

Epiboulangerite. — $3\text{PbS.Sb}_2\text{S}_3$. In striated prismatic needles and granular. $G. = 6.31$. Color dark bluish gray to black. From Altenberg, Saxony, Germany.

Epigenite. — Perhaps $4\text{Cu}_2\text{S.3FeS.As}_2\text{S}_5$. In short prisms resembling arsenopyrite. Color steel-gray. From Wittichen, Baden, Germany.

STANNITE. Tin Pyrites. Bell-metal Ore.

Tetragonal-sphenoidal. Pseudo isometric-tetrahedral through twinning. Twinning, (1) always interpenetrant with $e(101)$ as tw. pl., (2) interpenetrant with twin axis \perp to $p(111)$. Also massive, granular, and disseminated.

Cleavage: cubic, indistinct. Fracture uneven. Brittle. $H. = 4$. $G. = 4.3-4.522$; 4.506 Zinnwald. Luster metallic. Streak blackish. Color steel-gray to iron-black, the former when pure; sometimes a bluish tarnish; often yellowish from the presence of chalcopyrite. Opaque.

Comp. — A sulpho-stannate of copper, iron and sometimes zinc, $\text{Cu}_2\text{FeSnS}_4$ or $\text{Cu}_2\text{S.FeS.SnS}_2 = \text{Sulphur } 29.9, \text{ tin } 27.5, \text{ copper } 29.5, \text{ iron } 13.1 = 100$.

Pyr., etc. — In the closed tube decrepitates, and gives a faint sublimate; in the open tube sulphurous fumes. B.B. on charcoal fuses to a globule, which in O.F. gives off sulphur dioxide and coats the coal with tin dioxide; the roasted mineral treated with borax gives reactions for iron and copper. Decomposed by nitric acid, affording a blue solution, with separation of sulphur and tin dioxide.

Obs. — In Cornwall formerly found at Wheal Rock; and at Carn Brea; more recently in granite at St. Michael's Mount; also at Stenna Gwynn, etc.; at the Cronebane mine, Co. Wicklow, in Ireland; Zinnwald, in the Erzgebirge, Germany. Crystallized at Oruro, Bolivia. From the Black Hills, S. D.

Argyrodite. A silver sulpho-germanate, Ag_3GeS_4 or $4\text{Ag}_3\text{S.GeS}_2$. Isometric, crystals usually indistinct; at times they show octahedral and dodecahedral forms with frequent twinning according to the Spinel Law; also massive, compact. $H. = 2.5$. $G. = 6.085-6.266$. Luster metallic. Color steel-gray on a fresh fracture, with a tinge of red turning to violet. From the Himmelsfürst mine, Freiberg, Saxony; from Colquechaca and Aulagagas, Bolivia.

Canfieldite. Ag_3SnS_6 or $4\text{Ag}_3\text{S.SnS}_2$, the tin in part replaced by germanium. Isometric, in octahedrons with $d(110)$. Twins according to Spinel Law. $G. = 6.28$. Luster metallic. Color black. Colquechaca, Bolivia.

Teallite. PbSnS_2 . Orthorhombic? In thin flexible folia. Perfect basal cleavage. $H. = 1-2$. $G. = 6.4$. Color blackish gray. Streak black. Probably from Bolivia, exact locality unknown.

Franckeite. $\text{Pb}_3\text{Sn}_3\text{FeSb}_2\text{S}_{14}$ or $3\text{PbSnS}_2 + \text{Pb}_2\text{FeSb}_2\text{S}_8$. Massive. $G. = 5.55$. Color blackish gray to black. Las Animas, Bolivia.

Cylindrite. $\text{Pb}_3\text{Sn}_4\text{FeSb}_2\text{S}_{14}$ or $3\text{PbSnS}_2 + \text{SnFeSb}_2\text{S}_8$. $H. = 2.5-3$. $G. = 5.42$. Luster metallic. Color blackish lead-gray. In cylindrical forms separating under pressure into distinct shells or folia. Poopó, Bolivia.

IV. HALOIDS. — CHLORIDES, BROMIDES, IODIDES; FLUORIDES

I. Anhydrous Chlorides, Bromides, Iodides; Fluorides.

II. Oxychlorides; Oxyfluorides.

III. Hydrrous Chlorides; Hydrrous Fluorides.

The Fourth Class includes the haloids, that is, the compounds with the halogen elements, chlorine, bromine, iodine, and also the less closely related fluorine.

I. Anhydrous Chlorides, Bromides, Iodides; Fluorides

CALOMEL. Horn Quicksilver.

Tetragonal. Axis $c = 1.7234$; $001 \wedge 101 = 59^\circ 52'$. Crystals sometimes tabular || $c(001)$; also pyramidal; often highly complex.

Cleavage: $a(100)$ rather distinct; also $r(111)$. Fracture conchoidal. Sectile. $H. = 1-2$. $G. = 6.482$. Luster adamantine. Color white, yellowish gray, or ash-gray, also grayish, and yellowish white, brown. Streak pale yellowish white. Translucent — subtranslucent. Optically +. $\omega = 1.970$. $\epsilon = 2.650$.

Comp. — Mercurous chloride, $HgCl = \text{Chlorine } 15.1, \text{mercury } 84.9 = 100$.

Pyr., etc. — In the closed tube volatilizes without fusion, condensing in the cold part of the tube as a white sublimate; with soda gives a sublimate of metallic mercury. B.B. on charcoal volatilizes, coating the coal white. Insoluble in water, but dissolved by aqua regia; blackens when treated with alkalis.

Obs. — Usually associated with cinnabar. Thus at Moschellandsberg in the Palatinate, Germany; at Idria in Carniola, Austria; Almaden in Spain; at Mt. Avala near Belgrade in Servia. In crystals with many forms from Terlingua, Tex.

Calomel is an old term of uncertain origin and meaning, perhaps from $\kappa\alpha\lambda\acute{o}s$, *beautiful*, and $\mu\acute{\epsilon}\lambda\lambda\iota$, *honey*, the taste being sweet, and the compound the *Mercurius dulcis* of early chemistry; or from $\kappa\alpha\lambda\acute{o}s$ and $\mu\acute{\epsilon}\lambda\alpha\varsigma$, *black*.

Kleinite. Mercurammonite. A mercury ammonium chloride of uncertain composition. Hexagonal. Crystals short prismatic. Basal cleavage. $H. = 3.5$. $G. = 8.0$. Color yellow to orange, darkening on exposure. Volatile. From Terlingua, Tex.

Nantokite. Cuprous chloride, $CuCl$. Granular, massive. Cleavage cubic. $H. = 2-2.5$. $G. = 3.93$. Luster adamantine. Colorless to white or grayish. From Nantoko, Chile; Broken Hill, New South Wales.

Marshite. Cuprous iodide, CuI . Isometric-tetrahedral. Cleavage dodecahedral. $H. = 2.5$. $G. = 5.59$. Color oil-brown. $n = 2.346$. Broken Hill mines, New South Wales.

Halite Group. $\overset{I}{R}Cl, \overset{I}{R}Br, \overset{I}{R}I$. Isometric

Halite	NaCl	Embolite	Ag(Cl,Br)
Sylvite	KCl	Bromyrite	AgBr
Sal Ammoniac	$(NH_4)Cl$	Iodobromite	Ag(Cl,Br,I)
Cerargyrite	AgCl	Miersite	AgI

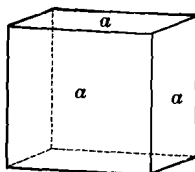
The HALITE GROUP includes the halogen compounds of the closely related metals, sodium, potassium, and silver, also ammonium (NH_4) . They crystallize in the isometric system, the cubic form being the most common. Sylvite and sal-ammoniac are plagiohedral, and the same may be true of the others.

HALITE. COMMON or ROCK SALT.

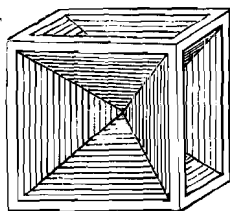
Isometric. Usually in cubes; crystals sometimes distorted, or with cavernous faces. Also massive, granular to compact; less often columnar.

Cleavage: cubic, perfect. Fracture conchoidal. Rather brittle. $H. = 2.5$. $G. = 2.1-2.6$; pure crystals 2.135. Luster vitreous. Colorless or white also yellowish, reddish, bluish, purplish. Transparent to translucent. Soluble; taste saline. $n = 1.5442$. Highly diathermanous.

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Comp. — Sodium chloride, NaCl = Chlorine 60.6, sodium 39.4 = 100. Commonly mixed with calcium sulphate, calcium chloride, magnesium chloride, and sometimes magnesium sulphate, which render it liable to deliquesce.

Pyr., etc. — In the closed tube fuses, often with decrepitation; when fused on the platinum wire colors the flame deep yellow. After intense ignition the residue gives an alkaline reaction upon moistened test paper. Nitric acid solution gives precipitate of silver chloride upon addition of silver nitrate. Dissolves readily in three parts of water.

Diff. — Distinguished by its solubility (taste), softness, perfect cubic cleavage.

Obs. — Common salt occurs in extensive but irregular beds in rocks of various ages, associated with gypsum, polyhalite, anhydrite, carnallite, clay, sandstone, and calcite; also in solution forming salt springs; similarly in the water of the ocean and salt seas. The deposits of salt have been formed by the gradual evaporation and ultimate drying up of enclosed bodies of salt water. Salt beds formed in this way are subsequently covered by other sedimentary deposits and gradually buried beneath the rock strata thus formed. The salt strata range from a few feet up to more than one hundred feet in thickness and have been found at depths of two thousand feet and more beneath the earth's surface.

The principal salt mines of Europe are at Stassfurt, near Magdeburg, Saxony; Wieliczka, in Galicia; at Hall, in Tyrol, Austria; and along the range through Reichenal in Bavaria, Hallein in Salzburg, Hallstadt, Ischl, and Ebensee, in Upper Austria, and Aussee in Styria; in Hungary, at Marmoros and elsewhere; Transylvania; Wallachia, Galicia, and Upper Silesia; in southern and southeastern Russia; Vic and Dieuze in France; Valley of Cardona and elsewhere in Spain; Bex in Switzerland; and Northwich in Cheshire, England.

Salt also occurs, forming hills and covering extended plains, near Lake Urumia, the Caspian Sea, etc. In Algeria; in Abyssinia. In India in enormous deposits in the Salt Range of the Punjab. In China and Asiatic Russia; in South America, in Peru, and at Zipaquera and Nemocón, the former a large mine long explored in the Cordilleras of Colombia; clear salt is obtained from the Cerro de Sal, San Domingo.

In the United States, salt has been found in large amount in central and western N. Y. Salt wells had long been worked in this region, but rock salt is now known to exist over a large area from Ithaca at the head of Cayuga Lake, Tompkins Co., and Canandaigua Lake, Ontario Co., through Livingston Co., also Genesee, Wyoming, and Erie Cos. The salt is found in beds with an average thickness of 75 feet, but sometimes much thicker (in one instance 325 feet), and at varying depths from 1000 to 2000 feet and more; the depth increases southward with the dip of the strata. The rocks belong to the Salina period of the Upper Silurian. Extensive deposits of salt occur in Mich., chiefly in Saginaw, Bay, Midland, Isabella, Detroit, Wayne, Manistee and Mason Counties. Salt has also been found near Cleveland, Ohio, associated with gypsum; in Kan.; in La., extensive beds occur in the southern portion of the state at and in the neighborhood of Petite Anse island. Salt has also been obtained from Nev., Utah, Ariz. and Cal. In Utah and Cal. salt is chiefly obtained by the evaporation of the waters of Great Salt Lake and the ocean.

Brine springs are very numerous in the Middle and Western States. Vast lakes of salt water exist in many parts of the world. The Great Salt Lake in Utah is 2000 square miles in area; L. Gale found in this water 20.196 per cent of sodium chloride. The Dead and Caspian seas are salt, and the waters of the former contain 20 to 26 parts of solid matter in 100 parts. Sodium chloride is the prominent salt present in the ocean.

Use. — The chief uses of salt are for culinary and preservative purposes. Soda ash is also made from it, being employed in the manufacture of glass, soap, bleaching, preparation of other sodium compounds, etc.

Villiaumite. NaF . Isometric. In small carmine colored grains. Soft. $G. = 2.8$. Refractive index = 1.33. Found in nepheline-syenite from the Islands of Los.

Huantajayite. $20\text{NaCl} \cdot \text{AgCl}$. In cubic crystals and as an incrustation. $H. = 2$. Not sectile. Color white. From Huantajaya, Tarapacá, Chile.

SYLVITE.

Isometric-plagiohedral. Also in granular crystalline masses; compact.

Cleavage: cubic, perfect. Fracture uneven. Brittle. $H. = 2$. $G. = 1.97-1.99$. Luster vitreous. Colorless, white, bluish or yellowish red from inclusions. Soluble; taste resembling that of common salt, but bitter. $n = 1.490$.

Comp. — Potassium chloride, KCl = Chlorine 47.6, potassium 52.4 = 100. Sometimes contains sodium chloride.

Pyr., etc. — B.B. in the platinum loop fuses, and gives a violet color to the outer flame. Dissolves completely in water (saline taste). After ignition residue reacts alkaline upon moistened test paper. Solution in nitric acid gives precipitate of silver chloride with silver nitrate.

Obs. — Occurs at Vesuvius, about the fumaroles of the volcano. Also in Germany at Stassfurt, Saxony; and at Leopoldshall (*leopoldite*), Anhalt; at Kalusz in Galicia.

Use. — A source of potash compounds used as fertilizers.

Sal Ammoniac. Ammonium chloride, NH_4Cl . $n = 1.642$. Observed as a white incrustation about volcanoes, as at Etna, Vesuvius, etc.

Cerargyrite Group. Isometric-Normal

An isomorphous series of silver haloids in which silver chloride, bromide and iodide may mix in varying proportions. The suggestion has been made that the name cerargyrite be kept as the group name and that the different sub-species be named as follows: *chlorargyrite*, AgCl ; *bromargyrite*, AgBr ; *embolite*, $\text{Ag}(\text{Cl}, \text{Br})$; *iodemolite*, $\text{Ag}(\text{Cl}, \text{Br}, \text{I})$.

CERARGYRITE. Horn Silver.

Isometric. Habit cubic. Twins: tw. pl. $o(111)$. Usually massive and resembling wax; sometimes columnar; often in crusts.

Cleavage none. Fracture somewhat conchoidal. Highly sectile. $H. = 1-1.5$. $G. = 5.552$. Luster resinous to adamantine. Color pearl-gray, grayish green, whitish to colorless, rarely violet-blue; on exposure to the light turns violet-brown. Transparent to translucent. $n = 2.0611$.

Comp. — Silver chloride, $\text{AgCl} = \text{Chlorine}, 24.7, \text{silver } 75.3 \approx 100$. Some varieties contain mercury.

Pyr., etc. — In the closed tube fuses without decomposition. B.B. on charcoal gives a globule of metallic silver. Added to a bead of salt of phosphorus, previously saturated with oxide of copper and heated in O.F., imparts an intense azure-blue to the flame. Insoluble in nitric acid, but soluble in ammonia.

Obs. — Cerargyrite and the related minerals are products of secondary action and are commonly found in the upper parts of silver deposits. Descending waters containing chlorine, bromine or iodine act upon the oxidation products of the primary silver minerals and so precipitate these relatively insoluble compounds. Commonly associated with other silver minerals, with lead, copper and zinc ores and their usual alteration products.

The largest masses are brought from Peru, Chile, Bolivia, and Mexico, where it occurs with native silver. Also once obtained from Johanngeorgenstadt and Freiberg, Saxony; occurs in the Altai Mts.; at Kongsberg in Norway.

In the United States, in Col., near Leadville, Lake Co.; near Breckenridge, Summit Co., and elsewhere. In Nev. near Austin, Lander Co.; at mines of Comstock lode; Tonapah. In Idaho, at the Poorman mine, in crystals; also at various other mines. In Utah, in Beaver, Summit and Salt Lake counties. At Tombstone, Ariz.

Named from *κερας*, horn, and *αργυρος*, silver.

Use. — An ore of silver.

Embolite. Silver chloro-bromide $\text{Ag}(\text{Br}, \text{Cl})$, the ratio of chlorine to bromine varying widely. Usually massive. Resembles cerargyrite, but color grayish green to yellowish green and yellow. $n = 2.15$. Abundant in Chile. Found also at Broken Hill, New South Wales; Tonapah, Nev.; Leadville, Col.; Yuma County, Ariz.; Georgetown, N. M.

Bromyrite. Silver bromide, AgBr . $G. = 5.8-6$. Color bright yellow to amber-yellow; slightly greenish. $n = 2.25$. From Mexico; Chile.

Iodobromite. $2\text{AgCl} \cdot 2\text{AgBr} \cdot \text{AgI}$. Isometric. $G. = 5.713$. Color sulphur-yellow, greenish. $n = 2.2$. From near Dernbach, Nassau; Broken Hill, New South Wales.

Miersite. Silver, copper iodide, $4\text{AgI} \cdot \text{CuI}$. Isometric; tetrahedral. $G. = 5.64$. In bright yellow crystals from the Broken Hill Silver Mines, New South Wales. *Cuprodargyrite* from Huantajaya, Peru, belongs here also.

Iodyrite. Silver iodide, AgI . Hexagonal-hemimorphic; usually in thin plates; pale

yellow or green. $G. = 5.5-5.7$. Optically +. $\omega = 2.182$. From Mexico, Chile, etc. Lake Valley, Sierra Co., N. M. In crystals from Broken Hill, New South Wales, and Tonapah, Nev.

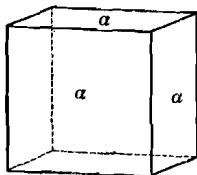
Fluorite Group. $\overset{II}{R}F_2, \overset{II}{R}Cl_2$

The species here included are Fluorite, CaF_2 , and the rare Hydrophillite, $CaCl_2$. Both are isometric, habit cubic.

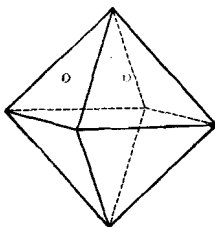
FLUORITE or FLUOR SPAR.

Isometric. Habit cubic; less frequently octahedral or dodecahedral; forms $f(310)$, $e(210)$ (fluoroids) common; also the vicinal form $\zeta(32\cdot1\cdot0?)$, producing striations on $a(100)$ (Fig. 682); hexoctahedron $t(421)$ also common with the cube (Fig. 681). Cubic crystals sometimes grouped in parallel position, thus forming a pseudo-octahedron. Twins: tw. pl. $o(111)$, com-

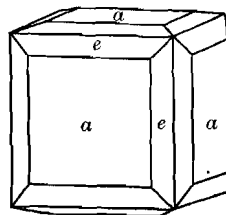
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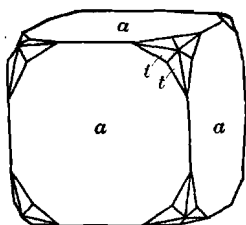


monly penetration-twins (Fig. 682). Also massive; granular, coarse or fine; rarely columnar; compact.

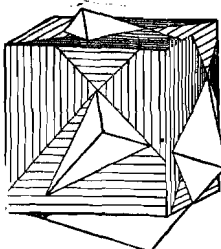
Cleavage: $o(111)$ perfect. Fracture flat-conchoidal; of compact kinds

splintery. Brittle. $H. = 4$. $G. = 3.01-3.25$; 3.18 cryst. Luster vitreous. Color white, yellow, green, rose- and crimson-red, violet-blue, sky-blue, and brown; wine-yellow, greenish blue, violet-blue, most common; red, rare. Streak white. Transparent — subtranslucent. Sometimes shows a bluish fluorescence. Some varieties phosphoresce when heated (p. 251). $n = 1.4339$.

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Comp. — Calcium fluoride, $CaF_2 =$ Fluorine 48.9, calcium 51.1 = 100. Chlorine is sometimes present in minute quantities.

Var. — 1. *Ordinary*; (a) cleavable or crystallized, very various in colors; (b) fibrous to columnar, as the Derbyshire blue-john used for vases and other ornaments; (c) coarse to fine granular; (d) earthy, dull, and sometimes very soft. *Chlorophane* yields a green phosphorescent light.

Pyr., etc. — In the closed tube decrepitates and sometimes phosphoresces. B. B. in the forceps and on charcoal fuses, coloring the flame orange, to an enamel which reacts alkaline on test paper. Fused in a closed tube with potassium bisulphate gives reaction for fluorine.

Diff. — Distinguished by its crystalline form, octahedral cleavage, relative softness (as compared with certain precious stones, also with the feldspars); etching power when treated with sulphuric acid. Does not effervesce with acid like calcite.

Obs. — Fluorite occurs most commonly as a vein mineral either in deposits in which it is the chief constituent or as a gangue mineral with various metallic ores, especially those of lead and zinc. It is common in sedimentary rocks, being often found in dolomites and limestones. It is also found as a minor accessory mineral in granite and other acid igneous rocks. It occurs as a sublimation product in connection with volcanic rocks.

In the North of England, it is the gangue of the lead veins, which intersect the coal formation in Northumberland, Cumberland, Durham, and Yorkshire. In Derbyshire it is abundant, and also in Cornwall, where the veins intersect metamorphic rocks. The Cumberland and Derbyshire localities especially have afforded magnificent specimens. Common in the mining district of Saxony; from Stolberg, Harz Mts.; fine near Kongsberg in Norway. In the dolomites of St. Gothard occurs in pink octahedrons; from Brienz, Switzerland. From Rabenstein, Tyrol, Austria. Rarely in volcanic regions, as in the Vesuvian lava. In colorless transparent crystals from Madoc, Hastings Co., Ontario, Canada.

Some localities in the United States are, Trumbull, Conn. (*chlorophane*); Muscoulonge Lake, Jefferson Co., N. Y., and Macomb, St. Lawrence Co., both in very large sea-green cubes; Franklin Furnace, N. J.; Amelia Court House, Va.; Westmoreland, Ver. Fluorite has been mined in the United States chiefly from Western Kentucky and adjacent sections in Hardin and Pope counties, Ill. Also obtained from Jamestown, Boulder County; Evergreen, Jefferson County, and near Rosita, Custer County, Col.; from ten miles north of Deming, N. M.; from Smith, Trousdale and Wilson counties, Tenn.; from Castle Dome district, Ariz.

Use. — As a flux in the making of steel; in the manufacture of opalescent glass; in enameling cooking utensils; the preparation of hydrofluoric acid; sometimes as an ornamental material.

Hydrophilite. Chlorocalcite. Calcium chloride, CaCl_2 . In white cubic crystals or as an incrustation at Vesuvius. *Baumlerite* is same material intergrown with halite and tachydrite from Leinetal, Germany.

The following are from Vesuvius: **Chloromagnesite**, MgCl_2 ; **Scacchite**, MnCl_2 ; **Chloralluminite**, $\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$; **Molysite**, FeCl_3 ; **Chlormanganokalkite**, $4\text{KCl} \cdot \text{MnCl}_2$.

Sellaite. Magnesium fluoride, MgF_2 . In prismatic tetragonal crystals. $H. = 5$. $G. = 2.97-3.15$. Colorless. Optically +. $\omega = 1.378$. From the moraine of the Gebroulaz glacier in Savoie, France. *Belonesite* is the same species.

Lawrencite. Ferrous chloride, FeCl_2 . Occurs in meteoric iron.

Rinneite. $\text{FeCl}_2 \cdot 3\text{KCl} \cdot \text{NaCl}$. Rhombohedral. In coarse granular masses. Prismatic cleavage. $H. = 3$. $G. = 2.3$. Colorless, rose, violet or yellow when fresh, becomes brown on exposure due to oxidation. $\omega = 1.59$. Easily fusible. Astringent taste. Found in Germany at Nordhausen and elsewhere in Saxony and at Diekholzen, Hannover.

Cotunnite. Lead chloride, PbCl_2 . In acicular crystals (orthorhombic) and in semi-crystalline masses. Soft. $G. = 5.24$. Color white, yellowish. Optically +. $\beta = 2.217$. From Vesuvius; also Tarapacá, Chile.

Tysonite. Fluoride of the cerium metals, $(\text{Ce}, \text{La}, \text{Di})\text{F}_3$. In thick hexagonal prisms, and massive. Cleavage: $c(001)$, perfect. $H. = 4.5-5$. $G. = 6.13$. Color pale wax-yellow, changing to yellowish or reddish brown. From the granite of Pike's Peak, El Paso Co., Col. *Fluocerite*, from Österby, Sweden, is probably the same species.

Yttrifluorite. $(\text{Ca}_2\text{Y}_2)\text{F}_6$, near *ytrocerite*. Isometric. In granular masses. Imperfect octahedral cleavage. $H. = 4.5$. $G. = 3.55$. Color yellow, also with brown or green shades. $n = 1.46$. Found in pegmatite in northern Norway.

CRYOLITE.

Monoclinic. Axes $a : b : c = 0.9663 : 1 : 1.3882$; $\beta = 89^\circ 49'$.

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

cm , $001 \wedge 110 = 89^\circ 52'$.

cv , $001 \wedge 101 = 55^\circ 2'$.

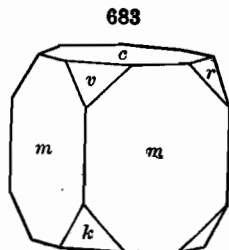
ck , $001 \wedge \bar{1}01 = 55^\circ 17'$.

cr , $001 \wedge 011 = 54^\circ 14'$.

cp , $001 \wedge 111 = 63^\circ 18'$.

Crystals often cubic in aspect and grouped in parallel position; often with twin lamellæ. Massive.

Parting at times due to twinning lamellæ parallel to $c(001)$, $m(110)$ and $k(\bar{1}01)$. Fracture uneven. Brittle. $H. = 2.5$. $G. = 2.95-3.0$. Luster vitreous to greasy; somewhat pearly on $c(001)$. Colorless to snow-white,



sometimes reddish or brownish to brick-red or even black. Transparent to translucent. Optically +. Mean index, 1.364.

Comp. — A fluoride of sodium and aluminium, Na_3AlF_6 or $3\text{NaF} \cdot \text{AlF}_3$ = Fluorine 54.4, aluminium 12.8, sodium 32.8 = 100. A little iron sesquioxide is sometimes present as impurity.

Pyr., etc. — Fusible in small fragments in the flame of a candle. Heated in C. T. with potassium bisulphate gives fluorine reaction. In the forceps fuses very easily, coloring the flame yellow. On charcoal fuses easily to a clear bead, which on cooling becomes opaque; after long blowing, the assay spreads out, the fluoride of sodium is absorbed by the coal, a suffocating odor of fluorine is given off, and a crust of alumina remains, which, when heated with cobalt solution in O.F., gives a blue color. Soluble in sulphuric acid, with evolution of hydrofluoric acid.

Diff. — Distinguished by its extreme fusibility. Because of its low index of refraction the powdered mineral becomes almost invisible when placed in water. Its planes of parting (resembling cubic cleavage) and softness are characteristic.

Obs. — Occurs in a bay in Arksukfiord, in West Greenland, at Ivigtut (or Evigtok), about 12 m. from the Danish settlement of Arksuk, where it constitutes a large bed in a granitic vein in a gray gneiss. Cryolite and its alteration products, pachnolite, thomsonolite, prosopite, etc., also occur in limited quantity at the southern base of Pike's Peak, El Paso county, Col., north and west of Saint Peter's Dome.

Named from *κρύος*, *frost*, *λίθος*, *stone*, hence meaning *ice-stone*, in allusion to the translucency of the white masses.

Use. — In the manufacture of sodium salts, certain kinds of glass and porcelain, and as a flux in the electrolytic process for the production of aluminum.

Cryolithionite is a variety of cryolite with half the sodium replaced by lithium. G. = 2.78. Refractive index 1.34. Associated with cryolite at Ivigtut.

Ghiolite. $5\text{NaF} \cdot 3\text{AlF}_3$. In small pyramidal crystals (tetragonal); also massive granular. Cleavages, $c(001)$ perfect, $p(111)$ distinct. H. = 3.5-4. G. = 2.84-2.90. Color snow-white. Optically —. ω = 1.349. From near Miask in the Ilmen Mts., Russia; also with the Greenland cryolite.

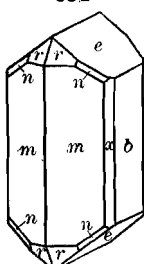
Hieratite. A fluoride of potassium and silicon. In grayish stalactitic concretions; isometric. From the fumaroles of the crater of Vulcano, Lipari Islands.

II. Oxychlorides, Oxyfluorides

ATACAMITE.

Orthorhombic. Axes $a : b : c = 0.6613 : 1 : 0.7515$.

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mm'' , $110 \wedge \bar{1}10 = 66^\circ 57'$.
 ee' , $011 \wedge \bar{0}\bar{1}1 = 73^\circ 51'$.

rr''' , $111 \wedge \bar{1}\bar{1}1 = 52^\circ 48'$.
 mr , $110 \wedge 111 = 36^\circ 16\frac{1}{2}'$.

Commonly in slender prismatic crystals, vertically striated. Twins according to a complex law. (*Paratacamite* is twinned atacamite.) In confused crystalline aggregates; also massive, fibrous or granular to compact; as sand.

Cleavage: $b(010)$ highly perfect. Fracture conchoidal. Brittle. H. = 3-3.5. G. = 3.75-3.77. Luster adamantine to vitreous. Color bright green of various shades, dark emerald-green to blackish green. Streak apple-green. Transparent to translucent. Optically —. α = 1.831. β = 1.861. γ = 1.880.

Comp. — $\text{Cu}_2\text{Cl}(\text{OH})_3$ or $\text{CuCl}_2 \cdot 3\text{Cu}(\text{OH})_2$ = Chlorine 16.6, copper 14.9, cupric oxide 55.8, water 12.7 = 100.

Pyr., etc. — In the closed tube gives off much water, and forms a gray sublimate. B.B. on charcoal fuses, coloring the O.F. azure-blue, with a green edge, and giving two coatings, one brownish and the other grayish white; continued blowing yields a globule of metallic copper; the coatings, touched with the R.F., volatilize, coloring the flame azure-blue. In acids easily soluble.

Obs. — Originally from Atacama in the northern part of Chile; also found at Collahuasi, Tarapacá and elsewhere in Chile and Bolivia; at Wallaroo and Bimbowrie, in South Australia; at Gloncurry, Queensland; at St. Just in Cornwall. In the United States, with cuprite, etc., at the United Verde mine, Jerome, Ariz.

Percylite. A lead-copper oxychloride, perhaps $\text{PbCl}_2 \cdot \text{CuO} \cdot \text{H}_2\text{O}$. In sky-blue cubes. From Sonora, Mexico; Atacama, Chile; Bolivia, etc.

Boleite. $9\text{PbCl}_2 \cdot 8\text{CuO} \cdot 3\text{AgCl} \cdot 9\text{H}_2\text{O}$. Tetragonal, pseudo-isometric. Twinned to form pseudo cubes. **Pseudo-boleite.** $5\text{PbCl}_2 \cdot 4\text{CuO} \cdot 6\text{H}_2\text{O}$. Tetragonal. **Cumengite.** $4\text{PbCl}_2 \cdot 4\text{CuO} \cdot 5\text{H}_2\text{O}$. Tetragonal. Pseudo-boleite and cumengite occur in parallel growth upon crystals of boleite. Boleite and pseudo-boleite have pearly luster on cleavage, while cumengite has not. All three deep blue in color, the first two showing a greenish tinge in powder. Found at Boleo, near Santa Rosalia, Lower California.

Matlockite. Lead oxychloride, Pb_2OCl_2 . In tabular tetragonal crystals. $G. = 7.21$. Luster adamantine to pearly. Color yellowish or slightly greenish. Optically —. $\omega = 2.15$. From Cromford, near Matlock, Derbyshire.

Mendipite. $\text{Pb}_2\text{O}_2\text{Cl}_2$ or $\text{PbCl}_2 \cdot 2\text{PbO}$. In fibrous or columnar masses; often radiated. $H. = 2.5-3$. $G. = 7-7.1$. Color white. Index, 1.93. From the Mendip Hills, Somersetshire, England; near Brilon, Westphalia.

Lorettoite. $6\text{PbO} \cdot \text{PbCl}_2$. Tetragonal? Coarse fibers or blades. Perfect basal cleavage. $G. = 7.6$. $H. = 3$. Fusible at 1. Color honey-yellow. Uniaxial, —. Indices, 2.37–2.40. From Loretto, Tenn.

Laurionite. PbClOH or $\text{PbCl}_2 \cdot \text{Pb}(\text{OH})_2$. In minute prismatic colorless crystals (orthorhombic), in ancient lead slags at Laurion, Greece. Optically —. $\beta = 2.116$. **Paralaurionite.** Same composition as laurionite but monoclinic. From Laurion. **Rafaelite** from Chile is the same mineral. Suggested that laurionite is the same as paralaurionite but owing to submicroscopic twinning has apparently orthorhombic symmetry. **Fiedlerite**, associated with laurionite, is probably also a lead oxychloride; in colorless monoclinic crystals.

Penfieldite. Pb_2OCl_2 or $\text{PbO} \cdot 2\text{PbCl}_2$. In white hexagonal crystals. Laurion, Greece.

Daviesite. A lead oxychloride of uncertain composition. In minute colorless prismatic crystals (orthorhombic) from the Mina Beatriz, Sierra Gorda, Atacama, Chile.

Schwartzembergite. Probably $\text{Pb}(\text{I}, \text{Cl})_2 \cdot 2\text{PbO}$. In druses of small crystals; also in crusts. $G. = 6.2$. Color honey-yellow. Desert of Atacama, Chile.

Nocerite. Perhaps $2(\text{Ca}, \text{Mg})\text{F}_2(\text{Ca}, \text{Mg})\text{O} (?)$. In white hexagonal acicular crystals from bombs in the tufa of Nocera, Italy.

Koenenite. An oxychloride of aluminium and magnesium. Rhombohedral. Perfect cleavage yielding flexible folia. Very soft. $G. = 2.0$. Color red, due to included hematite. From near Volpriehausen in the Solling, Germany.

Daubreite. An earthy yellowish oxychloride of bismuth. From Bolivia.

The following are oxychlorides of mercury from the mercury deposits at Terlingua, Texas. Associated minerals are montroydite, calomel, native mercury and calcite.

Eglestonite. $\text{Hg}_2\text{Cl}_2\text{O}$. Isometric in minute crystals of dodecahedral habit. Many forms observed. $H. = 2-3$. $G. = 8.3$. Luster adamantine to resinous. Color brownish yellow darkening on exposure to black. $n = 2.49$. Volatile.

Terlinguaite. Hg_2ClO . Monoclinic. In small striated prismatic crystals elongated parallel to the b -axis. Many forms observed. Cleavage perfect. $H. = 2-3$. $G = 8.7$. Luster adamantine. Color sulphur-yellow changing to olive-green on exposure.

III. Hydrous Chlorides, Hydrous Fluorides, etc.

CARNALLITE.

Orthorhombic. Crystals rare. Commonly massive, granular.

No distinct cleavage. Fracture conchoidal. Brittle. $H. = 1$. $G = 1.60$. Luster shining, greasy. Color milk-white, often reddish. Transparent to translucent. Strongly phosphorescent. Optically +. $2V = 70^\circ$. $\alpha = 1.466$. $\beta = 1.475$. $\gamma = 1.494$. Taste bitter. Deliquescent.

Comp. — $\text{KMgCl}_3 \cdot 6\text{H}_2\text{O}$ or $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ = Chlorine 38.3, potassium 14.1, magnesium 8.7, water 39.0 = 100.

Obs. — Occurs at Stassfurt, in beds, alternating with thinner beds of common salt and kieselite. In large crystals from Beienrode, near Königshütte, Silesia.

Use. — Carnallite is a source of potash compounds used in fertilizers.

DOUGLASITE, associated with carnallite, is said to be $2\text{KCl} \cdot \text{FeCl}_2 \cdot 2\text{H}_2\text{O}$.

Bischofite. $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$. Crystalline-granular; colorless to white. Optically +. $\beta = 1.507$. From Leopoldshall and Stassfurt, Prussia.

Kremersite. $\text{KCl} \cdot \text{NH}_4\text{Cl} \cdot \text{FeCl}_2 \cdot \text{H}_2\text{O}$. In red octahedrons. From Vesuvius and Mt. Etna, Sicily.

Mosesite. A mercury-ammonium compound containing chlorine, sulphur trioxide and water. Near *kleinite* in composition. Isometric. Minute octahedrons. Spinel twins. $H. = 3+$. Color yellow. Doubly refracting at ordinary temperatures. Found sparingly at Terlingua, Texas.

Erythrosiderite. $2\text{KCl} \cdot \text{FeCl}_3 \cdot \text{H}_2\text{O}$. In red tabular crystals. Vesuvius.

Tachydrite. $\text{CaCl}_2 \cdot 2\text{MgCl}_2 \cdot 12\text{H}_2\text{O}$. In wax- to honey-yellow masses. From Stassfurt, Germany.

Fluellite. $\text{AlF}_3 \cdot \text{H}_2\text{O}$. In colorless or white rhombic pyramids. Index, 1.47. From Stenna Gwyn, Cornwall.

Prosopite. $\text{CaF}_2 \cdot 2\text{Al}(\text{F},\text{OH})_3$. In monoclinic crystals, or granular massive. $H. = 4.5$. $G. = 2.88$. Colorless, white, grayish. $\beta = 1.502$. From Altenberg, Saxony; St. Peter's Dome near Pike's Peak, Col.; Utah.

Pachnolite and **Thomsenolite**, occurring with cryolite in Greenland, Col., and Ural Mts., have the same composition, $\text{NaF} \cdot \text{CaF}_2 \cdot \text{AlF}_3 \cdot \text{H}_2\text{O}$. Both occur in monoclinic prismatic crystals; prismatic angle for pachnolite, $98^\circ 36'$, crystal twins, orthorhombic in aspect. $\beta = 1.413$. For thomsenolite, $89^\circ 46'$, crystals often resembling cubes, also prismatic; distinguished by its basal cleavage; also massive. $\beta = 1.414$.

Gearskite. $\text{CaF}_2 \cdot \text{Al}(\text{F},\text{OH})_3 \cdot \text{H}_2\text{O}$. Earthy, clay-like. Index, 1.448. Occurs with cryolite.

Ralstonite. $(\text{Na}_2, \text{Mg})\text{F}_2 \cdot 3\text{Al}(\text{F},\text{OH})_3 \cdot 2\text{H}_2\text{O}$. In colorless to white, isometric, octahedrons. $H. = 4.5$. $G. = 2.56-2.62$. $n = 1.43$. With the Greenland cryolite.

Creedite. $2\text{CaF}_2 \cdot 2\text{Al}(\text{F},\text{OH})_3 \cdot \text{CaSO}_4 \cdot 2\text{H}_2\text{O}$. Monoclinic. In grains, prismatic crystals and radiating masses. Usually colorless, rarely purple. $H. = 3.5$. $G. = 2.71$. Perfect cleavage. Indices, $1.46-1.49$. $2V = 64^\circ$. $Y = b$ axis. Fusible with intumescence. Soluble in acids. Found near Wagon Wheel Gap, Creed Quadrangle, Col.

Tallingite. A hydrated copper chlorite from the Botallack mine, Cornwall; in blue globular crusts.

Yttrocerite. $(\text{Y}, \text{Er}, \text{Ce})\text{F}_3 \cdot 5\text{CaF}_2 \cdot \text{H}_2\text{O}$. Massive-cleavable to granular and earthy. $H. = 4-5$. $G. = 3.4$. Color violet-blue, gray, reddish brown. From near Falun, Sweden, etc.

V. OXIDES

I. Oxides of Silicon.

II. Oxides of the Semi-Metals: Tellurium, Arsenic, Antimony, Bismuth; also Molybdenum, Tungsten.

III. Oxides of the Metals.

The Fifth Class, that of the OXIDES, is subdivided into three sections, according to the positive element present. The oxides of the non-metal silicon are placed by themselves, but it will be noted that the compounds of the related element titanium are included with those of the metals proper. This last is made necessary by the fact that in one of its forms TiO_2 is isomorphous with MnO_2 and PbO_2 .

A series of oxygen compounds which are properly to be viewed as salts, e.g., the species of the Spinel Group and a few others, are for convenience also included in this class.