* of Klaproth, which is composed of Gold 64, and Silver 36, or two of gold to one atom of silver.

Obs. The native gold of Marmato, is composed of Gold 73·45, Silver 26·48, or 3 parts of gold to 1 of silver. Its specific gravity is only 12·666, as determined by Boussingault. The proportion of 3½ : 1 has been found by Rose in the gold of Titiribi, in Columbia; that of 5 : 1 by Boussingault in gold from Trinidad; 6 : 1 by Boussingault in specimens from Ojas Anchas, and by Rose in specimens from near Nischne Tagilsk, in Siberia, and St. Barbara, Transylvania. The proportion of 8 : 1 is the most abundant; such is the case in a specimen from Gozuschka, Nischne Tagilsk, which Rose found to contain 87·17 of Gold, and 12·41 of Silver; also in numerous others analyzed by the same chemist, and also by Boussingault. That of 12 : 1 is also of frequent occurrence. Boussingault found a specimen from St. Bartholomé to contain Gold 91·9, and Silver 8·1; another from Girar to be composed of Gold 91·9, and Silver 8; in each of which, the proportion of gold to silver is that last stated. A similar composition was found by Rose, in specimens from different localities; one from Boruschka contained Gold 91·36, and Silver 8·38. The least quantity of silver was found by G. Rose, in the native gold of Schabrowski, near Catharinenburg, in Siberia. It was composed of Gold 98·96, Silver 0·16, Copper 0·35, Iron 0·05=99·52. Its specific gravity was 19·099. Copper is also occasionally alloyed with gold.

It also occurs disseminated in grains or thin leaves in various metallic minerals, particularly iron pyrites.

Native gold occurs in veins, and in interspersed grains and laminæ, and occasionally crystallized, in quartz. In the United States, this quartz gangue forms beds in the mica slate of the region. Occasionally the mica slate has a talcose character. It is often found in the sands of rivers, and valleys, where it has been carried from the disintegration of auriferous rocks. Such is its mode of occurrence in Brazil, Mexico, and Peru, in which countries it is occasionally met with in masses of several pounds weight. Masses weighing even sixteen pounds have been discovered in the Ural, where the gold occurs in a similar situation. In Transylvania, a considerable quantity of gold is obtained from stream works. It is met with in alluvial soil, in the

Wicklow mountains of Ireland, and at Leadhills, in Scotland. A specimen, weighing nearly eight sovereigns, from the Breadalbane estate, near Glen Coich, in Perthshire, is now in the mineralogical cabinet of Mr. Allan, of Edinburgh. At Vorospatak, in Transylvania, the gold is disseminated in grains through the rock. The mines of Hungary and Transylvania, Kremnitz, Schemnitz, Posing, Botza, Magurka, Nagyag, Offenbanya, and Boitza, occasionally afford fine specimens of this metal. It occurs also in Salzburg, and thence in several places along the Alps, as far as La Gardette, near Allemont, in Dauphiny. The Russian mines, in the Uralian mountains, are quite productive.

The mines in the United States are quite as promising as any in the world. The principal deposits of gold, at present discovered, are situated within the states of Georgia, the Carolinas, and Virginia; but it has been traced as far north as the Chaudière river, in Lower Canada, and is believed to occur in a nearly continuous line from the Rappahanock, in Virginia, to the Coosa, in Alabama. The mines in North Carolina are mostly within the three ranges of counties between Frederick and Charlotte, which are situated about in a line running N. E. and S. W., corresponding in general with the direction of the coast. The mines at Mecklenburg, which are principally vein deposits, are the most valuable. The mines of Burke, Lincoln, and Rutherford, are for the most part in alluvial soil. Splendid specimens have occasionally been found, the most magnificent of which was discovered in Cabarras county; it weighed twenty eight pounds. In Virginia, valuable deposits occur in Spotsylvania Co., ten miles above Fredericksburg, on the Rappahanock river, at the U. S. gold mines; accompanying silver, lead, and Vivianite, at Rappahanock gold mines, Stafford Co., ten miles from Falmouth; in quartz and decomposed pyrites, at the Culpepper mines, Culpepper Co., on Rapidan river; in auriferous pyrites distributed through veins of quartz, lying in hornblende slate, at Orange grove gold mine, Orange Co.; in quartz, and also in alluvial deposits, at the Greenwood gold mines, Orange Co.; in beds of quartz, from one to two feet thick, associated with iron pyrites, copper pyrites, blende, argentiferous galena, spathic iron, and Anglesite, at Walton's gold mine, Louisa Co. About $100,000 have been obtained by washing along the streams in the vicinity of this mine. It accompanies granular heavy spar, in auriferous pyrites, at Eldridge's mine, in Buckingham Co., and occurs in various other parts of the state.

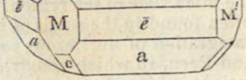
Gold is the most ductile and malleable of the metals. According to Dr. Ure, a grain may be made to cover in the form of gold leaf, 56¾ square inches; and Reaumur states, that a grain, extended to the thinness it has upon gilt silver wire, will cover an area of 1400 inches. The thinnest gold leaf is the 280 thousandth part of an inch thick. On account of the extreme malleability of this metal, though costly, it is one of the most common and cheapest means of ornamenting furniture, &c. It retains its perfect brightness of lustre uninfluenced by moisture and the atmosphere, and for this reason is perfectly fitted for its various ornamental uses, and also for numerous purposes in the arts.

The name *electrum*, was applied by the ancients to an alloy of silver and gold, in the proportion of one to five. This is the origin of Klaproth's name for a similar native alloy.

AURO-TELLURITE. Aurum rhombicum.

Yellow Ore of Tellurium. White Ore of Tellurium.

464. *Primary form:* a right rhombic prism. *Secondary form:* $M : \bar{e}=142^\circ\ 45'$, $M : \breve{e}=127^\circ\ 15'$, $P : a=108^\circ\ 30'$, $P : a=143^\circ\ 5'$. *Cleavage* in traces. Occurs in small crystals and imbedded crystalline laminæ. Soft. G.=10·678, Muller von Reichenstein. *Lustre* metallic. *Color* silver-white, much inclining to brass-yellow. Opaque. Rather brittle.



According to Klaproth, (Beitrage, iii. 28,) it contains Tellurium 44·75, Gold 26·75, Silver 8·50, Lead 19·50, Sulphur 0·50. Before the blowpipe it fuses into a metallic globule, and gives out a pungent odor. It is soluble in nitric acid.

Obs. Its only known locality is at Nagyag, in Transylvania, where it is associated with graphic gold and manganblende.

SILVER. Argentum octahedrum.

Hexahedral Silver, *M.* and *J.* Native Silver. Gediegen Silber, *W.* Argent Natif, *H.*

465. *Primary form:* the regular octahedron. *Secondary forms:* figs. 2, 3, 4, 16, and others intermediate, Pl. I. *Cleavage* none. *Compound crystals:* fig. 129, Pl. II. *Imperfect crystallizations:* coarse and fine filiform, reticulated and arborescent shapes; also in plates, and in superficial coatings.

H.=2·5—3. G.=10·4743, Haüy; 10·338, Gellert. *Lustre* metallic. *Streak* shining, metallic. *Color* silver-white; subject to tarnish, by which the color becomes a grayish-black. Ductile.

Native silver is usually an alloy of silver and copper. The composition, according to Berthier, of a specimen from Carey, is Silver 90, and Copper 10. It is also combined with gold in various proportions, as is stated under gold. Fordyce obtained from an alloy of this kind, Silver 72, and Gold 28; and Klaproth, from another ore, obtained Silver 36, and Gold 54. Probably several of the compounds of gold and silver will constitute distinct species, when their peculiarities shall have been more studied. It fuses readily in the blowpipe flame, and affords on cooling a globule, having an angular crystalline form. It dissolves in nitric acid and heated sulphuric acid.

Obs. Native silver occurs principally in arborescences and filiform shapes, in veins of calcareous spar or quartz, traversing gneiss slate, and other primitive rocks. The structure of these forms is sometimes quite peculiar; they being composed of one or more series of octahedrons, either closely united or arranged perpendicularly in straight rows. This structure is very apparent in most of the Norwegian and Mexican varieties.

The mines of Kongsberg, in Norway, formerly afforded magnificent specimens of native silver; they are now, however, for the most part, under water. One specimen among the splendid suite from this locality, in the royal collection at Copenhagen, weighs upwards of 5 cwt. Its principal Saxon localities are at Frieberg, Schneeberg, and Johanngeorgenstadt; its Bohemian, at Przibram, Jochimstahl, and Ratiborzitz. It also occurs in small quantities with other ores at Andreasberg, in the Hartz, in Suabia, Hungary, at Allemont, in Dauphiny, and in some of the Cornish mines. A mine on the estate of Alva, in Stirlingshire, about the middle of last century, afforded not less than £40,000 or £50,000 worth of silver; but it was long since abandoned.

Mexico and Peru are at present the most productive in silver. In Mexico it has been obtained mostly from its ores, while it occurs principally native in Peru. During the first 18 years of the present century, more than 8,180,000 marks of silver were afforded by the mines of Guanaxuato alone. Of the 8,000,000 sterling which it is calculated is the value of silver annually afforded by the mines of the world, about two thirds are obtained from Mexico.

The uses of silver as a material for coins, also in the manufacture of plate and various articles of luxury, are well known. For coinage it is alloyed in this country with 10 per cent. of copper, by which it is rendered harder, and consequently more durable. It is less malleable than gold, it being impossible to hammer it into unbroken leaves thinner than the hundred and sixty thousandth part of an inch, which is more than one third thicker than gold leaf.

MERCURY. Hydrargyrum fluidum.

Fluid Mercury, *M.* Native Mercury, or Quicksilven. Gediegen Quecksilber. Mercure Natif, *H.* Hydrargyum. Argentum Vivum. Spuma argenti. Liquor Æternalis, *Pliny.* Mercurius *of the alchemists.*

466. *Primary form:* the regular octahedron. Occurs in small fluid globules scattered through its gangue.

G.=13·568. *Lustre* metallic. *Color* tin-white. Opaque.

It is entirely volatile before the blowpipe, it vaporizing at the temperature of 662°, F. It becomes a solid at 39°, F., and with a little care will then crystallize in octahedrons. It dissolves readily in nitric acid.

Obs. Fluid mercury is a rare mineral; the quicksilver of commerce is mostly obtained from cinnabar, one of its ores. Its most important mines are those of Idria, in Carniola, and Almaden, in Spain. At Idria it occurs interspersed through a kind of slate clay, from which it is obtained by washing. The Idria mines, at the present time, afford annually, from its ores and the native metal, about 164 tons, which is a less quantity than formerly. Native mercury is also found in small quantities at Wölfstein and Mörsfield, in the Palatinate, in Carinthia, Hungary, Peru, and other countries. It has been lately discovered at Peyrat le Chateau, in the department of the Haute Vienne, in a disintegrated granite, unaccompanied by cinnabar.

Mercury is of great importance in the extraction of gold and silver ores, for which purpose it is exported in large quantities to South America. It is also employed for silvering mirrors, for thermometers and barometers, for percussion powders, and for various other purposes connected with medicine and the arts.

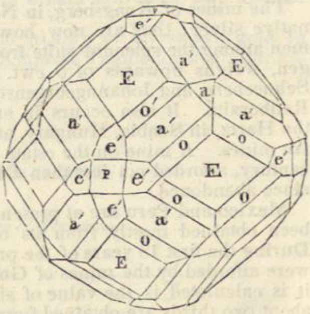
The common name of this metal, quicksilver, is a translation of the old name, argentum vivum, and in part also of hydrargyrum, which signifies liquid silver.

AMALGAM. Hydrargyrum dodecahedrum.

Dodecahedral Mercury, *M.* Native Amalgam. Naturlich Amalgam, *W.* Amalgam, *Haus.* and *L.* Mercure Argentif, *H.*

467. *Primary form:* the rhombic dodecahedron. *Secondary forms:* figs. 4, 6, 8, 9, 16, Pl. I., also the annexed figure. *Cleavage* parallel to E, or the faces of the dodecahedron, in traces. Occurs also massive.

H.=2—3·5. G.=10·5—14; 13·755, Haidinger. *Lustre* metallic. *Streak* and *color* silver-white. Opaque. *Fracture* conchoidal, uneven. Brittle. Cutting it with a knife is attended with a grating noise.



It contains, according to Klaproth (Beitrage, i. 183) and Cordier, (Phil. Mag. xiv. 41,)

Mercury	64	72·5
Silver	36=100, K.	27·5=100, C.

The first of these analyses corresponds nearly to two atoms of mercury and one of silver; the second to three atoms of mercury and one of silver.

The blowpipe heat volatilizes the mercury, and leaves a globule of pure silver. When rubbed on copper it communicates to it a silvery lustre. It dissolves in nitric acid.

Obs. This rare species occurs principally in the Palatinate, at Moschellandsberg, where occasionally large and highly modified crystals are found. It is associated with mercury and cinnabar, in ferruginous and argillaceous veins, and is said to occur where the veins of mercury and silver intersect one another. It has also been found at Rosenau, in Hungary, and has been observed in the mine of Sala, in Sweden.

LEAD. Plumbum octahedrum.

Hexahedral Lead, *Haid.* Gediegen Blei, *L.* Plomb Natif. Saturnus, *of the alchemists.* Plumbum nigrum.

468. *Primary form:* the regular octahedron. In delicate membranes, and in small globular masses.

H.=1·5. G.=11·3523. *Lustre* metallic. *Color* lead-gray. Opaque. *Fracture* hackly. Malleable and ductile.

It fuses readily, and covers the supporting charcoal with a yellow oxyd.

Obs. This species has been found in small quantities in Michigan, on the Anglaise river, forming delicate membranes in the cleavage joints of galena. It is reported as occurring at Alston, in Cumberland, in minute globules imbedded in galena. It has also been observed in the lava of Madeira.

The uses of lead are too well known to require enumeration.

BISMUTH. Bismutum octahedrum.

Octahedral Bismuth, *M.* Native Bismuth, Gediegen Wismuth, *W.* Bismuth Natif, *H.* Bisemutum, *Agricola.* Plumbum Cinereum. Tectum Argenti. Antimonium Femininum.

469. *Primary form:* the regular octahedron. *Cleavage* highly perfect, parallel with the faces of the octahedron. Occurs also in reticulated and arborescent shapes, and foliated and granular masses.

H.=2—2·5. G.=9·737. *Lustre* metallic. *Streak* and *Color* silver-white, with a reddish hue; subject to tarnish. Opaque. *Fracture* not observable. Sectile. Brittle when cold, but when heated may be malleated.

It is pure bismuth, excepting occasionally a slight admixture of arsenic. It fuses readily, its fusing temperature being as low as 476° F. Before the blowpipe it evaporates, and leaves a yellow coating on the charcoal. It dissolves in nitric acid; subsequent dilution causes a white precipitate. Crystallizes readily from fusion.

Bismuth occurs in veins which traverse gneiss and clay slate, accompanying various ores of silver, cobalt, lead, and zinc. It occurs the most abundantly at the silver and cobalt mines of Saxony and Bohemia, Schneeberg, Annaberg, Altenberg, Joachimstahl, Johanngeorgenstadt, &c. It has also been found at Modum, in Norway, and Fahlun, in Sweden. At Schneeberg it forms arborescent delineations in brown jasper. At Wheal Sparnon, near Redruth, and at Carrock Fell, in Cumberland, it is associated with ores of cobalt; formerly it was met with near Alloa, in Stirlingshire.

Lane's Mine, in Monroe, Conn., is its only known locality in the United States;

it is there associated with wolfram, tungstate of lime, galena, blende, &c., and is imbedded in quartz.

Bismuth is employed in the formation of type metal, pewter, solder, &c. It is one of the constituents of the alloy, called, from its extreme fusibility, *fusible metal*, it melting at a temperature below that of boiling water; the proportions of the component parts of this alloy are 8 parts of Bismuth, 5 of Lead, and 3 of Tin. It is sometimes used for taking casts of delicate objects that would be destroyed by heat.

BISMUTH SILVER. Bismutum Argenticum.

Bismuthic Silver Ore. Wismuth Silber, *of the Germans*. Bismuth Sulfuré Plombo-Argentifère, *Levy*.

470. Rarely presents acicular or capillary crystallizations; generally in amorphous masses.

Soft. *Lustre* metallic. *Color* tin-white or grayish; subject to tarnish. Opaque. *Fracture* uneven. Sectile.

It contains Bismuth 27, Lead 33, Silver 15, Iron 4·3, Copper 0·9, Sulphur 16·3. It is soluble in nitric acid. Before the blowpipe it fuses readily into a silver button, covering the charcoal with the oxyds of lead and bismuth.

Obs. It accompanies copper pyrites, in amorphous masses, at Schapbach, in the Valley of Kintzig, in Baden.

COPPER. Cuprum octahedrum.

Octahedral Copper, *M.* and *J.* Gediegen Kupfer, *of the Germans*. Cuivre Natif, *H.* Venus *Alchem.*

471. *Primary form:* the regular octahedron. *Secondary forms:* figs. 1—11 inclusive, Pl. I. *Cleavage* none. *Compound crystals:* composition parallel to a face of the octahedron; variously modified. *Imperfect crystallizations:* arborescent and filiform shapes; amorphous.

H.=2·5—3. G.=8·5844, Haüy. *Lustre* metallic. *Streak* metallic shining. *Color* copper-red. Ductile and malleable. *Fracture* hackly.

It consists purely of copper. Before the blowpipe it fuses readily; on cooling, it is covered with a coating of black oxyd. It dissolves readily in nitric acid, with the extrication of the red fumes of nitrous acid, and produces a blue solution with ammonia.

Obs. Copper occurs in beds and veins accompanying its various ores, and sometimes associated with iron. It is frequently found in loose masses imbedded in the soil.

The finest crystalline specimens are brought from Siberia and the island of Nalsoe, in Faroe, where it is associated with fibrous mesotype in amygdaloid, and though mostly disseminated in minute particles, it sometimes branches through the rock with extreme beauty. Cornwall, and many of the mines near Redruth, however, are the greatest repositories of this metal; it also occurs in considerable quantities at the Consolidated Mines, Wheal Buller, and others. Its crystallizations are seldom regular, but usually lengthened, and grouped in elongated series, similar to native silver. Brazil also affords native copper.

This metal has been found native throughout the red sandstone region of the United States, particularly in Massachusetts, Connecticut, and still more abundantly in New Jersey, where it has been met with at several different places, sometimes in fine crystalline masses. A magnificent mass exists near Lake Superior. In the Yale College cabinet there is a large irregular mass weighing 137 lbs. from the vicinity of this Lake, near the On-ta-naw-gaw river. Another specimen still remains on the west bank of this river, which, according to the computation of Mr. Henry R. Schoolcraft, who has seen and described it, weighed, in 1821, about 2200 lbs. Smaller masses are quite common in the same region.*

Copper is of very extensive application in the arts. In the pure state it forms various utensils, the sheathing of ships, &c. Alloyed with zinc, it constitutes brass, and with tin, it forms bell metal. A similar alloy, in different proportions, composed the material of which the ancients made their *brass* weapons and cutting instruments. The proportion in these instruments was about as five of copper to one of tin, which is the ratio that affords an alloy of maximum hardness. This was the constitution of an ancient dagger, analyzed by Hielm. The term χαλκος, or *æs*, which was applied to this material, was also a general appellation for copper, and the various alloys in which it was the principal ingredient.

TELLURIUM. TELLURIUM HEXAGONUM.

Native Tellurium, *M.* and *P.* Hexahedral Tellurium, *P.* Gediegen Sylvan, *W.* Gediegen Tellur, *Haus.* and *L.* Tellure Natif Auro-Ferrifère, *H.*

472. It has been found in crystals, which, according to Mr. W. Phillips, are regular six sided prisms, with the terminal edges replaced; P : e=122° 24′. *Cleavage* undetermined. It also occurs massive and granular.

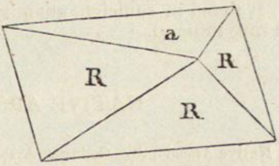
H.=2—2·5. G.=5·7—61, Phillips. *Lustre* metallic. *Streak* and *Color* tin-white. Brittle.

It contains, according to Klaproth, Tellurium 92·55, Iron 7, and Gold 0·25. It fuses readily on charcoal, burning with a greenish flame, and volatizes almost entirely in white vapors.

OBS. Native tellurium has hitherto been found only in the mine of Maria Loretto, at Facebay, near Zalathna, in Transylvania, where it occurs in sandstone, accompanying quartz, iron pyrites, and gold. About forty years since it was found in considerable abundance, and was melted to extract the small quantity of gold it contains. At present it is very rare.

NATIVE ANTIMONY. STIBIUM RHOMBOHEDRUM.

Rhombohedral Antimony, *M.* Dodecahedral Antimony, *J.* Native Antimony, Gediegen Antimon, Oder Speisglas, *W.* Gediegen Speissglanz, *Haus.* Antimoine Natif, *H.*



473. *Primary form:* an obtuse rhombohedron; R : R=117° 15′. *Secondary form:* the annexed figure. *Cleavage* highly perfect and producing a surface of splendent lustre, parallel to a, also distinct, parallel with R. Seldom in crystals: generally massive, structure lamellar.

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* Silliman's Am. Jour. III. 201, on the Native Copper of the southern shore of Lake Superior, by H. R. Schoolcraft.

H.=3—3·5. G.=6·72, Klaproth; 6·646, a Swedish variety. *Lustre* metallic. *Streak* and *color* tin-white. Rather brittle; not ductile.

It contains, according to Klaproth, Antimony 98, Silver 1, and Iron 0·25=99·25. Before the blowpipe it soon melts into a globule, which continues to burn though the heat be removed; a continuation of the heat causes it to evaporate in white fumes, which are deposited around the globule. Under the microscope, yellowish white octahedrons, probably of antimonious acid, are seen to be first formed, and subsequently, prismatic crystals of oxyd of antimony, with which at last the whole globule is covered. It crystallizes readily from fusion.

Obs. It occurs in lamellar concretions in limestone at Sahlberg, near Sahla, in Sweden; at Andreasberg, in the Hartz; in argentiferous veins in gneiss, at Allemont, in Dauphiny; at Przibram, in Bohemia; in Mexico, and other places. It is often accompanied by the following species, from which, however, it is readily distinguished by means of the blowpipe. Antimony is variously employed in the arts, and for pharmaceutical preparations. One part of antimony is alloyed with 16 parts of lead in the formation of type metal. With tin, it forms the metal on which music is engraved.

ANTIMONIAL SILVER. STIBIUM RHOMBICUM.

Prismatic Antimony, *M.* Octahedral Antimony, *J.* Antimoniet of Silver, Spiesglas-Silber, *W.* Silber Speissglanz, *Haus.* Antimon Silber, *L.* Argent Antimonial, *H.*

474. *Primary form:* a right rhombic prism. *Cleavage* parallel to P distinct. *Compound crystals:* similar to those of Arragonite and white lead ore. *Imperfect crystallizations:* composition granular, particles of various sizes, weakly coherent.

H.=3·5—4. G.=9·44—9·8; 9·4406, Haüy. *Lustre* metallic. *Streak* and *Color* silver-white, inclining to tin-white. Opaque. *Fracture* uneven.

It contains, according to Klaproth, (Beitrage, ii. 298,) and Vauquelin, (Haüy, iii. 392,)

Silver	84	76	77	78
Antimony	26=110, K.	24=100, K.	23=100, K,	22=100, V.

Before the blowpipe gray fumes of antimony are given off, and a gray metallic globule, which is not malleable, is left. By continuing the heat the silver is obtained.

Obs. It occurs in veins at Altwolfach, in Furstenberg, Wittichen, in Swabia, and Andreasberg, in the Hartz, associated with several ores of silver, native arsenic, galena, and other species.

If found in sufficient quantity, this would be a valuable ore of silver; but it is yet a rare mineral.

NATIVE ARSENIC. ARSENIUM RHOMBOHEDRUM.

Native Arsenic, *M.* Gediegen Arsenik, *W.* Arsenic Natif, *H.* Arsenicum. Αῤῥενικον, Αρσενικον.

475. *Primary form:* an obtuse rhombohedron; R : R=114° 26′. *Cleavage* imperfect parallel with a. Presents also reticulated, reniform, and stalactitic shapes; structure columnar or granular: when the former, a cleavage is observed perpendicular to the axis of the individual.

H.=3·5. G.=5·672, Harepath. It varies from 5·67—5·93. *Lustre* metallic. *Streak* and *Color* tin-white, tarnishing soon to dark-gray.

When heated it volatilizes in a white smoke, which has the odor of garlic; if heated nearly to redness it burns with a pale bluish flame, giving out alliaceous white fumes.

Obs. Native arsenic commonly occurs in veins in primitive mountains, and is often accompanied by red silver ore, realgar, blende, and other metallic minerals. The silver mines of Freiberg, Annaberg, and Schneeberg, afford this metal in considerable quantities. It occurs also at Joachimstahl, in Bohemia; at Andreasberg, in the Hartz; at Kapnik, in Transylvania; at Orawitza, in the Bannat; at Zincoff, in Siberia, in large masses, and at St. Marie aux Mines, in Alsace.

Its peculiar odor when heated, which is also apparent when struck with a hammer, is quite characteristic. Arsenic is a virulent poison. It is employed in several pharmaceutical preparations. It is also used in giving a peculiar tint to glass, and in various metallurgical operations.

The name Arsenic, is derived from the Greek, αρσενικον, or αρρενικον, *masculine*, a term applied to orpiment or sulphuret of arsenic, on account of its potent properties.

ORDER IX.—PYRITINEA.

ARSENICAL SILVER. Argyrites Argenteus.

Arsenical Antimonial Silver, *P.* Arseniet of Silver, *Thom.* Arsenik-Silber, *W.* Argent Arsenical, *Levy.* Argent Antimonial Ferro-Arsenifère, *H.*

476. *Primary form:* unknown; occurs generally mammillated, or in curved lamellar distinct concretions, consisting of very thin crystalline coats.

H.=4. G.=9·4. *Lustre* shining or glimmering, metallic. *Streak* shining. *Color* nearly that of native silver, but usually tarnished of a blackish color. Opaque. *Fracture* uneven. Sectile.

According to Klaproth, (Beitrage, i. 187,) the variety from Andreasberg contains, Silver 12·75, Arsenic 35, Antimony 4, and Iron 44·25.

Before the blowpipe it affords a strong alliaceous odor, accompanying the fumes of the volatilized arsenic and antimony; and their remains a globule of impure silver surrounded by a slag.

Obs. It occurs at Andreasberg, in the Hartz; at Guadalcanal, in Estremadura, in Spain; and at Kongsberg, in Norway, associated with antimonial silver, galena, and native arsenic. The arsenical fumes under the blowpipe, and its liability to tarnish, distinguish it from the antimonial silver, for which it might be mistaken.

NICKEL STIBINE. Argyrites eutomus.

Eutomous Cobalt Pyrites, *M.* Nickeliferous Gray Antimony, Nickelspiesglaserz, *of the Germans.* Antimoine Sulfuré Nickelifère, *H.*

477. *Primary form:* the cube. *Cleavage* parallel with P perfect. Occurs also massive—structure granular.

H.=5—5·5. G.=6·451, a cleavable variety. *Lustre* metallic. *Color* steel-gray, inclining to silver-white. Brittle.

Its composition, as determined by Klaproth and Stromeyer, is as follows:

Nickel	36·60	25·25
Antimony	43·80	47·75
Sulphur	17·71	15·25
Arsenic	——	11·75
Iron and Manganese	1·89=100, S.	——=100, K.

In the blowpipe flame it is partly volatilized, and the charcoal is covered with a white coating. Ultimately it fuses into a metallic globule, which communicates a blue color to glass of borax.

Obs. It occurs in the duchy of Nassau, in the mines near Freussberg, associated with sparry iron, galena, and copper pyrites.

ANTIMONIAL NICKEL. Argyrites hexagonus.

Antimoniet of Nickel.

478. *Primary form:* a hexagonal prism. *Secondary form:* thin hexagonal plates.

H. = about 5·5. *Lustre* metallic, splendent. *Streak* reddish-brown. *Color* in the fresh fracture light copper-red, inclining strongly to violet. Opaque. *Fracture* uneven—small subconchoidal. Brittle. Not acted on by the magnet.

According to Stromeyer, (Poggendorf's Annalen, xxxi. 134,) it contains, Nickel 28·946, Antimony 63·734, Iron 0·866, Sulphuret of Lead 6·437=99·983. Some antimony sublimes before the blowpipe.

Obs. It occurs in the Andreasberg mountains, associated with calcareous spar, galena, and smaltine.

COPPER NICKEL. Argyrites cupricolor.

Prismatic Nickel Pyrites, *M.* Arseniet of Nickel, *Thom.* Kupfer Nickel, *W.* Arsenik-Nickel, *L.* Nickel Arsenical, *H.*

479. *Primary form* is stated to be trimetric. Occurs usually massive—structure nearly impalpable; also reniform, with a columnar structure.

H.=5—5·5. G.=7·655. *Lustre* metallic. *Streak* pale brownish-black. *Color* copper-red. Opaque. *Fracture* uneven. Brittle.

It contains, according to Pfaff, (Schweig. Journ. xxii. 256,) Berthier, (Ann. des Mines, iv. 467,) and Stromeyer, (Mohs, ii. 447,)

Nickel	48·90	39·94	44·206
Arsenic	46·42	48·80	54·726
Iron	0·34	trace	0·337
Sulphur	0·80	2·00	0·401
Antimony	——	8·00	——
Lead	0·56=97·02, P.	Cobalt 0·16=98·9, B.	Lead 0·320=99·99, S.

According to Stromeyer's analysis, it is composed of one atom of arsenic and one of nickel. Before the blowpipe, on charcoal, it emits arsenical fumes and fuses into a white globule, which darkens by exposure to the air. In nitric acid it soon assumes a green coating, and in nitromuriatic acid is dissolved.

Obs. Copper nickel accompanies cobalt, silver, and copper, in the Saxon mines of Annaberg, Schneeberg, &c.; also in Thuringia, Hessia, and Styria, and at Allemont, in Dauphiny. It is occasionally observed in Cornwall.

It is found at Chatham, Conn., in gneiss, associated with smaltine.

Nickel is employed in the manufacture of what is called "German silver," of which it constitutes 17·48 per cent.; the other constituents are copper 53·9, and zinc 29·13.

WHITE NICKEL. Argyrites Hoffmanni.

Binarseniet of Nickel, *Thom.*

480. *Primary form:* supposed to be the cube. *Secondary forms:* figs. 2 and 5, Pl. I. Occurs also massive.

Lustre metallic. *Color* tin-white. Opaque. *Fracture* uneven.

It contains, according to Booth, (Silliman's Am. Journn. xxix. 241,) and Hoffmann, (Poggendorf's Annalen, xxv. 491,)

	Riechelsdorf.		Schneeberg.
Arsenic	72.64		71·30
Nickel	20·74		28·14
Cobalt	3·37	Bismuth	2·19
Iron	3·25	Copper	0·50
Sulphur	—=100, B.		0·14=102·27, H.

It evolves arsenical fumes before the blowpipe, and fuses into a brittle metallic button. Fused with salt of phosphorus, it affords a clove-brown transparent glass in the outer, and a brown opaque glass in the inner flame, thus indicating the presence of nickel.

Obs. It occurs in crystals in the cobalt mine of Riechelsdorf, in Hesse; also massive at Schneeberg, mixed with quartz, and often covered with a thin coating of nickel green.

NICKEL GLANCE. Argyrites decrepitans.

Sulpho-arsenide of Nickel, *Thom.*

481. *Primary form:* the cube. *Cleavage* highly perfect parallel with the primary form. Occurs also in lamellar and granular masses.

H.=5·5. G.=6·097—6·129. *Lustre* metallic. *Color* silver-white—steel gray.

It contains, according to Berzelius, (Kong. Vet. Acad. Handl., 1820, p. 241,)

Arsenic	55·50	53·32	48·06
Nickel	28·17	27·00	19·29
Sulphur	12·67	14·40	30·80
Iron	3·63	5·29	2·99
Silica	0·61=100·58.	——=100·01.	1·00=102·14.

When heated it decrepitates with great violence. Ignited in a glass tube, sulphuret of arsenic sublimes as a transparent yellowish-brown mass, which remains clear on cooling.

Obs. It occurs at Loos, in Helsingland, Sweden, and in the Albertine mine, near Harzgerode, in the Hartz. It is associated with copper pyrites, galena, calcareous spar, fluor spar, and quartz. It was noticed by Cronstedt, but first analyzed and described by Pfaff.

LEUCOPYRITE. Argyrites acrotomus.

Axotomous Arsenical Pyrites, *M.* Prismatic Arsenical Pyrites, *J.*

482. *Primary form:* a right rhombic prism; M : M=122° 26′. *Secondary form:* similar to the figure of liroconite, p. 241; a : a (adjacent planes) =51° 20′. Occurs also massive.

H.=5—5·5. G.=7·228, specimen from Silesia; 7·337, a crystal from Bedford Co., Penn. *Lustre* metallic. *Streak* grayish-black. *Color* between silver-black and steel-gray. *Fracture* uneven. Brittle.

Obs. It occurs associated with copper nickel at Schladming, in Styria; with serpentine at Richenstein, in Silesia; and at Löling, near Hüttenberg, in Carinthia, in a bed of sparry iron, associated with bismuth and scorodite.

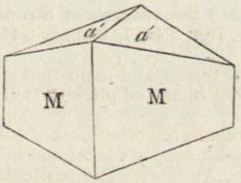
A crystal, weighing two or three ounces, has been found in Bedford Co., Penn., but it is not known under what circumstances. In Randolph Co., N. C., a mass was found weighing nearly two pounds.

MISPICKEL. Argyrites peritomus.

Prismatic Arsenical Pyrites, *M.* Marcasite. Sulpho-arsenite of Iron. Arsenik-kies, *of the Germans.* Fer Arsenical, *H.*

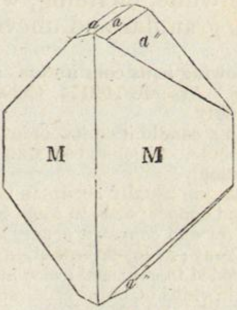
483. *Primary form:* a right rhombic prism; M : M=111° 53′. *Secondary forms:*

1.



Franconia, N. H.

2.



Franconia, N. H.

$a' : a'=145^\circ\ 26'$, $a : a=118^\circ\ 32'$, $a'' : a''=80^\circ\ 8'$. *Cleavage* parallel to M rather distinct. *Compound crystals:* composition of the first kind parallel with M. *Imperfect crystallizations:* structure columnar—straight and divergent, or irregular; fine granular, or impalpable—particles strongly coherent.

H.=5·5—6. G.=6·127. *Lustre* metallic. *Streak* dark grayish-black. *Color* silver-white, inclining to steel-gray. *Fracture* uneven. Brittle.

It contains, according to Stromeyer and Chevreul,

Iron	36·04	34·94
Arsenic	42·88	43·42
Sulphur	21·08=100, S.	20·13=98·49, C.

On charcoal, before the blowpipe, copious arsenical fumes are driven off, and a globule is obtained of nearly pure sulphuret of iron, which acts on the needle like magnetic pyrites. It gives fire with steel, emitting at the same time an alliaceous odor. It dissolves in nitric acid, with the exception of a whitish residue.

The localities of mispickel are principally in primitive regions, and its usual mineral associates are silver, lead, and tin, iron and copper pyrites, and blende. It is abundant at Freiberg and Munzig, where it occurs in veins; and also in beds at Breitenbrun and Raschau, Andreasberg, Joachimstahl, Tunaberg in Sweden; Wheal Mawdlin, and Unanimity, in Cornwall, are other localities.

It is met with in fine crystallizations in gneiss at Franconia, N. H., associated with copper pyrites. A massive variety occurs at Worcester, Mass., and at Chatham, Conn., associated with smaltine and copper nickel; and at Monroe, Conn., accompanying wolfram, magnetic pyrites, and native bismuth.

SMALTINE. ARGYRITES OCTAHEDRUS.

Octahedral Cobalt Pyrites, *M.* Gray Cobalt. Tin-White Cobalt, *J.* Binarseniet of Cobalt, *Thom.* Weisser-Speiskobold, *W.* Speiskobalt, *Haus.* and *L.* Cobalt Arsenical, *H.*

484. *Primary form:* the regular octahedron. *Secondary forms:* figs. 1—10, and fig. 16, Pl. I.; also several of these forms in combination. *Cleavage* most distinct parallel to the primary faces; also in traces parallel to the faces of the cube and rhombic dodecahedron. *Imperfect crystallizations:* reticulated, and other imitative shapes; granularly massive—particles of various sizes.

H.=5·5. G.=6·466. *Lustre* metallic. *Streak* grayish-black. *Color* tin-white, inclining, when massive, to steel-gray. Opaque. *Fracture* granular and uneven. Brittle.

The following is its constitution, according to the analysis of Stromeyer, (Ann. Phil. x. 228,) Arsenic 74·2174, Cobalt 20·3135, Iron 3·4257, Copper 0·1586, Sulphur 0·8860=99·0012.

Heated in a candle it emits copious arsenical fumes, and melts into a white brittle metallic globule. It colors borax and other fluxes blue, and produces with nitric acid a pink solution.

OBS. Smaltine usually occurs in veins, accompanying other ores of cobalt and ores of silver and copper; also, in some instances, with copper nickel and mispickel.

With silver and copper it occurs at Freiberg, Annaberg, and particularly Schneeberg, in Saxony; at Joachimstahl, in Bohemia, the reticulated varieties are frequently found imbedded in calc spar; also at Wheal Sparnon, in Cornwall; at Riechelsdorf, in Hessia, in veins of cupriferous shale.

Chatham, Conn., is the only known locality of this mineral in the United States. It there occurs in veins traversing gneiss, associated with mispickel and copper nickel. Deep shafts have been cut into the rock at this place for the purpose of working the ore, but the project is now given up.

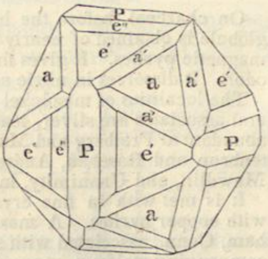
The presence of copper nickel, which is a very common associate with this species, is the cause of no small annoyance to the miner; for even a minute quantity suffices to destroy the fine blue color obtained from cobalt. The ore, when separated from this attendant, is roasted to drive off the arsenic, and finely pulverized, and is then prepared for giving the blue color employed in painting porcelain and stoneware. With silex and potash it affords smalt.

The *radiated white cobalt* of Werner, from Schneeberg, contains, according to John, Arsenic 65·75, Cobalt 28·00, Iron with Manganese 6·25=100.

COBALTINE. ARGYRITES HEMI-CUBICUS.

Hexahedral Cobalt Pyrites, *M.* Silver White Cobalt. Bright White Cobalt. Glance Cobalt. Sulpho-Arseniet of Cobalt, *Thom.* Glanz Kobold, *W.* Kobalt Glanz, *Haus* and *L.* Cobalt Gris, *H.*

485. *Primary form:* the cube. *Secondary forms:* figs. 42—47 inclusive, Pl. I., also the annexed fig. P : e″=166° 30′, P : e′=153° 26′ 5½″. *Cleavage* parallel with P, perfect. Planes P, longitudinally striated. Occurs also massive; structure granular—particles small, but discernible.



H.=5·5. G.=6·298. *Lustre* metallic. *Streak* grayish-black. *Color* silver-white, inclining to red. *Fracture* uneven and lamellar. Brittle.

It contains, according to Fassaert, Klaproth, and Stromeyer,

Cobalt	36·66	44·0	33·1012
Arsenic	49·00	55·5	43·4644
Sulphur	6·50	0·5	20·0840
Iron	5·66=97·82, T.	— =100, K.	2·2324=99·8820, S.

The blowpipe heat causes the extrication of arsenic in white fumes, and produces, after roasting, a dull black metallic globule, which attracts the magnet. It colors borax blue, and effervesces in heated nitric acid, like the preceding species.

Obs. It occurs at Tunaberg and Hokensbo, in Sweden, in large, splendid, well defined crystals; also at Modum, in Norway, where it is mined. Other localities are at Querbach, in Silesia, and at Botallick, near St. Just, and in other places in Cornwall. The most productive mines are those of Wehna, in Sweden, where it occurs in mica slate. These mines were first opened in 1809.

This, and the preceding species, afford the greatest part of the smalt of commerce. It is also employed in porcelain painting.

TERARSENID OF COBALT. Argyrites Karsteni.

Bismuth Cobalt Ore. Terarseniet of Cobalt.

486. Structure radiated.

G.=6—6·7, of pure specimens; usually from an admixture of grains of quartz, as low as 4·5 or 4·7. *Lustre* metallic; sometimes splendent. *Streak* dull; same as color. *Color* between lead-gray and steel-gray.

It contains, according to Karsten, Arsenic 77·9602, Cobalt 9·8866, Iron 4·7695, Bismuth 3·8866, Copper 1·3030, Nickel 1·1063, Sulphur 1·0160=99·9282. Before the blowpipe it gives out fumes of arsenous acid, and coats the charcoal with a yellow crust, the assay becoming at the same time brown. When well roasted, it colors glass of borax blue.

Obs. It has been observed only at Schneeberg, in Saxony.

COBALTIC PYRITES. Argyrites cubicus.

Isometric Cobalt Pyrites, *M.* Sulphuret of Cobalt, *Thom.* Cobalt Kies, *J.* Kobaltkies.

487. *Primary form:* the cube. *Secondary forms:* figs. 2, 3, and others, Pl. I. *Cleavage* parallel to the faces of the cube imperfect. Occurs also massive—structure granular, sometimes impalpable.

H.=5·5. G.=6·3—6·4. *Lustre* metallic. *Color* pale steel-gray, inclining to copper-red when tarnished. Opaque. *Fracture* uneven or subconchoidal.

The Swedish variety contains, according to Hisinger, (Afhandlingar iii. 316,) Cobalt 43·2, Copper 14·4, Sulphur 38·5, Iron 3·53=99·63. It gives off a sulphurous odor when heated, and after roasting, colors glass of borax blue.

Obs. It occurs in gneiss, at Bastnaes, near Riddarhyttan, in Sweden, associated with copper pyrites and hornblende; and at Mussen, near Siegen, in Prussia, with heavy spar and carbonate of iron.

ARSENID OF MANGANESE. Argyrites Manganicus.

Arseniet of Manganese, *Thom.* Arseniuret of Manganese.

488. Occurs in botryoidal masses, also amorphous; structure foliated or granular.

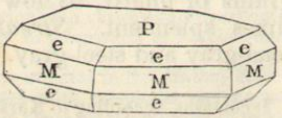
H. above 5? stated as hard. G.=5·55. *Lustre* metallic. *Color* grayish-white. Opaque. *Fracture* uneven.

According to the analysis of Mr. Kane, (Quarterly Journal of Science, new series, vi. 381,) it contains Manganese 45·5, Arsenic 51·8, and a trace of Iron=97·3. Before the blowpipe it burns with a blue flame, and falls into powder; at a higher temperature the arsenic evaporates, and covers the charcoal with a white powder. It dissolves in aqua regia, without leaving any residue.

Obs. It is found in Saxony, and was first observed by Mr. R. J. Kane, of Dublin, attached to a mass of galena from that country.

MAGNETIC PYRITES. Pyrites hexagonus.

Rhombohedral Iron Pyrites, *M.* Sulphuret of Iron. Magnetkies, *W.* Leberkies, *L.* Fer Sulfuré Ferrifère, Fer Sulfurè Magnetique *H.*



489. *Primary form:* a hexagonal prism. *Secondary form:* similar to fig. 125, Pl. II.; also the annexed figure. P : e=108° 41′, M : e=161° 19′, M : *e*=150°. *Cleavage* perfect parallel with P; less so in the direction of M. Commonly massive and amorphous; structure granular.

H.=3·5—4·5. G.=4·631, a crystalline variety. *Lustre* metallic. *Streak* dark grayish-black. *Color* between bronze-yellow and copper-red. *Fracture* small subconchoidal. Brittle. Slightly attractable by the magnet, and subject to speedy tarnish.

It contains, according to Hatchett, (Phil. Trans. 1804, p. 315,) and Stromeyer, (Gilbert's Annalen, xlviii. 183,)

	Cornwall.	Utön.	Pyrenees.
Iron	63·5	59·85	56·37
Sulphur	36·5=100, H.	40·15=100, Strom.	43·63=100, Strom.

Before the blowpipe it affords fumes of sulphurous acid and the odor of sulphur. On charcoal, in the exterior flame, it is converted into a globule of red oxyd of Iron; in the interior flame it fuses and continues to glow, after the blowpipe is removed. The black mass, which on cooling is obtained, exhibits a crystalline structure on a surface of fracture, a metallic lustre, and a yellowish color. It dissolves in dilute sulphuric acid.

Obs. Crystalline plates of this species have been observed at Kongsberg, in Norway, and at Andreasberg, in the Hartz; but they are of rare occurrence. It generally occurs massive, in fissures of primitive rocks. Cleavable varieties accompany iolite at Bodenmais, in Bohemia. The compact specimens are abundant in Cornwall, at Appin in Argyleshire, in Saxony, Silesia, and the Hartz. It has also been observed in the lavas of Vesuvius, and in some meteoric stones.

Trumbull, Conn., and the adjoining town of Monroe, afford the cleavable variety of this species; at the former place, it occurs in the topaz and fluor vein; at the latter, in a quartz vein, in gneiss. Compact varieties occur with iron pyrites, at Stafford and Shrewsbury, Vt., and in many parts of Massachusetts.

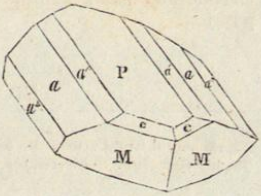
It is mined for its sulphur, and for the fabrication of sulphuric acid and sulphate of iron.

Its inferior hardness is sufficient to distinguish it from the following species.

WHITE IRON PYRITES. Pyrites rhombicus.

Prismatic Iron Pyrites, *M.* and *J.* White Iron Pyrites. White Bisulphuret of Iron. Radiated Pyrites. Spear Pyrites. Hepatic Pyrites. Cellular Pyrites. Kamkies, Leberkies, Zelkies, Sparkies, Wasserkies, *of the Germans.* Fer Sulphuré Aciculaire Radié, Fer Sulfuré Blanc, *H.*

1.



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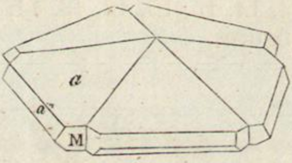


490. *Primary form:* a right rhombic prism; M : M=106° 36′. *Secondary form:* fig. 1., of a crystal from Cornwall. Similar crystals, with merely the modifying planes *a*, have been observed at Warwick, N. Y. P : *a*=130° 55′. *Cleavage* parallel with M, rather perfect. Planes *a* and *a″* longitudinally striated. *Compound crystals:* composition of the first kind—parallel with M. Compound crystals of five individuals, united by the acute lateral angle, are of frequent occurrence. This angle is about one fifth of 360°, which accounts for the occurrence of these forms. For remarks on the structure of other analogous forms, see § 76. Other compound crystals occur, whose structure depends on composition of the third kind, or parallel to *a*. *Imperfect crystallizations:* globular, reniform, and other imitative shapes—structure straight columnar—impalpable; massive; structure columnar or granular. *Pseudomorphs* in low nearly regular hexagonal prisms.

H.=6—6·5. G.=4·678—4·847. *Lustre* metallic. *Streak* grayish-black or brownish-black. *Color* pale bronze-yellow, sometimes inclining to green or gray. *Fracture* uneven. Brittle.

It contains, according to Hatchett, (Phil. Trans. 1804, p. 325,) and Berzelius, (Mineralogie, p. 263,)

Iron	46·4	45·66	45·07
Sulphur	53·6	54·34	53·35
Manganese	—	—	0·70
Silica	—=100, H.	—=100, B.	0·80=99·92, B.

Before the blowpipe, on charcoal, it becomes red, the sulphur is mostly volatilized, and an oxyd of iron remains. Some of the varieties are very liable to decomposition.

Obs. This species was formerly subdivided according to the different forms the mineral presents. *Radiated pyrites* included the radiated masses and more simple crystals; *spear pyrites*, the macled crystals; *hepatic pyrites*, or *leberkies*, (so called from ἧπαρ, *liver*,) the decomposed liver-brown tessular crystals which were original iron pyrites, and also certain hexagonal pseudomorphs; *cockscomb pyrites*, or *kamkies*, the crest-like aggregations of this species of pyrites; *cellular pyrites*, the cellular varieties, formed by the decomposition of crystals of galena, which contained films of pyrites between its layers, thus producing a honeycomb appearance.

The spear pyrites occurs abundantly in the plastic clay of the brown coal formation, at Littmitz and Altsattell, near Carlsbad, in Bohemia, and is extensively mined for its sulphur and the formation of sulphate of iron. The radiated variety occurs at the same places; also at Joachimstahl, and in several parts of Saxony. The cockscomb variety occurs with galena and fluor spar, in Derbyshire. It occurs in stalactitic concretions, in Cornwall.

At Warwick, N. Y., is the only known locality of crystallized specimens in the United States. It is there imbedded in granite, in single crystals, and is associated with zircon. Massive fibrous varieties, abound throughout the mica slate of New England, and particularly at Cummington, Mass., where it is associated with Cummingtonite and garnet. It occurs also at Lane's mine, in Monroe, Conn., and in the topaz and fluor vein, in Trumbull, Conn.; also in gneiss, at East Haddam.

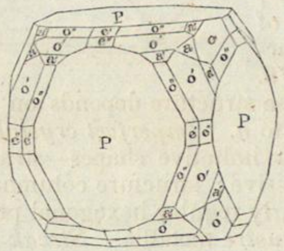
Cockscomb pyrites is employed in the manufacture of sulphur, sulphuric acid, and sulphate of iron, though less frequently than the common iron pyrites. Its color is considerably paler than the ordinary pyrites, and also it is more liable to decomposition.

IRON PYRITES. Pyrites cubicus.

Hexahedral Iron Pyrites, *M.* and *J.* Cubic Pyrites. Mundic. Marchasite. Bisulphuret of Iron, *Thom.* Gemeiner Schwefelkiés, Zelkies, *W.* Eisenkies, *L.* Fer Sulfuré, *H.* πυρίτης.

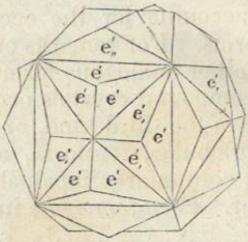
491. *Primary form:* the cube. *Secondary forms:* figs. 2, 3, 4, 14, 15, 16, 42, 43, 44, 45, 46, 47, 48, Pl. I.; also the annexed figures.

1.



Peru.

2.



Schoharie.

P : a=125° 15′ 51¾″, P : a′=144° 44′ 8¼″, P : e″=146° 18′ 36″, P : e′=153° 26′ 6″, P : o′=143° 18′ 3″, P : o″=150° 47′ 39″. *Cleavage* parallel to the faces of the cube and octahedron, more or less distinct. Planes P and e′ often striated. *Compound crystals:* Composition of *the second kind,* parallel to e′. This composition sometimes takes place parallel to each of the edges, when the form in fig. 2 is produced. *Imperfect crystallizations:* imbedded and implanted globules—surface crystalline—structure indistinctly columnar; massive, structure granular—particles strongly coherent.

H.=6—6·5. G.=4·83—5·031. *Lustre* metallic, splendent—glistening. *Streak* brownish-black. *Color* a characteristic bronze-yellow, nearly uniform. Opaque. *Fracture* conchoidal, uneven. Brittle. Strikes fire with steel.

It consists, according to Berzelius, of Iron 45·74, Sulphur 54·26, and is, therefore, a bisulphuret of iron. It becomes red in the oxydating flame of the blowpipe, and gives off fumes of sulphur; ultimately, there is obtained a globule of oxyd of iron, which is attractable by the magnet. It is soluble in nitric acid, except a white residue. Some varieties are very liable to decomposition on exposure to the atmosphere.

Obs. Iron pyrites occurs abundantly in rocks of all ages, from the oldest primitive to the most recent alluvial deposits. It usually occurs in small cubes, but often modified as above described; also in irregular spheroidal nodules and in veins, in clay slate, graywacke slate, the coal formation, &c. Cubes of gigantic dimensions have been found in some of the Cornish mines; pentagonal dodecahedrons and other forms occur on the island of Elba, sometimes three or four inches in diameter. Large octahedral crystals are found at Perzberg, in Sweden. Magnificent crystals have been brought from Peru; but still more brilliant and well finished crystals occur at Traversella, in Piedmont. Alston Moor, Derbyshire, Cornwall, Fahlun in Sweden, Kongsberg in Norway, are well known localities. The clay at Munden, near Hanover, and the chalk at Lewes, in Surry, have afforded some remarkable compound crystals. It has also been met with in the Vesuvian lavas, in small irregular crystals.

The United States have not hitherto afforded any very splendid specimens of this species. It is, however, very abundant. The limestone of Shoreham, Vt., and Schoharie, N. Y., have afforded some interesting forms. Highly polished crystals, similar to fig. 48, with the addition of plane e′, occur at Rossie, N. Y. Small octahedral crystals are common at Lane's mine, Monroe, Conn. It occurs thickly disseminated in graywacke, (mill stone grit,) in grains and small crystals near Utica, N. Y.

This species is of the highest importance in the arts, it affording the greater part of the sulphate of iron and sulphuric acid of commerce, and also a considerable portion of the sulphur and alum. The sulphur and sulphate of iron, or green vitriol, are commonly obtained at one and the same process. The pyrites is usually heated in clay retorts, by which about 17 per cent of sulphur is distilled over and collected. The ore is then thrown out into heaps and exposed to the atmosphere, and afterwards lixiviated. The green vitriol is thus dissolved, and thence is collected in ditches constructed for the purpose and crystallized. In other instances the ore is piled in heaps, after being broken in small pieces and then moistened, when decomposition goes on as before. This decomposition often takes place in cabinets, from merely the moisture of the atmosphere; but usually only in massive varieties. In Germany, the lixiviated liquid is employed for the production of sulphuric acid, by evaporating and distilling it; and the residue, which is an oxyd of iron, often called colcothar, is used as a coarse red pigment.

This species is also of importance in the smelting of ores, particularly those of silver.

Pyrites sometimes contains, mechanically mingled, a minute quantity (perhaps one five thousandth part) of gold, and is then termed auriferous pyrites. It occurs abundantly in the gold mines of Beresoff, in Siberia, and in Brazil, in detached disintegrating crystals of a dark-brown color.

The name *pyrites*, is derived from the Greek, πυρὶτης, a term applied to this mineral, because, as Pliny states, " there was much fire in it," as was made apparent by friction. This term was applied also to flint and some siliceous millstones, on account of their external resemblance to copper pyrites.

ARSENID OF COPPER. PYRITES ALLIACEUS.

Arseniet of Copper. Weisskupfererz.

492. Massive and disseminated.

G.=4·5, Delametherie. *Lustre* metallic, glistening. *Color* between tin-white and brass-yellow. *Fracture* small and fine-grained. Brittle; easily frangible.

Before the blowpipe it evolves arsenical fumes and melts into a grayish-black slag. It has not been analyzed, but is supposed to consist of Arsenic, Copper, and Iron. According to Henkel, it contains 40 per cent of copper.

Obs. It is stated by Jameson to occur at Huel Garland, in Cornwall, and at several places in Germany and Hungary. It is a rare species.

VARIEGATED COPPER ORE. Pyrites erubescens.

Octahedral Copper Pyrites, *M.* Variegated Copper, *J.* Purple Copper, *P.* Liver-Colored Copper Ore. Buntkupfererz, *W.* and *L.* Bunter Kupferkies, *Haus.* Cuivre Pyriteux Hepatique, *H.*

493. *Primary form:* the regular octahedron. *Secondary forms:* figs. 1, 2, and 3, Pl. I. *Cleavage,* traces parallel with the faces of the primary. *Compound crystals:* fig. 129, Pl. II. *Imperfect crystallizations:* structure granular, strongly connected.

H.=3. G.=5·003. *Lustre* metallic. *Streak* pale, grayish-black, and slightly shining. *Color* between copper-red and pinchbeck brown. *Fracture* small conchoidal, uneven. Brittle. It speedily tarnishes when exposed.

It contains, according to Hisinger (Afhandlingar, iv. 359) and Phillips, (Annals of Phil. 2d ser. iii. 81,)

Copper	63·334	61·07
Iron	11·804	14·00
Sulphur	24·696	23·75
Silica	0·166=100, H.	0·50=99·32, P.

Before the blowpipe it blackens, and becomes red on cooling; at an increased temperature it fuses into a globule, attractable by the magnet. It is mostly dissolved by nitric acid.

Obs. It occurs with other copper ores in primitive and secondary rocks.

The crystalline varieties have been found only in Cornwall, and mostly in the mines of Tincroft and Dolcoath, near Redruth. Other foreign localities of massive varieties are at Ross Island, in Killarney, in Ireland; in cupriferous shale, in the Mansfield district; in Norway, Siberia, Hessia, Silesia, and the Bannat.

Massive varieties of variegated copper are found in the United States at Mahoopeny, near Wilkesbarre, Penn., and in other parts of the same state, in a cupriferous shale, associated in small quantities with vitreous copper; also in granite, at Chesterfield, Mass., also in New Jersey and Connecticut.

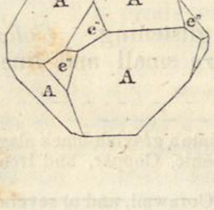
This species is a valuable ore of copper. Its name alludes to its liability to tarnish, and thus receiving a reddish hue.

COPPER PYRITES. Pyrites pyramidalis.

Pyramidal Copper Pyrites, *M.* Octahedral Copper Pyrites, *J.* Yellow Copper Pyrites. Pyritous Copper. Yellow Copper Ore. Kupferkies, *W.* and *L.* Cuivre Pyriteux.

494. *Primary form:* a square octahedron; A : A=101° 52′, Phillips. *Secondary forms:*

1.



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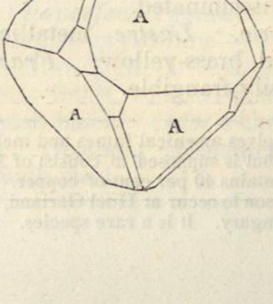

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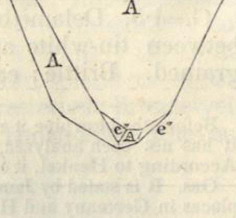
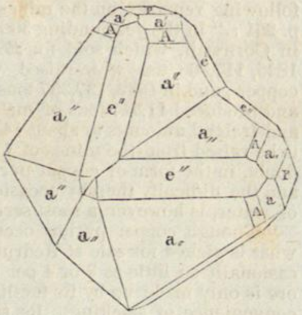




A : e=140° 46′. *Cleavage* sometimes distinct, parallel with e″; parallel with p, indistinct. *Compound crystals:* 1. Composition of the *third kind*—parallel to A, producing a form resembling fig. 129, Pl. II. Very complex forms result when this composition takes place, parallel to each of the faces A. 2. Composition of the *second kind*—parallel to e, (a plane truncating the terminal edge of A.) This form is represented in the annexed figure. A repetition of this composition parallel to each of the terminal edges, produces some of the most singularly complex and interesting forms in the mineral kingdom. These forms have been accurately delineated and described by Haidinger, in the third volume of Brewster's Journal, in a highly finished article on twin crystals, continued from Vol. I. of the same Journal, into several of the succeeding volumes. *Imperfect crystallizations:* globular, botryoidal, stalactitic, and other shapes—structure impalpably granular; granularly massive, often impalpable—particles strongly coherent.

H.=3·5—4. G.=4·159—4·160. *Lustre* metallic. *Streak* greenish-black—a little shining. *Color* brass-yellow; frequently subject to tarnish. Opaque. *Fracture* conchoidal, uneven. Rather sectile.

It contains, according to Rose, (Annals of Phil. 2d ser. vii. 355,) Phillips, (Annals of Phil. 2d ser. iii. 299,) Berthier, (Ann. des Mines, viii. 341,) and Thomson, (Min. i. 624,)

	Ramberg.			Cornwall.
Sulphur	35·87	34·46	36·3	34·655
Copper	34·40	31·20	32·1	33·640
Iron	30·47	30·80	31·5	31·535
Earthy Matter	0·27	1·10	—	0·555
	101·01, R.	97·56, P.	99·9, B.	100·385, T.

Before the blowpipe, on charcoal, it blackens, but becomes red on cooling. After a continued heat, it fuses into a globule which is magnetic. With borax it affords pure copper. It dissolves in nitric acid, excepting the sulphur, forming a green solution. A drop of liquid ammonia changes it to a deep blue.

Obs. Copper pyrites is the principal ore of copper at the Cornish mines. It is there associated with tin, variegated copper, galena, gray copper, and blende. The copper beds of Fahlun, in Sweden, are composed principally of this ore, which occurs in large masses, surrounded by a coating of serpentine, and imbedded in gneiss. At Rammelsberg, near Goslar, in the Hartz, it forms a bed in graywacke slate, and is associated with iron pyrites, galena, blende, and minute portions of silver and gold. The Kuprinz mine, at Freiberg, affords well defined crystals. It occurs also in the Bannat, Hungary, Thuringia, &c.

In the United States it has been found in several places, but nowhere in sufficient abundance to be worked. It occurs at the Southampton Lead Mines, Mass.; at the falls on the Connecticut, near Deerfield, Mass.; at Franconia, N. H., in gneiss; at Strafford and Shrewsbury, Vt., with magnetic pyrites. In Rossie, and the surrounding region, St. Lawrence Co., N. Y., it occurs in granite. It is also afforded by the Phœnix Copper Mines, in Fauquier Co., Virginia.

Cornwall has hitherto been one of the most important sources of copper. The following remarks on the mines in that region, are cited from Allan's Mineralogy, p. 261 : " In the year ending 30th June, 1822, 104,522 tons of copper ore were raised in Cornwall, which sold for £663,085, and yielded 9140 tons of pure copper. In 1826, 117,308 tons were raised, which sold for £788,971, and yielded 9026 tons of copper ; and in 1832, 137,357 tons of copper ore were raised, which sold for £825,612, and produced 11,947 tons of metallic copper. The whole produce of Great Britain and Ireland amounts to about 14,500 tons of copper, five sixths of which thus appear to be raised from the mines of Cornwall alone, and by much the larger portion, no doubt, in the form of copper pyrites. The enormous expense of fuel in that district, and the difficulty thereby occasioned of keeping the more extensive workings free of water, is however a most serious drawback on the profits of Cornish mining.

" Though copper pyrites occurs in vast profusion, it is by no means a rich one ; what is picked for sale at Redruth rarely yielding 12, generally only 7 or 8, and occasionally so little as 3 or 4 per cent. of metal. In the latter case, such poverty of ore is only made up by its facility of transport, the moderate expense of fuel, or the convenience of smelting. Its richness may in general be judged of by the color ; if of a fine yellow hue, and yielding readily to the hammer, it may be considered a good ore ; but if hard and pale-yellow, it is assuredly a poor one, being mixed with iron pyrites."

Copper pyrites is readily distinguished from iron pyrites, which it somewhat resembles, by its inferior hardness ; it may be cut by the knife, while iron pyrites will strike fire with the steel. The effects of nitric acid are also different. It differs from gold in being brittle, on account of which, it cannot be cut off in slices, like the latter metal.

CAPILLARY PYRITES. PYRITES CAPILLARIS.

Native Nickel, *M.* and *J.* Sulphuret of Nickel. Schwefel-Nickel, Haarkies *of the Germans.* Nickel Sulfuré, *Levy.*

495. In delicate capillary crystals.

H. about 3. *Lustre* metallic. *Color* brass-yellow, inclining to bronze-yellow and steel-gray. Opaque. Brittle.

It consists, according to Arfwedson, (Kong. Vet. Acad. Handl., 1822, p. 443,) of Nickel 64·35, and Sulphur 34·26=98·61. Before the blowpipe it fuses into a brittle metallic globule ; it colors glass of borax violet-blue. It forms with nitric acid a pale-green solution.

Obs. It occurs in thin capillary crystals in the cavities, and among the crystals of other minerals, at Joachimstahl, in Bohemia, Johanngeorgenstadt, in Saxony, Andreasberg, Cornwall, and other places.

ORDER X.—GALINEA.

TIN PYRITES. Cyprites cubicus.

Hexahedral Copper Glance, *M.* Sulphuret of Tin, *P.* Capreous Sulphuret of Tin, *Thom.* Bell Metal Ore. Zinnkies, *W.* Etain Sulfure, *H.*

496. *Primary form :* the cube. Occurs commonly massive—structure granular, particles strongly coherent.

H.=4. G.=4·3—4·4. *Lustre* metallic. *Streak* black. *Color* steel-gray when pure ; often yellowish from the presence of copper pyrites. Opaque. *Fracture* uneven. Brittle.

According to Klaproth, (Beitrage, ii. 259, and v. 228,) it contains

Sulphur	25	30·5
Tin	34	25·5
Copper	36	30·0
Iron	2=97	12·0=98.

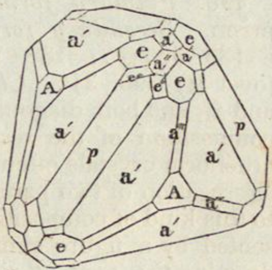
Before the blowpipe, sulphur is expelled, and afterwards a black scoriaceous globule is obtained. It is soluble in nitro-muriatic acid, with the exception of a residue of sulphur.

Obs. This species has been observed only in Cornwall, and principally at Hull Rock, in the parish of St. Agnes, where it forms a considerable vein, and is accompanied by iron pyrites, blende, and other minerals. It frequently has the appearance of bronze, or bell metal, and hence the name *bell metal ore.*

GRAY COPPER ORE. Cyprites tetrahedrus.

Tetrahedral Copper Glance, *M.* and *J.* Gray Copper, Fahlerz, *P* Schwarzerz, *W.* Kupferfahlerz, Schwarzgiltigerz, *Haus.* Cuivre Gris, *H.*

497. *Primary form :* the octahedron. *Secondary forms :* crystals hemihedrally modified ; figs. 7, 16, 30, 32, 34, 35, 36. *Cleavage* in traces parallel to the faces of the octahedron. *Compound crystals :* composition parallel to a face of the octahedron. *Imperfect crystallizations :* structure granular—particles of various sizes, often impalpable, strongly connected.



H.=3—3. G.=4·798—5·104, Haidinger. *Lustre* metallic. *Streak* sometimes inclined to brown, but generally the same as the color. *Color* between steel-gray and iron-black. Opaque. *Fracture* subconchoidal, uneven. Rather brittle.

Its composition, according to Rose, who analyzed specimens from various localities, (Poggendorf's Annalen, xv. 576,) is given as follows in Thomson's Mineralogy, i. 627:

	Alsace.	Gersdorf.	Kapnik.	Clausthal.
Sulphur	26·83	26·33	25·77	24·73
Copper	40·60	38·63	37·98	34·48
Antimony	12·46	16·52	23·94	28·24
Arsenic	10·19	7·21	2·88	——
Iron	4·66	4·89	0·86	2·27
Zinc	3·69	2·76	7·29	5·55
Silver	0·60	2·37	0·62	4·97
Silica	0·41	—	—	—
	99·44	98·71	99·34	100·24

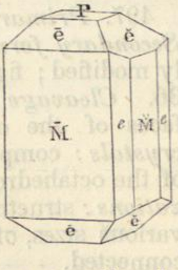
In another analysis of a specimen from Furstenberg, he obtained 17·71 per cent. of silver. A variety from Guadalcanal, in Spain, contains from one to ten per cent. of platinum, and another from Hohenstein, a little gold. Their comportment before the blowpipe is somewhat various. They all give off fumes of antimony or arsenic, finally melt, and after roasting, afford a globule of copper. When pulverized, they dissolve, with a little residue, in nitric acid.

Obs. The Cornish mines near St. Austle, afford large tetrahedral crystals; their surfaces are commonly rough and dull. More brilliant and highly modified crystallizations occur at Andreasberg, in the Hartz, Kremnitz in Hungary, Freiberg in Saxony, Kapnik in Transylvania, and Dillenberg in Nassau. Those belonging to the *Fahlerz* (gray ore) of Werner, having a steel-gray color. The *Schwarzerz* is nearly iron-black. This variety occurs principally at the old mine of Schwatz, in the Tyrol, and at Kapnik in Transylvania; also at Clausthal in the Hartz, where it is imbedded in red manganese.

It is associated usually with copper pyrites, and is worked as an ore of copper. The weiss kupfererz, or cuivre pyriteux of Levy, appears to belong to this species.

BOURNONITE. CYPRITES RECTANGULUS.

Di-prismatic Copper Glance, *M.* Triple Sulphuret. Endellionite, *Bournon.* Schwarz-Spiesglaserz, *W.* Bleifahlerz, Spiessglanz-bleierz, *Haus.* Bournonit, *L.* Radelerz. Antimoine Sulfuré Plombo-cuprifère, *H.*



498. *Primary form:* a right rectangular prism. *Secondary form:* P : ē=133° 34′, P : ĕ=136° 50′, M̄ : *e*=138° 15½′, M̆ : *e*=131° 45½′, *e*:*e* (over M̄) =96° 31′. *Cleavage* parallel with M̄ and M̆, and both diagonals. *Compound crystals:* composition of the second kind, parallel to ĕ; cruciform crystals often occur, resulting from an aggregation of two pairs of molecules, according to this kind of composition. This may be represented by a figure similar to fig. 4, Pl. IV., by drawing the axes at right angles, and making, consequently, the

circumscribing parallelogram rectangular. Supposing the primary form to be a rhombic prism, with the planes ĕ as the primary lateral, this composition is represented by the figure referred to, without any change in it, except a little variation in the angles. These crystals cross at angles of 93° 30′, and 86° 20′, as necessarily follows from the inclination of P on ĕ, *Imperfect crystallizations:* structure granular, particles strongly connected.

H.=2·5—3. G.=5·766, Hatchett. *Lustre* metallic. *Streak* and *Color* steel-gray, inclining to blackish lead-gray, or iron-black. Opaque. *Fracture* conchoidal, or uneven. Brittle.

According to Rose, (Poggendorf's Annalen, xv. 573,) it consists of

	Crystals from Pfaffenburg.
Sulphur	20·31
Antimony	26·28
Lead	40·84
Copper	12·65=100·08,

and consequently, it is composed of one atom of sulphacid of antimony, (antimonious sulphacid,) one atom of sulpuret of lead, and one atom of the sulphuret of copper.

It decrepitates in the blowpipe flame and gives out white fumes of sulphur. Ultimately, it fuses into a black globule. In a strong heat, the charcoal is covered with the oxyd of lead. It readily dissolves in nitric acid.

Obs. The finest crystallizations of this species occur in the mines of Neudorf, in the Hartz, where they occasionally exceed an inch in diameter. It accompanies quartz, gray copper ore, and phosphorescent blende, at Kapnik, in Transylvania, in flattened crystals; at Servos, in Piedmont, it is associated with pearl spar and quartz. Other localities are at Braunsdorf and Gersdorf, in Saxony, Clausthal and Andreasberg, in the Hartz, &c.; also Endellion near Redruth, in Cornwall, where it was first found, and whence it was called *Endellionite*, by Count Bournon. It has since been named in compliment to this distinguished mineralogist.

TENNANTITE. Cyprites dodecahedrus.

Quart. Journ. vii. 95.

499. *Primary form:* the rhombic dodecahedron. *Secondary forms:* figs. 5, 6, 32, 36, Pl. I. *Cleavage* parallel with the faces of the primary, imperfect. Has not been observed massive.

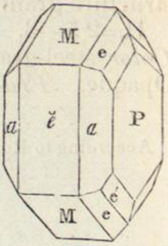
H.=3·5—4. G.=4·375—4·491. *Lustre* metallic. *Streak* reddish-gray. *Color* blackish lead-gray. *Fracture* uneven.

It contains, according to Phillips, (Phil. Mag. x. 157,) Copper 45·32, Arsenic 11·84, Iron 9·26, Sulphur 28·74, Silica 5. Before the blowpipe it decrepitates slightly, burns with a blue flame, emits copious arsenical fumes having an alliaceous odor, and finally fuses into a black scoria, which acts upon the magnet.

Obs. This species has only been observed in the Cornish mines, particularly near Redruth and St. Day. It commonly occurs in very splendent crystals investing other ores of copper.

VITREOUS COPPER. CYPRITES RHOMBICUS.

Prismatic Copper Glance, ***M.*** **Sulphuret of Copper. Disulphuret of Copper,** ***M.*** **Glance Copper. Kupferglas,** ***W.*** **Kupferglanz,** ***Haus.*** **and** ***L.*** **Cuivre Sulfuré,** ***H.***



500. *Primary form:* a right rhombic prism; M : M=119° 25′. *Secondary form:* M : ĕ=120° 13′, M : e=152° 56′, M : e′=122° 44′. *Cleavage* indistinct parallel to M. *Compound crystals:* stellated forms similar to those of Arragonite; very frequent. *Imperfect crystallizations:* structure granular, particles of various sizes, usually small and often impalpable.

H.=2·5—3. G.=5·5—5·8; 5·7022, Thomson. *Lustre* metallic. *Streak* and *Color* blackish lead-gray; often tarnished blue or green; streak sometimes shining. *Fracture* conchoidal. Sectile.

According to Klaproth, (Beit. ii. 279, and iv. 37,) and Thomson, (Min. i. 599,) this mineral contains

Sulphur	18·50	22·0	20·62
Copper	78·50	76·5	77·16
Iron	2·25	0·5	1·45
Silica	0·75=100, K.	——=99, K.	——=99·23 T.

In the oxydizing flame of the blowpipe it melts, gives out fumes of sulphur, and emits glowing drops with a noise. In the reducing flame it becomes covered with a coating and does not melt. If the sulphur is driven off, a globule of copper remains. In heated nitric acid the copper is dissolved, and the solution assumes a green color; the sulphur is precipitated.

OBS. Cornwall affords splendid crystals of this species, where it occurs in veins and beds with other ores of copper. Some of the Cornish collections contain elegant suites of this beautiful though complicatedly crystallized mineral. The compact and massive varieties occur in Siberia, Hessia, Saxony, the Bannat, &c.

In the United States, compact varieties occur in the red sandstone formation at Simsbury and Cheshire, Conn.; also at Schuyler's mines, N. Y. A fine vein has lately been discovered at Bristol, Conn. In Virginia, it occurs in the U. S. copper mine district, Blue Ridge, Orange Co.

The argent en epis or Cuivre speciforme, of Haüy, which is merely vegetable matter impregnated with this ore, occurs at Mahoopeny, Penn.

BLUE COPPER.

Kupferindig.

501. Massive; in spheroidal forms with a crystalline surface.

Lustre resinous, faint. *Streak* lead-gray, shining. *Color* indigo-blue or darker. Opaque. Sectile.

Before the blowpipe it burns, before becoming red hot, with a blue flame, and fuses into a globule, which is strongly agitated and emits sparks; finally it yields a button of copper.

It contains, according to Walchner, Copper 64·77, Sulphur 32·64, Lead 1·05, Iron 0·46.

ANTIMONIAL COPPER.

Sulphuret of Copper and Antimony, *H. Rose*, Ann de Poggendorf, XXXV. 357.

502. Occurs in small aggregated prisms, which, according to M. G. Rose, are right rhombic, with their edges deeply truncated.

H.=3—4. G. at least 4·474. *Lustre* metallic. *Streak* black. *Color* between lead-gray and iron-gray. Opaque. *Fracture* conchoidal.

It contains, according to H. Rose, Copper 24·46, Iron 1·39, Antimony 46·81, Lead 0·56, Sulphur 26·34=99·56. The iron is supposed to exist in it, in the state of pyritous copper, and the lead, in that of feather ore. It is always covered with a thin coat of copper pyrites.

Obs. It occurs in nests in the mine of gray antimony, at Wolfsberg, in the Hartz.

EUCAIRITE. Lunites Selenicus.

Seleniuret of Silver and Copper, *P.* Argentiferous Seleniet of Copper. Eukairite, *Berzelius* and *L.* Selenkupfer Silber *of the Germans.* Cuivre Sélenié Argental, *H.*

503. Massive; in thin superficial black metallic films, staining the calcareous spar in which it is contained.

Soft. *Lustre* metallic. *Streak* shining. *Color* between silver-white and lead-gray.

According to Berzelius, (Afhandlingar, iv. 136,) it contains Silenium 26, Copper 23·05, Silver 38·93, foreign earthy matter 8·90=96·88. Before the blowpipe it gives out copious fumes of selenium, attended with the odor of horse-radish; and on charcoal, fuses readily into a gray metallic globule, which colors borax green, leaving a bead of selenid of silver. It dissolves in boiling nitric acid.

Obs. It has been found only in small quantities in the Skrickerun copper mine in Smaland, Sweden, in a serpentine kind of rock, imbedded in calcareous spar. It was discovered and analyzed by Berzelius, and thus named from ευ and καιρος, *opportunely*, because the mineral was found soon after the discovery of selenium.

STROMEYERITE. Lunites Cupricus.

Argentiferous Copper Glance, *J.* Sulpho-Cuprite of Silver, *Thom.* Argentiferous Sulphuret of Copper. Cupreous Sulphuret of Silver. Sulphuret of Silver and Copper. Silber-kupferglanz *of the Germans.* Cuivre Sulfuré Argentifère.

504. Massive; structure impalpably granular.

H.=3—4. G.=4·258. *Lustre* metallic. *Streak* shining. *Color* steel-gray. *Fracture* subconchoidal. Sectile, according to Stromeyer.

It contains, according to Stromeyer's analysis, (Gilbert's Annalen, liv. 114,) Sulphur 15·782, Silver 52·272, Copper 30·478, Iron 0·333=98·865. Easily fusible. The blue solution, obtained with nitric acid, affords indications of copper, when a plate of iron is dipped into it, and also precipitates silver upon an immersed copper plate.

Obs. This species is of rare occurrence. It is found associated with copper pyrites at Schlangenberg, near Colivan, in Siberia. A variety has been observed at Combavalla, in Peru, which contains some iron. It was first described and recognized as a peculiar species by Prof. Stromeyer.

VITREOUS SILVER. Lunites dodecahedrus.

Hexahedral Silver Glance, *M.* and *J.* Sulphuret of Silver, Vitreous Silver, *P.* Glaserz, *Haus.* Silberglanz, *L.* Argent Sulfuré, *H.*

505. *Primary form:* the rhombic dodecahedron. *Secondary forms:* figs. 1—9, inclusive, Pl. I., also 14, 15, 16. *Cleavage* traces parallel to the faces of the dodecahedron. *Imperfect crystallizations:* reticulated, arborescent, and filiform; also amorphous. H.=2—2·5. G.=7·196—7·365. *Lustre* metallic. *Streak* and *color* blackish lead-gray; streak shining. Opaque. *Fracture* imperfect and small subconchoidal, uneven.

By Klaproth's analysis, (Beitrage, i. 162,) it contains Silver 85, and Sulphur 15=100. A fragment before the blowpipe intumesces, and soon affords a globule of silver. It is soluble in dilute nitric acid, and when isolated and rubbed, acquires resinous electricity.

Obs. This important ore of silver occurs in Europe, principally at Annaberg, Joachimstahl, and other mines of the Erzgebirge, Schemnitz and Cremnitz, in Hungary, and at Freiberg. At the last place it accompanies other silver ores, in veins traversing gneiss. The silver of Mexico is obtained principally from this ore.

TELLURIC SILVER. Lunites Telluricus.

Bitelluret of Silver, *Thom.* Tellur-Silber, *of the Germans.*

506. In coarse grained masses.

H.=2—2·5. G.=8·412—8·465. *Lustre* metallic. *Color* between lead-gray and steel-gray.

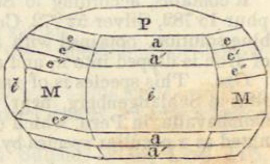
It contains, according to G. Rose, (Poggendorf's Annalen, xviii. 64,) Silver 62·37, Tellurium 36·92, and Iron 0·37=99·66. Before the blowpipe, on charcoal, it fuses into a black globule, which on cooling, after the action of the reducing flame, presents points or dendrites of silver on its surface. When heated in a glass tube it melts and gives a yellow color to the glass. Fused with carbonate of soda a globule of pure silver is obtained.

Obs. It occurs in the new mine of Sawodinski, about forty wersts from the rich silver mine of Siränowski, on the river Buchthorma, in Siberia, where it is found in a talcose rock, containing small quantities of iron pyrites, black blende, and copper pyrites. Specimens in the museum of Barnaul, on the Ob, where this mineral was first observed, were a cubic foot in size. It was first described and analyzed by Mr. G. Rose.

GRAPHIC TELLURIUM. Lunites Auricus.

Prismatic Antimony Glance, *M.* Graphic Gold. Schrifterz. Tellure Natif Auro-argentifère, *H.*

507. *Primary form:* a right rhombic prism; M : M=107° 44′. *Secondary form:* P : a=141° 30′, P : a′=129° 12′, P : e=151° 40′, P : e′=136° 42′, P : e″=132° 45′. *Cleavage* highly perfect parallel with M; less so parallel with P. *Compound crystals:* prismatic crystals



intersect at 68° and 120°, nearly. *Imperfect crystallizations:* structure imperfectly columnar and granular.

H.=1·5—2. G.=5·723. *Lustre* metallic. *Streak* and *Color* pure steel-gray. *Fracture* uneven. Very sectile.

It contains, according to Berzelius, (Kong. Vet. Acad. Handl., 1828, p. 113,) Tellurium 52, Silver 11·33, Gold 24, Iron 1·50=88·83, together with some copper, iron, antimony, sulphur, and arsenic. It fuses easily, tinging the flame greenish-blue, and covering the charcoal with a white oxyd; finally a ductile metallic globule is obtained. It dissolves in nitric acid.

Obs. It occurs with gold at Offenbanya, in Transylvania, in narrow veins, which traverse porphyry; also at Nagyag, in the same country.

Its name alludes to the peculiar disposition of the crystals, which present an appearance like writing characters.

The large amount of gold it contains, renders it a highly valuable ore.

POLYBASITE. Lunites rhombohedrus.

508. *Primary form:* a rhombohedron. Occurs usually in short and tabular hexagonal prisms. Terminal planes striated parallel to the alternately terminal edges. *Cleavage* not observable. Occurs also massive.

H.=2—3. G.=6·214. *Lustre* metallic. *Streak* black. *Color* iron-black. Opaque. *Fracture* uneven.

According to H. Rose, (Poggendorf's Annalen, xv. 575,) it contains

Sulphur	17·04
Silver	64·29
Antimony	5·09
Arsenic	3·74
Copper	9·93
Iron	0·06=100·15.

Obs. It occurs in the mine at Guanaxuato, in Mexico; also at Guansamez, in Durango, with copper pyrites and calcareous spar.

BRITTLE SILVER ORE. Lunites rhombicus.

Prismatic, Melane Glance, *M.* Brittle Silver Glance. Black Silver. Brittle Sulphuret of Silver. Trisulpho-Antimoniate of Silver. Sprodglaser, *W.* Sprodglanzerz, *Haus.* Argent Noir, Argent Antimonié Sulphuré Noir, *H.* Argent Sulphuré Fragile.

509. *Primary form:* a right rhombic prism; M : M=115° 39′, M : e=142° 10′, e : e (over M̆)=104° 19′, *a* : *a* (over ĕ)=107° 47′, P : *a*=126° 6½′. *Cleavage* imperfect and interrupted, parallel to M and ĕ. *Compound crystals:* composition of the *first kind*, producing forms similar to those of white lead ore and Arragonite; very frequent. *Imperfect crystallizations:* structure granular—particles strongly coherent.

H.=2—2·5. G.=6·269, specimen from Przibram. *Lustre* metallic. *Streak* and *Color* iron-black. *Fracture* uneven. Sectile.

According to Rose, (Poggendorf's Annalen, xv. 475,) it contains Sulphur 16·42, Antimony 14·68, Silver 68·54, Copper 0·64=100·28. Before the blowpipe it fuses and gives out fumes of sulphur and antimony, and is reduced to a dark-colored metallic globule, which may be further reduced by the addition of soda or silica. It is soluble in dilute nitric acid.

Obs. It occurs in veins with other silver ores in Freiberg, Schneeberg, and Johanngeorgenstadt, in Saxony, at Przibram and Ratieborzitz, in Bohemia, at Schemnitz and Kremnitz, in Hungary, at Andreasberg, in the Hartz, at Zacatecas, in Mexico, and in Peru.

The *schwarzgiltigerz*, of Werner, includes the compact varieties of this species, and his *weiss-giltigerz* is merely a mechanical mixture of brittle silver, galena, and gray antimony.

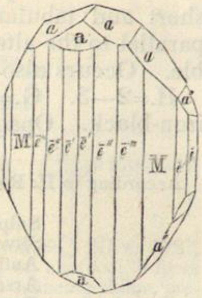
It is a valuable ore of silver.

ANTIMONIAL SULPHURET OF SILVER. Lunites peritomus.

Peritomous Antimony Glance, *M.* Sulphuret of Silver and Antimony, *P.* Schwefel Schilfglaserz, *Freisleben.* Silver und Antimon. Argent Sulfuré Antimonifère et Cuprifère, *Levy.*

510. *Primary form:* a right rhombic prism; M : M=100° 8′. *Secondary form : a : a*=130° 8′, a'' : a''=122° 15′, $\breve{e}$: a''=118° 53′, M : $\bar{e}'$=146° 30′, M : $\bar{e}''$=160° 30′, M : $\bar{e}'''$=170° 10′. M, longitudinally striated. *Cleavage* perfect, parallel with M.

H.=2—2·5. G.=5·5—5·6. *Lustre* metallic. *Color* light steel-gray, inclining to silver-white. Yields easily to the knife.



It is supposed to consist chiefly of Antimony, Sulphur, Silver, and Copper. Before the blowpipe it emits copious white vapors and a slight sulphureous odor, after which, a white metallic globule remains.

Obs. Occurs with vitreous silver, spathic iron, and galena, in the Himmelfurst mine, at Freiberg in Saxony, and Kapnik in Transylvania.

MOLYBDIC SILVER. Lunites Molybdicus.

Molybdena Silver, *J.* Molybdic Silver, *P.* Molybdan Silver, *W.*

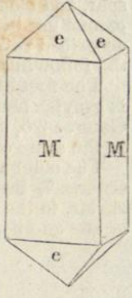
511. *Primary form:* a rhombohedron. *Cleavage* perfect, parallel with R.

Soft. G.=7·2—8. *Lustre* metallic. *Streak* dark iron-black. *Color* pale steel-gray. Electric when in thin laminæ.

GRAY ANTIMONY. Lycites diatomus.

Prismatoidal Antimony Glance, *M.* Sulphuret of Antimony, *P.* Sesquisulphid of Antimony, *Thom.* Hyp-Antimoneous Sulphacid. Grauspiessglaserz, *W.* Grauspiessglanzerz, *Kaus.* Antimoine Sulfuré, *H.* Stibium, Στιμμι. Πλατυόφθαλμον. Leo Ruber. Plumbum Nigrum, *Vetr.* Lupus Metallorum.

512. *Primary form :* a right rhombic prism; M : M=90°



45′. *Secondary form:* M : e=155° 29′, P : P=109° 16′, and 108° 10′. Lateral planes deeply striated longitudinally. *Cleavage* highly perfect, parallel with the shorter diagonal. *Imperfect crystallizations:* structure columnar, particles of various sizes, usually thin; structure granular, impalpable, strongly connected.

H.=2. G.=4·516, Haüy; 4·62, Mohs. *Lustre* metallic. *Streak* and *Color* lead-gray, inclining to steel-gray; subject to tarnish. *Fracture* small subconchoidal. Sectile. Thin laminæ a little flexible.

It consists of

Antimony	74·06	74	73·77
Sulphur	25·94=100, Davy.	26=100, Bergmann.	26·23=100, Thomson.

It fuses readily in the flame of a candle; before the blowpipe it is absorbed by the charcoal, emitting at the same time white fumes and a strong sulphureous odor.

Obs. Gray antimony occurs with spathic iron in beds, but generally in veins. It is often associated with blende, heavy spar, and quartz.

It is met with in veins at Wolfsthal, in the county of Stollberg, in the Hartz, and at Posing, near Presburg, in Hungary. Its most celebrated localities, however, are Felsobanya, Schemnitz, and Kremnitz, in Hungary, where it often occurs in diverging prisms several inches long, accompanied by crystals of heavy spar and other mineral species. At Dumfriesshire it occurs fibrous and laminated; at Cornwall, massive; and compact, at Magurka, in Hungary.

This ore affords nearly all the antimony of commerce. The crude antimony of the shops is obtained by simple fusion, which separates the accompanying rock. From this product, most of the pharmaceutical preparations of antimony are made, and the pure metal extracted. This ore was employed by the ancients for coloring their hair, eyebrows, eyelashes, and edges of the lids; and as this last application was intended to increase the apparent size of the eye, they called the ore πλατυόφθαλμον, from πλατυς, *broad*, and οφθαλμος, *eye*. According to Dioscorides, it was prepared for this purpose by enclosing it in a lump of dough, and then burying it in the coals till reduced to a cinder. It was then extinguished with milk and wine, and again placed upon coals and blown till ignition; after which the heat was discontinued, lest, as Pliny says, "plumbum fiat," *it become lead.* From this we may infer, that the metal antimony was occasionally seen by the ancients, though not recognised by them as distinct from lead. (Moore's Ann. Min., p. 52.)

BERTHIERITE. Lycites Berthieri.

Haidingerite *of Berthier.* Berthierit, *Poggendorf.*

513. In elongated prisms or massive; a pretty distinct longitudinal cleavage.

Lustre metallic, less splendent than gray antimony. *Color* dark steel-gray, inclining to pinchbeck-brown; surface often covered with iridescent spots.

It contains, according to Berthier, (Ann. de Ch. et de Ph. xxxv. 351,) Sulphur 28·3, Antimony 48·3, Iron 14·9, Zinc 0·3, Quartz 3·2, Iron Pyrites 3·2=98·2. It fuses readily before the blowpipe, gives out fumes of antimony, and forms a black slag, which acts on the magnet. It dissolves readily in muriatic acid, giving out sulphuretted hydrogen.

Obs. It occurs at Charzelles, in Auvergne, associated with quartz, calcareous spar, and iron pyrites. It yields antimony of so inferior quality, that manufacturers cannot use it. It was first recognized and analyzed by Berthier. Berthier has lately described two other ores of antimony, (Memoires par Berthier, ii. 273,) which have the following characters.

The first has a fibrous texture, cross fracture granular, and almost dull. The color is grayish blue, but less blue and having less lustre than gray antimony. It contained Gangue 6·0, Sesquisulphuret of antimony 33·7, and Sulphuret of Iron 6·3. It occurs in the mine of Martouret, near Chazelle.

The other has an iron-gray color, and a granular and fibrous structure. It contained Quartz 7, Sesquisulphuret of Antimony 75, Sulphuret of Iron 18. It is found at Aglar, in the department of La Creuse. These, however, may possibly be varieties of one another.

ZINKENITE. Lycites Zinkeni.

G. Rose, Poggendorf's Annalen, VII. Brewster's Journal, VI. 17.

514. *Primary form:* a hexagonal prism. *Secondary form:* the primary terminated by a low hexagonal pyramid. P : e=102° 42′. Lateral faces longitudinally striated. G. Rose found in some instances, the interfacial angle M : M equal to 120° 39′, and hence conjectures, that the primary is a rhombic prism of this angle, and that the observed crystals are compound forms similar to fig. 3 or 6, Pl. IV. The crystals are usually in groups, sometimes forming fibrous and massive varieties. *Cleavage* not observable.

H.=3—3·5. G.=5·303. *Lustre* metallic. *Streak* and *Color* steel-gray. Opaque. *Fracture* uneven.

It contains, according to H. Rose, (Poggendorf's Annalen, viii. 99,) Sulphur 22·58, Lead 31·84, Copper 0·42, Antimony 44·39=99·23. Heated alone on charcoal it decrepitates briskly, and fuses as readily as gray antimony, affording small metallic globules, which are soon volatilized, and the charcoal is covered with a white coating of oxyd of lead. With carbonate of soda it yields globules of metallic lead.

Obs. It occurs in the antimony mine of Wolfsberg, in the Hartz. Its groups of columnar crystals occur on a massive variety of the same species in quartz. These crystals sometimes exceed half an inch in length, and have a breadth of two or three lines; but frequently they are extremely thin and form fibrous masses. It was named in compliment to Mr. Zinken, the director of the Anhalt mines, by Dr. G. Rose, to whom we are indebted for the first description of it.

It much resembles gray antimony and Bournonite, but may be distinguished by its superior hardness and specific gravity.

JAMESONITE. Lycites acrotomus.

Axotomous Antimony Glance, *M.*

515. *Primary form:* a right rhombic prism; M : M=101° 20′, and 78° 40′. *Cleavage* highly perfect parallel with P. *Imperfect crystallizations:* structure columnar, particles delicate, straight, and parallel or divergent.

H.=2—2·5. G.=5·5—5·8; 5·564, Haidinger. *Lustre* metallic. *Streak* and *Color* steel-gray. Opaque. Sectile.

Its composition was determined as follows by H. Rose :

Sulphur	22·15	22·53
Antimony	34·40	34·90
Lead	40·75	38·71
Lead, with traces of Iron and Zinc,	——	0·74
Copper	0·13	0·19
Iron	2·30=99·73.	2·65=99·72.

Before the blowpipe, in an open tube, it affords a dense white smoke of oxyd of antimony.

Obs. It occurs principally in Cornwall, associated with quartz and minute crystals of Bournonite; occasionally also in Siberia, and it is said in Hungary. Its perfect cleavage at right angles with the vertical axis, is sufficient to distinguish it from the species it resembles. It was first ranked as a species by Mohs, and named in compliment to Prof. Jameson, of Edinburgh.

The Plumose antimonial ore, or feather ore of lead, *federerz* of the Germans, has been analyzed by M. H. Rose, and found to contain Sulphur 19·72, Antimony 31·04, Lead 46·87, Iron 1·30, Zinc 0·08=99·01, which differs from the composition of Jamesonite, in containing half an atom more of sulphuret of lead. It occurs of a lead-gray color, in long capillary crystals, filling the drusy cavities of quartz, much resembling a cobweb. It fuses almost instantly in the flame of a candle, evolving at the same time white fumes. It occurs in Saxony and Hungary, &c. The specimen analyzed by Rose, was from Wolfsberg, in the Eastern Hartz.

ARSENICAL ANTIMONY. Lycites alliaceus.

Arseniet of Antimony, *Thom.* Min. I. 84.

516. In reniform masses and amorphous ; structure fine granular.

H.=2—4. G.=6·13, Thomson ; 6·2. *Lustre* metallic, occasionally splendent ; sometimes dull. *Color* tin-white, or reddish-gray.

According to Thomson's analysis (Min. i. 84,) of a specimen from Allemont, it contains Antimony 46·612, Arsenic 38·508, Loss 14·880.

Before the blowpipe it emits fumes of arsenic and antimony, and fuses into a metallic globule, which takes fire and burns away, leaving oxyd of antimony on the charcoal.

Obs. It occurs sparingly at Allemont; also at Przibram, in Bohemia, where it was observed by Zippe, in metallic veins, associated with blende, antimony, spathic iron, &c.

BOULANGERITE.

Sulphuret of Antimony and Lead, *C. Boulanger*, Ann. des Mines. VII. 1835.

517. In masses, exhibiting in the fracture a crystalline structure. G.=5·97. *Lustre* metallic. *Color* bluish-gray.

It contains, according to Boulanger,

Sulphuret of Antimony	35·0
Sulphuret of Lead	62·1
Sulphuret of Iron	1·9
Sulphuret of Copper	1·1=100·1.

Fuses readily before the blowpipe, with exhalations of sulphurous acid and fumes of the white oxyd of antimony. On charcoal, a yellow circle indicates the presence of lead. Easily attacked by nitric acid. Boiling strong muriatic acid decomposes it with the extrication of sulphuretted hydrogen.

Obs. Occurs quite abundantly at Molières department of Gard, in France.

GALENA. Plumbites cubicus.

Hexahedral Lead Glance, *M.* Sulphuret of Lead. Blue Lead. Bleiglanz, Blau-Bleierz, *W.* Bleishweif, *Haus.* Plomb. Sulfuré, *H.* Plumbum Galena, *Linn.*

518. *Primary form:* the cube. *Secondary forms:* figures from 1 to 23, on Pl. I., and frequently several of them combined in the same crystal. *Cleavage* highly perfect and easily obtained, parallel to the faces of the cube. *Compound crystals:* fig. 129, Pl. II.; the same kind of composition frequently repeated. *Imperfect crystallizations:* reticulated, tabular, and other imitative shapes; also massive, structure granular—particles of various sizes, sometimes impalpable; occasionally fibrous. *Pseudomorphs:* imitative of pyromorphite, &c.

H.=2·5—2·75. G.=7·532—7·652. *Lustre* metallic. *Streak* and *Color* pure lead-gray. Surface of crystals occasionally tarnished. *Fracture*, when obtainable, flat subconchoidal, or even. Easily frangible.

When pure, it contains Sulphur 13·34, Lead 86·66. Before the blowpipe it decrepitates, unless heated with caution, when it fuses, gives off sulphur, and at last affords a globule of pure lead.

Obs. Galena occurs in beds and veins, both in primary and secondary rocks. At Freiberg, in Saxony, it occupies veins in gneiss; at Clausthal and Neudorf in the Hartz, and at Przibram in Bohemia, it traverses similar veins in clay slate; at Feistritz, and other places in Stiria, it occurs in the same kind of rock in beds; at Sala, in Sweden, it forms veins in primitive limestone; through the gray-wacke of Leadhills and the Killas of Cornwall, are disseminated veins of this ore; and in transition or mountain limestone, occur the rich repositories of Derbyshire, Cumberland, and the northern districts of England, as also those of Bleiberg, and the neighboring localities in Carinthia. In the English mines it is associated with calcareous spar, pearl spar, fluor spar, heavy spar, Witherite, calamine, and blende.

The most extensive deposits of this ore in the United States, and probably in the world, are met with at various places on the Mississippi river, from the banks of the Arkansaw to Prairie Du Chien. The ore occurs in limestone, and also disseminated in clay. The appearances ordinarily presented at the mines near Potosi, are as follows: "The shafts descend perpendicularly fifteen or twenty feet through a tenacious red clay, intermixed with masses of sulphate of barytes and sulphuret of lead; then succeeds the soft gray rock, which the miners call sandstone, but which is an aggregate of small crystalline particles of carbonate of lime; this stratum lies horizontally, but the miners remark, that it is uncertain at what depth they will strike it, as its surface is extremely uneven, and marked by deep concavities. It has numerous drusy cavities lined with minute quartz crystals, and is traversed by veins in which these crystals occur, intermixed with barytes and galena. This stratum varies in thickness at different points where it has been pierced, from six or eight to fifteen or twenty feet. It is succeeded by red clay, barytes, &c., similar to the former; and near the surface of this, sometimes in it, and sometimes in the red clay, the largest quantities of lead have been found."* The lead is so very abundant, that

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* Remarks on the limestones of the Mississippi lead mines. By E. James, Ass't Surgeon, U. S. army, in Journ. Acad. Nat. Sc. of Philad. v. 376.

the miners seldom excavate very extensive shafts; but if mining becomes difficult, they select some new spot for their diggings, where less labor is required. The lead mines of this extensive region furnished, from the year 1821 to 1833, inclusive, 63,845,740 lbs.

The ore is usually accompanied by heavy spar, blende, pyrites, quartz, and calcareous spar.

Galena also occurs at Cave-in-Rock, in Illinois, associated with fluor spar. A rich vein has been lately discovered at Rossie, in St. Lawrence Co., N. Y., traversing, nearly perpendicularly, the gneiss of the region. This vein varies from one to three or four feet in width, and consists mostly of the pure ore. Other deposits have been discovered in the same region, some apparently in the direction of the main vein, and others remote from it. It is associated with perfect crystallizations of calcareous spar, commonly presenting the form of the scalene dodecahedron. The ore of this region varies in its structure from fine granular to broad lamellar, and sometimes presents large and well-defined crystals. Southampton, Mass., affords small quantities of galena; also at Austin's mines, in Weythe Co., Walton's gold mines, in Louisa Co., and at other places in Virginia, it occurs in small quantities. An argentiferous variety occurs sparingly, at Monroe, Conn., which afforded Prof. Silliman, by cupellation, 3 per cent. of silver.

COBALTIC GALENA. Plumbites Cobalticus.

Cobaltic Lead Glance, or Cobaltic Galena, *J.* Cobalt-bleierz, *Haus.*

519. Occurs in minute moss-like groups of crystals, possessing cleavage; also massive.

Soft and sectile. Soils a little. G.=8·44. *Lustre* metallic and shining. *Color* lead-gray, inclining to blue. Opaque.

According to Du Menil, it contains Lead 62·89, Arsenic 22·47, Sulphur 0·47, Iron 2·11, Cobalt 0·94, Arsenical Pyrites 1·44=90·32. Before the blowpipe it decrepitates; it colors glass of borax a smalt-blue.

Obs. It occurs in a vein of clay-slate and brown spar, traversing gray-wacke, in one of the Clausthal mines, in the Hartz.

CLAUSTHALITE. Plumbites Selenicus.

Seleniuret of Lead. Seleniet of Lead. Selenblei, *of the Germans.* Plomb Seleniuré, *Levy.*

520. Occurs commonly in fine granular masses; in some specimens a foliated structure is apparent.

H.=2—2·5. G.=7·187. *Lustre* metallic. *Streak* dark-gray. *Color* lead-gray, somewhat bluish. Opaque. *Fracture* granular and shining. Rather sectile.

It contains, according to H. Rose and Turner,

Lead	71·81	70·98
Selenium	27·59	28·11
Cobalt	——=99·40, R.	0·83=99·92, T.

Before the blowpipe, in addition to the usual phenomena arising from the presence of lead, it gives off the odor of horse-radish, and deposits on the charcoal a reddish-brown substance. Heated in a glass tube, closed at one end, the selenium almost immediately sublimes, forming a red ring within the tube, and on heating the tube to redness, the ore fuses and the red ring partially disappears, and a white crystalline deposit remains.

Obs. Clausthalite much resembles a granular galena; but its color is somewhat peculiar in its slight tinge of blue. It occurs only massive in a vein of hematite, near Harzgerode, in the Hartz.

This ore is found at the Harzgerode, combined either mechanically or chemically with several other selenids.

Selenid of lead and cobalt closely resembles the above, and is probably a mechanical mixture. It contains Selenium 31·42, Lead 63·92, Cobalt 3·14, Iron 0·45=98·93.

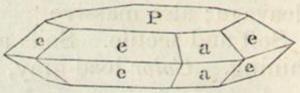
The *selenid of lead and copper* is also probably a mechanical mixture. It bears a close resemblance to the above. It contains Selenium 29·96, Lead 59·67, Copper 7·86, with less than one per cent. of Iron.

Another *selenid of lead and copper* had a violet color, and was very fusible. It was composed of Selenium 34·26, Lead 47·43, Copper 15·45, Silver 1·29, Oxyd of Lead and Iron 2·08=100·51, which indicates a compound of an atom each of selenid of lead and selenid of copper.

The following is the composition of two selenids of lead and mercury from the same locality, as determined by Rose: Selenium 24·97, Lead 55·84, Mercury 16·94 =97·75; the second, Selenium 27·98, Lead 27·33, Mercury 44·69=100. They closely resemble, in external appearance, the simple selenid of lead.

FOLIATED TELLURIUM. Elasmites quadratus.

Pyramidal Tellurium Glance, *M.* Bitelluret of Lead, *Thom.* Black Tellurium, *P.* Tellurium Glance. Nagyager-erz, *W.* Blattertellur, *Haus.* and *L.* Tellure Natif Aurifère et Plombifère, Tellure Natif Auro-Plombifère, *H.*



521. *Primary form:* a right square prism. *Secondary form:* P : e=110°, e : e=140°, P : a=118° 35′, a : a=122° 50′. *Cleavage* perfect, parallel with P. Occurs also granularly massive; particles of various sizes, sometimes slightly elongated, but generally foliated.

H.=1—1·5. G.=7·085. *Lustre* metallic. *Streak* and *Color* blackish lead-gray. Opaque. Sectile. Flexible in thin laminæ.

It contains, according to Klaproth (Beitrage, iii. 32) and Brandes, (Schweigger's Jahrbuch, v. 409,)

Tellurium	32·2	31·96
Lead	54·0	55·49
Gold	9·0	8·44
Silver	0·5	trace
Copper	1·3	1·14
Sulphur	3·0=100, K.	3·07=100·10, B.

From which it appears that it contains two atoms of tellurium and one atom of lead.

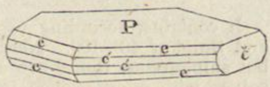
Before the blowpipe, on charcoal, it fuses readily into a malleable metallic button, tinging the flame at the same time blue, and covering the charcoal with white fumes. With borax it affords a bead of gold, with a little silver. It dissolves partially in nitric acid, and entirely in nitro-muriatic.

Obs. It occurs at Nagyag and Offenbanya, in Transylvania, in foliated masses and crystalline plates, accompanying, at the former place, silicate of manganese, blende, and gold; and at the latter, associated with antimony ores. A bitellurid of lead from Altai, has been described by Mr. G. Rose, (Pogg. Ann. xviii. 68,) which appears to be a purer variety of this species. An identity of crystalline form has not yet been shown, and we therefore have not incorporated its description with the above, but here append it.

G.=8·159. *Color* tin-white, much resembling that of native antimony. Sectile. Easily reduced to a powder. It contains Tellurium 38·37, Lead 60·85, and Silver 1·38. It is therefore nearly a pure bitelluret of lead. It may be wholly evaporised in the reducing flame, excepting a minute bead of silver. Its behavior under the blowpipe is very similar to that above described.

STERNBERGITE. Elasmites rhombicus.

Haidinger, Edin. Phil. Trans. XI. 1., and Brewster's Journal, VII. 242.



522. *Primary form:* a right rhombic prism; M : M=119° 30′. *Secondary form:* M : ĕ=120° 15′, e : e=118°. *Cleavage* highly eminent, parallel with P. Occurs commonly in implanted crystals, forming rose-like aggregations. The crystals are sometimes compound.

H.=1—1·5. G.=4·215. *Lustre* of P, highly metallic. *Streak* black. *Color* pinchbeck-brown, with occasionally a violet-blue tarnish on e. Opaque. Thin laminæ flexible; may be smoothed down by the nail when bent, and in this respect resembling tin-foil. Very sectile. Leaves traces on paper like plumbago, which may be removed by caoutchouc.

According to Prof. Zippe, of Prague, (Poggendorf's Annalen, xxvii. 690,) it contains Silver 33·2, Iron 36, and Sulphur 30=99·2.

Heated in a glass tube it gives out a sulphureous odor, loses its lustre, and becomes dark-gray and friable. On charcoal, before the blowpipe, it burns with a blue flame, and melts into a globule which is generally hollow, has a crystalline surface, and is covered with metallic silver. This globule acts on the magnetic needle, and exhibits the properties of sulphuret of iron. With borax, a globule of silver may be obtained.

Obs. It occurs with ores of silver, particularly the red and brittle silver ores, at Joachimstahl, in Bohemia. It was first noticed by Haidinger in a specimen in the public collection at Prague, of which Count Caspar Sternberg is the patron and supporter, and named by him in compliment to this talented nobleman.

FLEXIBLE SILVER ORE. Elasmites rhomboideus.

Ferro-Sulphuret of Silver. Argent Sulfuré Flexible, *Bournon*.

523. Occurs in small tabular crystals, whose primary form, according to Brooke, is a right rhomboidal prism; M : T=125°. *Cleavage* very perfect in one direction. Also massive.

Very soft, yields readily to the knife. *Lustre* metallic. *Streak* shining. *Color* externally nearly black. Opaque. Flexible in thin laminæ.

Composed, according to Wollaston, of Silver, Sulphur, and a little Iron.

Obs. This rare species has been found in small quantities at Himmelsfurst in Saxony, and in Hungary.

MOLYBDENITE. Elasmites hexagonus.

Rhombohedral Molybdena Glance, *M.* Sulphuret of Molybdena, *P.* Bisulphide of Molybdenum, *Thom.* Molybden Glanz, *L.* Wasserblei, *W.* Molybdene Sulfuré, *H.*

524. *Primary form:* a hexagonal prism. *Secondary form:*

flat hexagonal prisms with replaced terminal edges. *Cleavage* eminent, parallel with P. Occurs commonly in foliated masses.

H.=1—1·5. G.=4·569, Karsten; 4·7385, Brisson. *Lustre* metallic. *Streak* similar to color, slightly inclined to green. *Color* pure lead-gray. Opaque. *Fracture* not observable. Thin laminæ highly flexible, but not elastic. Sectile, and almost malleable.

It contains, according to Bucholz, (Gehlen's Journ. iv. 60,) Molybdenum 60, and Sulphur 40=100. Neither fusion nor reduction is effected by the blowpipe, but sulphureous fumes are emitted, which are deposited on the charcoal. It dissolves with effervescence in nitric acid, excepting a gray residue. It deflagrates with nitre.

Obs. Molybdenite generally occurs imbedded in, or disseminated through, granite, gneiss, zircon-sienite, and other primitive rocks. Numedahl, in Sweden, and Arendal, in Norway, and Greenland, are the only places where it has been observed in hexagonal prisms. The secondary form is exceedingly rare. Altenberg, in Saxony, Schlaggenwald and Zinnwald, in Bohemia, are among its foreign localities. At Caldbeck Fell, in Cumberland, it is associated with tungstate of lime and apatite; it also occurs at several of the Cornish mines.

At Haddam, Conn., and the adjoining towns on the Connecticut river, it occurs in gneiss in crystals and large plates; at Saybrook it is associated with stilbite. At Westmoreland, Vt., there is a large vein of molybdenite, where it occurs in granular masses of considerable size, and is associated with crystals of white apatite. It is also found at Shutesbury, Mass., and Bowdoin, Me.

This mineral is readily distinguished from plumbago by its lustre and streak, and also with perfect facility by its behavior before the blowpipe and with acids.

SULPHURET OF BISMUTH. Bismites rectangulus.

Prismatic Bismuth Glance, *M.* and *J.* Bismuthine. Wismuth Glanz, *of the Germans.* Bismuth Sulfuré, *H.*

525. *Primary form:* a right rectangular prism. Lateral planes *e*, longitudinally striated; $\bar{M}$: *e*=about 135° 30′, *e* : *e*=91°. *Cleavage* parallel with the planes P $\bar{M}$ and $\breve{M}$, most perfect parallel with $\bar{M}$. The above angle, 91°, was obtained by Brooke, by a measurement of artificial crystals of sulphuret of bismuth. It occurs generally either in acicular crystals, or massive, with a foliated or fibrous structure.

H.=2—2·5. G.=6·549. *Lustre* metallic. *Streak* and *Color* lead-gray. Opaque. Sectile.

It contains, according to Rose (Gilbert's Annalen, lxxii. 192) and Wöhrle, (Jahres-Bericht, 1833, p. 177,)

Sulphur	18·72	18·28
Bismuth	80·98=99·70, R.	80·96=99·24, W.

It fuses in the flame of a candle; before the blowpipe it is volatilized, and covers the charcoal with a yellow areola, during which it continually throws out small drops in a state of incandescence. It dissolves readily in hot nitric acid, from which a white precipitate falls, on diluting it with water.

Foliated masses of sulphuret of bismuth accompany molybdenite and apatite in quartz, at Caldbeckfell in Cumberland. In Cornwall it occurs in acicular prisms with pyrites. At Johanngeorgenstadt, both massive and acicular crystallizations are met with in limestone. It is associated with cerium ore at Bastnaes in Sweden.

It is said to have been observed at Haddam, Conn., associated with chrysoberyl, beryl, automolite, garnet, and Columbite.

Unlike native bismuth, this ore does not effervesce in cold nitric acid. By this test, these two species may be distinguished, when other characters fail. It is also more fusible than galena, and less volatile than gray antimony.

ACICULAR BISMUTH. Bismites acicularis.

Acicular Bismuth Glance, Needle Ore, *J.* Plumbo-Cupriferous Sulphuret of Bismuth. Nadelerz, *of the Germans.* Bismuth Sulfuré, Plumbo-Cuprifère, *Levy.*

526. Occurs in imbedded acicular crystals; also massive.

H.=2—2·5. G.=6·125, John. *Lustre* metallic. *Color* blackish lead-gray, with a pale copper-red tarnish. Opaque. *Fracture* uneven.

It contains, according to John, (Gehlen's Jour. 2d ser. V. 227,)

Bismuth	43·20
Lead	24·32
Copper	12·10
Nickel ?	1·58
Tellurium ?	1·32
Sulphur	11·58
Gold	0·79=94·89.

Before the blowpipe it gives off fumes of sulphur, fuses, and emits numerous burning globules, and yields a bead of lead containing copper, which colors glass of borax greenish-blue.

Obs. Acicular bismuth occurs imbedded in white quartz, and accompanies gold, malachite, and galena, at Beresof, near Ekatherinenberg, in Siberia. It was first described and analyzed by John and Karsten.

Another variety of cupreous bismuth has been observed in certain mines near Wittichen, in Furstenberg. Its color is pale lead-gray, passing into tin-white—subject to tarnish; streak black; composition, according to Klaproth, Bismuth 47·24, Copper 34·66, Sulphur 12·58=94·48. It is associated with native bismuth and copper pyrites, which constitute veins traversing granite.

TELLURIC BISMUTH. Bismites rhombohedrus.

Telluret of Bismuth. Bornite.

527. *Primary form:* a rhombohedron. *Cleavage* perfect parallel with R.

G.=7·514, Baumgärtner; 7·5, Wörhle. *Lustre* metallic. *Color* pale steel-gray. Not very sectile. Laminæ elastic. *Soils* paper like molybdenite.

It contains, according to Wörhle and Berzelius,

Bismuth	59·84	58·30
Tellurium	35·24	36·05
Sulphur	4·92	4·32
Matrix	——=100, W.	0·75=99·42, B.

It fuses instantly in the blowpipe flame, and soon volatilizes, covering the charcoal with a yellow coating. It dissolves, when pulverized, in nitric acid, excepting the sulphur, which is precipitated.

Obs. It occurs in Hungary, at Deutsch Pilsen, with iron pyrites, calc spar, &c.

RIONITE. ZINCITES FLAMMANS.

Seleniet of Zinc. Selenid of Zinc.

528. Massive.

G.=5·56. *Lustre* metallic, or earthy. *Streak* blackish, when the color is lead-gray. *Color* lead-gray—to cochineal-red.

According to Del Rio, it contains Selenium 49, Zinc 24, Mercury 19, and Sulphur 1·5, with 6 per cent. of lime from the gangue. It appears to be, therefore, a biselenid of zinc, with some disulphuret of mercury; whether mechanically mingled or not, it is uncertain.

Before the blowpipe it burns with a fine violet-colored flame, and exhales selenium with the strong odor of horse-radish. When heated in a retort, selenium, mercury, and a little sulphur, sublime.

OBS. This species was discovered by Del Rio, in 1817, at Calebras, in the mining district of El Doctor, in Mexico.

ORDER XI.—ADELINEA.

MANGANBLENDE. Acarpia cubica.

Hexahedral Glance Blende, *M.* Sulphuret of Manganese, *P.* Manganblende, *Breit.* Schwarzerz, *Haus.* Manganglanz, *L.* Manganèse Sulfuré, *H.*

529. *Primary form:* the cube. *Secondary form:* the regular octahedron. *Cleavage* perfect parallel with the primary faces. Occurs also granularly massive.

H.=3·5—4. G.=3·95—4·014. *Lustre* submetallic. *Streak* green. *Color* iron-black, tarnished brown on exposure. *Fracture* uneven.

It contains, according to Klaproth, Vauquelin, and Arfwedson,

Protoxyd of Manganese	82	85	62·6
Sulphur	11	15	37·0
Carbonic Acid	5=98, K.	—=100, V.	—=99·6, A.

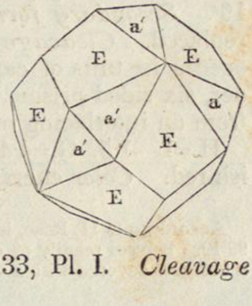
Only the thinnest edges are fused by means of the blowpipe. When pulverized and thrown into muriatic acid, or dilute sulphuric acid, sulphuretted hydrogen is evolved.

Obs. Manganblende occurs in veins, in the gold mines of Nagyag, in Transylvania, associated with tellurium, carbonate of manganese, and quartz.

BLENDE. Acarpia dodecahedra.

Dodecahedral Garnet Blende, *M.* Sulphuret of Zinc. Black Jack. Blende, *of the Germans.* Zinc Sulfuré, *H.* Pseudo-galena. Zincum sterile, *Linn.*

530. *Primary form:* the rhombic dodecahedron. *Secondary forms:* figs. 1, 6, 8, 9, 30, 32, Pl. I.; also the annexed figure, in which the acute solid angles are replaced by two instead of four secondary planes. These secondary planes would replace the alternate solid angles of the cube, three planes being situated on each, as in fig. 33, Pl. II. Sometimes this modification is accompanied by a truncation of the alternate obtuse solid angles of the dodecahedrons, which planes on the cube would occupy the unmodified solid angles of fig. 33, Pl. I. *Cleavage*



highly perfect parallel with the primary faces. *Compound crystals:* similar to fig. 129, Pl. II.; occurs parallel to the same faces (A, fig. 4, or a, fig. 8) in several of the secondary forms. This composition is often repeated. *Imperfect crystallizations:* botryoidal, and other imitative shapes—structure columnar—impalpable; also amorphous, with a similar structure.

H.=3·5—4. G.=4·027—4·078. *Lustre* adamantine—resinous. *Streak* white—reddish-brown. *Color* brown, black, yellow, red, green, none bright; yellow, when pure. Transparent—translucent. *Fracture* conchoidal. Brittle.

It contains, according to Arfwedson, (Kong. Vet. Acad. Handl., 1822, p. 438,) Berthier, (Ann. des Mines, ix. 420,) and Thomson, (Min. i. 540,)

		Brown.	
Zinc	66·34	63·0	66·000
Sulphur	33·66	33·6	32·628
Iron	——=100, A.	3·4=100, B.	1·372=100, T.

It is therefore a simple sulphuret of zinc. It often, however, contains a large portion of iron; in one specimen Thomson detected 20·74 per cent. It is infusible both *per se* and with borax. By a strong heat in the oxydating flame of the blowpipe, vapors of zinc are evolved, which coat the charcoal. It dissolves in nitric acid, during which sulphuretted hydrogen is disengaged. Some specimens exhibit a phosphorescence when struck with a steel, or by friction.

Obs. Blende occurs in both primary and secondary rocks, and is usually associated with galena; also with heavy spar, copper pyrites, fluor, spathic iron, and frequently it occurs in silver mines. Derbyshire, Cumberland, and Cornwall, afford the black varieties; also Transylvania, Hungary, and the Hartz. Sahla, in Sweden, Ratieborzitz, in Bohemia, and many Saxon localities, afford splendid black and brown crystals. A variety having a diverging fibrous structure, and presenting botryoidal forms, is met with at Fowey.

A yellowish-brown blende occurs abundantly with galena at Southampton, Mass. A black variety occurs at Monroe, Conn., with galena, wolfram, tungstate of lime, and magnetic pyrites. The Perkiomen lead mine near Philadelphia, and the Missouri lead mines, afford this ore in abundance. It is also found in connection with the veins of galena in St. Lawrence Co., N. Y. Other localities are the Falls of Niagara, Walton's gold mine, Louisa Co., Virginia, the Ancram lead mine, Columbia Co., N. Y.

RED ANTIMONY. Cerasia rhomboidea.

Prismatic Purple Blende, *M.* **Prismatic Antimony Blende,** *J.* **Rothspiesglaserz,** *W.* **Rothspeisglanzerz,** *Haus.* **Antimon Blende,** *L.* **Antimoine Hydro-Sulfuré, Antimoine Oxydé Sulfuré,** *H.*

531. *Primary form:* a right rhomboidal prism; M : T=101° 19′. *Secondary form:* primary with the lateral edges (*e*) deeply replaced. *Cleavage* highly perfect parallel with M. It usually occurs in tufts of capillary crystals, consisting of elongated, slender, six sided prisms. Also in flakes, resembling tinder, resulting from an interlacing of minute individuals.

H.=1—1·5. G.=4·45—4·6. *Lustre* adamantine. *Streak* brownish-red. *Color* cherry-red. Feebly translucent. Sectile.

According to H. Rose, it contains Antimony 74·45, Oxygen 4·27, Sulphur 20·47=99·19. It fuses readily on charcoal, and at last is entirely volatilized. In nitric acid it becomes covered with a white coating.

Obs. This rare mineral occurs in veins in quartz, accompanying gray and white antimony, at Malazka near Posing, in Hungary; at Braunsdorf, near Freiberg, in Saxony; and at Allemont, in Dauphiny. The tinder ore variety is found principally at Clausthal and Andreasberg, in the Hartz.

MIARGYRITE. Rubella obliqua.

Hemi-prismatic Ruby Blende, *M.* Bisulpho-antimoniate of Silver, *Thom.*

532. *Primary form:* an oblique rhombic prism; M : M=86° 4′, P : M=101° 6′. *Secondary forms:* similar to fig. 97, Pl. II.; lateral planes deeply striated. *Cleavage* parallel with M imperfect.

H.=2—2·5. G.=5·234. *Lustre* submetallic-adamantine. *Streak* dark cherry-red. *Color* iron-black. Opaque, except in thin splinters, which, by transmitted light, present a deep blood-red color. *Fracture* subconchoidal. Very sectile.

According to H. Rose, (Poggendorf's Annalen, xv. 469,) it contains Sulphur 21·95, Antimony 39·14, Silver 36·40, Copper 1·06, Iron 0·62=99·17. Before the blowpipe its action resembles that of the following species.

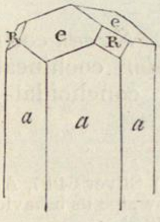
Obs. This rare species has been observed only in a mine at Braunsdorf, near Freiberg, in Saxony, associated with argentiferous arsenical pyrites. It was first distinguished from red silver ore by Mohs. Its name is derived from μειων, *less*, and ἀργυρος, *silver*, and was given it because it contained less silver than some kindred ores.

DARK RED SILVER ORE. Rubella rhombohedra.

Rhombohedral Ruby Blende, *M.* Ruby Silver, *P.* Black Silver. Subsesquisulpho-Antimoniate of Silver, *Thom.* Ærosite, Rothgiltigerz, *W.* Dunkles Rothgültigerz, *G.* Argent Antimonié Sulfuré, *H.* Argentum Rubrum, *Linn.*

533. *Primary form:* an obtuse rhombohedron; R : R=108° 18′. *Secondary forms:*

1.



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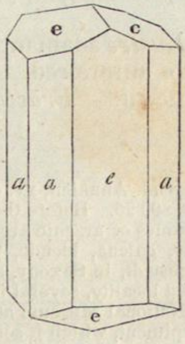

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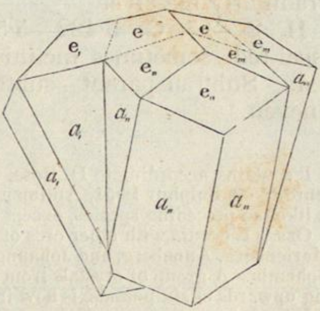


R : e=144° 9′, e : e=137° 29′. The crystals are often differently modified at their two extremities. *Cleavage* parallel with R, sometimes pretty distinct. *Compound crystals:* composition of the *second kind;* 1. parallel to e, or a plane truncating the terminal edge; this composition taking place parallel with each plane e at one extremity of the crystal, gives rise to the form represented in fig. 3, which is composed of four individuals; 2. parallel with *e* or a plane truncating a lateral edge; composition of the *third kind*, parallel to the face *a*, fig. 121, which truncates the lateral angle. *Imperfect crystallizations:* structure granular, sometimes impalpable.

H.=2·5. G.=5·7—5·9, Breithaupt. *Lustre* metallic-adamantine. *Streak* cochineal-red. *Color* black, sometimes approaching cochineal-red. Translucent—opaque. *Fracture* conchoidal. Sectile, yielding readily to the knife.

According to Bonsdorf, (Kong. Vet. Acad. Handl. 1821, 338,) it contains Silver 58·949, Antimony 22·846, Sulphur 16·609, Earthy matter 0·299=98·703, from which Thomson deduces the above chemical name of this species given among the synonyms. It fuses and gives out fumes of antimony; ultimately a globule of silver is obtained. It partially dissolves in heated nitric acid.

Obs. The *dark red silver ore* occurs principally with calcareous spar, native arsenic and galena, at Andreasberg, in the Hartz. In Saxony, Hungary, Norway, and at Guadalcanal in Spain, are other localities. In Mexico it is worked extensively as an ore of silver.

It is highly valuable as an ore of silver. Cinnabar may be distinguished from this species, by its complete volatility under the blowpipe.

LIGHT RED SILVER ORE. Rubella florida.

Rhombohedral Ruby Blende, *M.* Lichter Rothgültigerz. Proustite.

534. *Primary form:* an obtuse rhombohedron; R : R=107° 36′. *Secondary form:* similar to fig. 116 and 119, Pl. II. *Compound crystals:* similar to the preceding species. Occurs also granularly massive.

H.=2—2·5. G.=5·422—5·53. *Lustre* adamantine. *Streak* cochineal-red, sometimes inclining to aurora-red. *Color* cochineal-red. Subtransparent—subtranslucent. *Fracture* conchoidal—uneven.

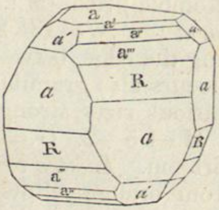
It contains, according to H. Rose, (Poggend. Annalen, xv. 473,) Silver 64·67, Arsenic 15·09, Sulphur 19·51, Antimony 0·69=99·96. Before the blowpipe its behavior is like the preceding species, except that fumes of arsenic are emitted.

Obs. It occurs with other ores of silver, galena, blende, pyrites, and arsenic, at Marienberg, Annaberg, and Johanngeorgenstadt, in Saxony, and at Joachimstahl, in Bohemia. A group of crystals from the last locality, several inches long, and weighing upwards of six pounds, is now in the National Museum at Prague.

It is an important ore of silver. Red orpiment, which it sometimes resembles, differs from it in having a yellow streak.

CINNABAR. Rubella peritoma.

Peritomous Ruby Blende, *M.* Sulphuret of Mercury. Zinnober. Quecksilber-Lebererz, *W.* Stinkzinnober Lebererz, *Haus.* Mercure Sulfuré, *H.* Κινναβαρις, *Theoph.* c. 103. Αμμιον, *Dioscor.* V. c. 109, 110. Minium. *Vitruv. Plin.*



535. *Primary form:* an acute rhombohedron; R : R=71° 47′. *Secondary form:* R : a''''=157° 20′. R horizontally striated. *Cleavage* parallel with *a*. *Compound crystals:* composition of the third kind—parallel with a, a plane truncating the terminal angle. *Imperfect crystallizations:* granularly massive—particles usually small, and often impalpable; sometimes forming superficial coatings.

H.=2—2·5. G.=8·098, a cleavable variety from Neurmarktel. *Lustre* adamantine, inclining to metallic in dark colored varieties, and to dull in friable varieties. *Streak* scarlet-red. *Color* cochineal-red, the darker varieties inclining to brownish-red, and lead-gray. Subtransparent—subtranslucent. *Fracture* subconchoidal, uneven. Sectile.

It contains, according to Klaproth, (Gehlen's Journal, v. 436, 440,)

	Neurmarktel.	Liver Ore from Idria.
Mercury	85·00	81·80
Sulphur	14·25=99·25.	13·75=95·55.

In the liver ore, which is a compact variety of a brown color, in addition to the above, Klaproth found Charcoal 2·30, Silica 0·65, Alumina 0·55, Iron 0·20, Copper 0·02, Water 0·73.

Before the blowpipe it volatilizes readily, when pure. It dissolves in nitric acid.

Obs. The *hepatic cinnabar* or *liver ore*, is an impure variety of this species; it sometimes affords a brownish streak in consequence of its impurities, and is occasionally slaty, though commonly granular or impalpable in its structure.

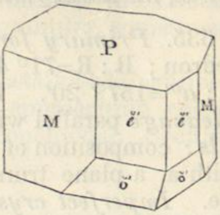
Cinnabar is usually associated in beds with native mercury, native amalgam, and occasionally only with calcareous spar and quartz. It has been observed in veins, with ores of iron.

The finest crystals of this species occur in the coal formations of Moschellandsberg and Wolfstein, in the Palatinate; also in Japan, Mexico, and Brazil. The most important beds of this ore are at Almaden in Spain, and at Idria in Carniola, where it is usually massive. It occurs at Richenau, in Upper Carinthia, in beds traversing gneiss; at Dunbrawa, in Transylvania, in gray-wacke; at Windisch Kappel, in Carinthia; at Neurmarktel, in Carniola. The variety *coralinerz*, from Idria, has a curved lamellar structure.

This ore is the great source of the mercury of commerce, from which it is obtained by sublimation. When pure, it is identical with the manufactured vermilion of commerce, which is a valuable pigment, and besides various other uses, is employed in coloring sealing wax. It was highly esteemed for its brilliancy of color by the ancients, and was employed as a paint for various sacred purposes.

REALGAR. Euchroa rubella.

Hemi-prismatic Sulphur, *M.* Red Orpiment or Ruby Sulphur, *J.* Red Sulphuret of Arsenic. Sulphide of Arsenic, *Thom.* Arsenous Sulphacid. Rothes Rauschgelb, *W.* Realgar, *Haus.* and *L.* Arsenic Sulfuré Rouge, *H.* Arsenicum Sandaraca, *Linn.* Σανδαρακη, *Theoph. Dioscor.* Sandaraca, *Plin. Vitr.*



536. *Primary form:* an acute oblique rhombic prism, M : M=74° 26′. *Secondary form:* ĕ′ : ĕ′=113° 20′; P : ĕ (plane truncating the edge between ĕ′ and ĕ′) =113° 16′. Occurs also granularly massive, particles of various sizes, strongly connected.

H.=1·5—2. G.=3·642, Breithaupt; 3·384, Brisson. *Lustre* resinous. *Streak* varying from orange-yellow to aurora-red. *Color* aurora-red or orange-yellow. Transparent—translucent. *Fracture* conchoidal, uneven. Sectile; yields to the nail.

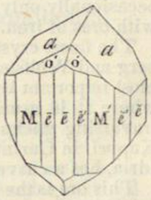
It contains Sulphur 29·96, and Arsenic 70·04=100. It fuses readily before the blowpipe and burns with a blue flame, and is dissipated in fumes of an alliaceous odor, with some sulphurous acid. By friction, it acquires negative electricity.

Obs. Fine crystallizations of this species have been observed with ores of silver and lead, at Felsobanya, in Upper Hungary, at Kapnik and Nagyag in Transylvania, at Joachimstahl in Bohemia, at Schneeberg in Saxony, and at Andreasberg in the Hartz. At Tajowa, in Hungary, it occurs in beds of clay, and at St. Gothard, in Switzerland, imbedded in dolomite. It has also been observed in the Vesuvian lavas, in minute crystals. Strabo speaks of a mine of *sandaraca* (the ancient name of this species) at Pompeiopolis in Paphlagonia.

Realgar has long been used as a pigment.

ORPIMENT. Euchroa aurea.

Prismatoidal Sulphur, *M.* Yellow Sulphuret of Arsenic. Sesquisulphide of Arsenic, *Thom.* Arsenic Sulphacid. Gelbes Rauschgelb, *W.* Rauschgelb, *Haus.* Auripigment, *L.* Arsenic Sulfuré Jaune, *H.* Resigallum. Auripigmentum, *Vitr.* 'Αρσενικόν, *Dioscor.* Αῤῥενῖκον, *Theoph.* Arsenicum, *Plin.*



537. *Primary form:* a right rhombic prism; M : M=100° 40′. *Secondary form:* M : ē=140° 20′, M : ĕ=129° 40′, *a* : *a*=83° 37′, ĕ : *a*=138° 12′. *Cleavage* parallel with ĕ highly perfect; parallel with ē in traces; ĕ longitudinally striated.

H.=1·5—2. G.=3·48, Haidinger; 3·4, Breithaupt. *Lustre* metallic-pearly upon the faces of perfect cleavage; elsewhere resinous. *Streak* yellow, commonly a little paler than the color. *Color* several shades of lemon-yellow. Subtransparent—subtranslucent. Sectile. Thin laminæ obtained by cleavage, flexible, but not elastic.

It contains Sulphur 39·08, and Arsenic 60·92. It burns with a blue flame on charcoal before the blowpipe, and emits fumes of sulphur and arsenic. Dissolves in nitric, muriatic, and sulphuric acids.

Obs. Orpiment occurs in small crystals imbedded in clay, near Neusohl, in Lower Hungary. It usually occurs in foliated and fibrous masses, and in this form is found at Kapnik in Transylvania, at Moldawa in the Bannat, and at Felsobanya in Upper Hungary, where it exists in metalliferous veins, associated with realgar and native arsenic.

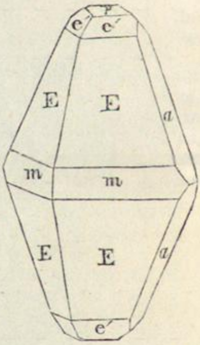
The name orpiment, is a corruption of its Latin name auripigmentum, "*paint of gold*," which was so called in allusion to its color, and also because it was supposed to contain gold.

It is used as a pigment.

ORDER XII.—THEIINEA.

NATIVE SULPHUR. SULPHUR PYRAMIDALIS.

Prismatic Sulphur, *M.* and *J.* Native Sulphur. Naturlicher Schwefel. Soufre, *H.* Θειον.



538. *Primary form:* a rhombic octahedron; E : E (adjacent in the same pyramid) =106° 38′, and 84° 58′, E : E (adjacent but in different pyramids) =143° 17′. *Secondary form:* m : m=101° 59′, m : E=161° 39′, E : *a*=132° 29′, e′ : e′ (adjacent) =127° 1′, p : e′=134° 53′, p : *a*=117° 48′. *Cleavage* parallel with E and m imperfect. *Compound crystals:* composition parallel with with *p*. *Imperfect crystallizations:* imitative shapes and amorphous; composed of concentric coats; massive structure granular—particles small, often impalpable, strongly coherent.

H.=1·5—2·5. G.=2·072, crystals from Spain. *Lustre* resinous. *Streak* sulphur-yellow—yellowish-white. *Color* sulphur-yellow, sometimes reddish or greenish. Transparent—subtranslucent. *Fracture* conchoidal, more or less perfect. Sectile.

It is pure sulphur, but is often contaminated with clay or bitumen. It burns with a bluish flame at a low temperature, with the strong odor of sulphurous acid. It becomes resinously electrified by friction. It is insoluble in water, and is not acted upon by the acids.

OBS. Sulphur is one of the dimorphous substances, since its crystalline form varies fundamentally with the temperature at which crystallization takes place. Crystallized from fusion, it presents obtuse oblique rhombic prisms, in which M : M=90° 32′, and P : ē (plane truncating the obtuse or front lateral edge) =95° 46′.

The great repositories of sulphur are either beds of gypsum and the associate rocks, or the regions of active and extinct volcanoes. In the valley of Noto and Mazzara in Sicily, at Conil near Cadiz in Spain, and Cracow in Poland, it occurs in the former situation. Sicily, and the neighboring volcanic isles, the Solfatara near Naples, the volcanoes of the Pacific ocean, &c., are localities of the latter kind. The crystals from Sicily are sometimes two or three inches in diameter. It is also deposited from hot springs in Iceland; and in Savoy, Switzerland, Hanover, and other countries, is met with in certain metallic veins. At Radoboy, near Crapina in Croatia, it occurs in imbedded spheroidal masses, which have a brownish tinge, owing to the presence of bitumen. Stromeyer detected selenium in a dark reddish colored sulphur of the Lipari islands.

The sulphur mines of Sicily, the crater of Volcano, and the Solfatara, near Naples, afford immense quantities of sulphur for commerce. Previous to becoming an article of commerce, it is purified by fusion or sublimation. The manufacture of gunpowder, of sulphuric acid, casts, cements, and various pharmaceutical preparations, are among the important processes in which sulphur is required.