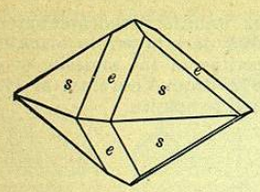
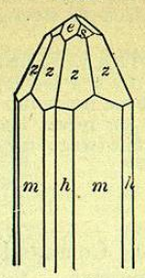
CASSITERITE. Tin-stone, Tin Ore. Zinnstein *Germ.*

Tetragonal. Axis $\dot{c} = 0{\cdot}6723$.

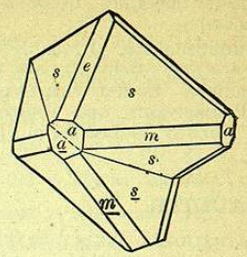
671.



672.



673.



ee', $101 \wedge 011 = 46° 28'$.
ee'', $101 \wedge 101 = 67° 50'$.
ss', $111 \wedge \bar{1}11 = 58° 19'$.
ss'', $111 \wedge \bar{1}\bar{1}1 = 87° 7'$.
ms, $110 \wedge 111 = 46° 27'$.
zz', $321 \wedge 231 = 20° 53\frac{1}{2}'$.
zz^{vii}, $321 \wedge 3\bar{2}1 = 61° 42'$.

Twins common: tw. pl. *e*, both contact- and penetration-twins (Fig. 673, also Fig. 373, p. 124); often repeated. Crystals low pyramidal; also prismatic and acutely terminated. Often in reniform shapes, structure fibrous divergent; also massive, granular or impalpable; in rolled grains.

Cleavage: *a* imperfect; *s* (111) more so; *m* hardly distinct. Fracture subconchoidal to uneven Brittle. H. = 6–7. G. = 6·8–7·1. Luster adamantine, and crystals usually splendent. Color brown or black; sometimes red, gray, white, or yellow. Streak white, grayish, brownish. Nearly transparent to opaque. Optically +. Indices: $\omega_y = 1{\cdot}9966$, $\epsilon_y = 2{\cdot}0934$.

Var.—*Ordinary.* Tin-stone. In crystals and massive.

Wood-tin (Holzzinnerz *Germ.*). In botryoidal and reniform shapes, concentric in structure, and radiated fibrous internally, although very compact, with the color brownish, of mixed shades, looking somewhat like dry wood in its colors. *Toad's-eye tin* is the same, on a smaller scale. *Stream tin* is the ore in the state of sand, as it occurs along the beds of streams or in gravel.

Comp.—Tin dioxide, SnO_2 = Oxygen 21·4, tin 78·6 = 100. A little Ta_2O_5 is sometimes present, also Fe_2O_3.

Pyr., etc.—B.B. alone unaltered. On charcoal with soda reduced to metallic tin, and gives a white coating. With the fluxes sometimes gives reactions for iron and manganese. Only slightly acted upon by acids.

Diff.—Distinguished by its high specific gravity, hardness, infusibility, and by its yielding metallic tin B B; resembles some varieties of garnet, sphalerite, and black tourmaline. Specific gravity (6·5) higher than that of rutile (4); wolframite is easily fusible.

Obs.—Occurs in veins traversing granite, gneiss, mica schist, chlorite or clay schist, and porphyry; also in finely reticulated veins forming the ore-deposits called stockworks, or simply impregnating the enclosing rock. The commonly associated minerals are quartz, wolframite, scheelite; also mica, topaz, tourmaline, apatite, fluorite; further pyrite, arsenopyrite, sphalerite; molybdenite, native bismuth, etc.

Formerly very abundant, now less so, in Cornwall, in fine crystals, and also as *wood-tin* and *stream-tin;* in Devonshire, near Tavistock and elsewhere; in pseudomorphs after feldspar at Wheal Coates, near St. Agnes, Cornwall; in fine crystals, often twins, at Schlackenwald, Graupen, Joachimsthal, **Zinnwald, etc.,** in Bohemia, and at Ehrenfriedersdorf, Altenberg, etc., in Saxony; at Limoges in splendid crystals; Sweden, at Finbo; Finland, at Pitkäranta.

In the E. Indies, on the Malay peninsula of Malacca and the neighboring islands, Banca, and Bilitong near Borneo. In New South Wales abundant over an area of 8500 sq. miles, also in Victoria, Queensland and Tasmania. In Bolivia; Mexico, in Durango; also Guanajuato, Zacatecas, Jalisco.

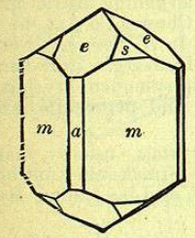
In the United States, in *Maine*, sparingly at Paris, Hebron, etc. In *Mass.*, at Chesterfield and Goshen, rare. In *N. Hamp.*, at Jackson. In *Virginia*, on Irish Creek, Rockbridge Co., with wolframite, etc. In *Alabama*, in Coosa Co. In *S. Dakota* near Harney Peak and near Custer City in the Black Hills, where it has been mined. In *Wyoming*, in Crook Co. In *Montana*, near Dillon. In *California*, in San Bernardino Co., at Temescal.

Polianite. Manganese dioxide, MnO_2. In composite parallel groupings of minute crystals; also forming the outer shell of crystals having the form of manganite. H. = 6–6·5. G. = 4·992. Luster metallic. Color light steel-gray or iron-gray. Streak black. From Platten, Bohemia. It is distinguished from pyrolusite by its hardness and its anhydrous character. Like pyrolusite it is often a pseudomorph after manganite.

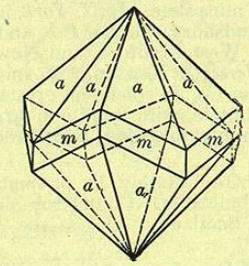
RUTILE.

Tetragonal. Axis $\dot{c} = 0{\cdot}64415$.

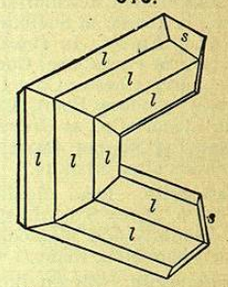
674.



675.



676.



ll^{vii}, $310 \wedge 310 = 36° 54'$.
ee', $101 \wedge 011 = 45° 2'$.
ee'', $101 \wedge \bar{1}01 = 65° 34\frac{1}{2}'$.
ss', $111 \wedge \bar{1}11 = 56° 52\frac{1}{2}'$.
ss'', $111 \wedge \bar{1}\bar{1}1 = 84° 40'$.
tt', $313 \wedge 133 = 29° 6'$.

Twins: tw. pl. (1) *e*, often geniculated (Fig. 676); also contact-twins of very varied habit, sometimes sixlings and eightlings (Fig. 361, p. 122; Fig. 375, p. 124). (2) *v* (301) rare, contact-twins (Fig. 377, p. 125). Crystals commonly prismatic, vertically striated or furrowed; often slender acicular. Occasionally compact, massive.

Cleavage: *a* and *m* distinct; *s* in traces. Fracture subconchoidal to uneven. Brittle. H. = 6–6·5. G. = 4·18–4·25; also to 5·2. Luster metallic-adamantine. Color reddish brown, passing into red; sometimes yellowish, bluish, violet, black, rarely grass-green; by transmitted light deep red. Streak pale brown. Transparent to opaque. Optically +. Refractive indices high: $\omega_y = 2{\cdot}6158$, $\epsilon_y = 2{\cdot}9029$ for Na. Birefringence very high. Sometimes abnormally biaxial.

Comp., Var.—Titanium dioxide, TiO_2 = Oxygen 40·0, titanium 60·0 = 100. A little iron is usually present, sometimes up to 10 p. c.

Var.—*Ordinary.* Brownish red and other shades, not black. G. = 4·18–4·25. Transparent quartz (*sagenite*) is sometimes penetrated thickly with acicular or capillary crystals. Dark smoky quartz penetrated with the acicular rutile is the Flêches d'amour *Fr.* (or Venus hair-stone). Acicular crystals often implanted in parallel position on tabular crystals of hematite; also somewhat similarly on magnetite.

Ferriferous. (*a*) *Nigrine* is black in color, whence the name; contains 2 to 3 p. c. of Fe_2O_3 (*b*) *Ilmenorutile* is a black variety from the Ilmen Mts., containing up to 10 p. c. or more of Fe_2O_3. G. = 5·07 – 5·13

Pyr., etc.—B B. infusible. With salt of phosphorus gives a colorless bead, which in R.F. assumes a violet color on cooling Most varieties contain iron, and give a brownish-yellow or red bead in R.F., the violet only appearing after treatment of the bead with metallic tin on charcoal. Insoluble in acids; made soluble by fusion with an alkali or

alkaline carbonate. The solution containing an excess of acid, with the addition of tin-foil, gives a beautiful violet color when concentrated.

Diff.—Characterized by its peculiar sub-adamantine luster and brownish-red color. Differs from tourmaline, vesuvianite, augite in being entirely unaltered when heated alone B.B. Specific gravity about 4, of cassiterite 6·5.

Obs.—Rutile occurs in granite, gneiss, mica slate, and syenitic rocks, and sometimes in granular limestone and dolomite; common, as a secondary product, in the form of microlites in many slates. It is generally found in embedded crystals, often in masses of quartz or feldspar, and frequently in acicular crystals penetrating quartz; also in phlogopite (wh. see), and has been observed in diamond. It has also been met with in hematite and ilmenite, rarely in chromite. It is common in grains or fragments in many auriferous sands.

Prominent localities are: Arendal and Kragerö in Norway; Horrsjöberg, Sweden, with lazulite and cyanite; Saualpe, Carinthia; in the Urals; in Tyrol; at St. Gothard and Binnenthal, Switzerland; at Yrieux, near Limoges in France; at Ohlapian in Transylvania, *nigrine* in pebbles; in large crystals in Perthshire, Scotland; in Donegal Co., Ireland.

In *Maine*, at Warren. In *Vermont*, at Waterbury; also in loose bowlders in middle and northern Vermont, acicular, some specimens of great beauty in transparent quartz. In *Mass.*, at Barre, in gneiss; at Shelburne, in mica slate. In *N. York*, in Orange Co., Edenville; Warwick; E. of Amity. In *Penn.*, at Sudsbury, Chester Co., and the adjoining district in Lancaster Co.; at Parksburg, Concord, West Bradford, and Newlin, Chester Co.; at the Poor House quarry, Chester Co. In *N. Jersey*, at Newton, with spinel. In *N. Car.*, at Crowder's Mountain; at Stony Point, Alexander Co., in splendent crystals. In *Georgia*, in Habersham Co.; in Lincoln Co., at Graves' Mountain, with lazulite in large and splendent crystals. In *Arkansas*, at Magnet Cove, commonly in twins, with brookite and perovskite, also as paramorphs after brookite.

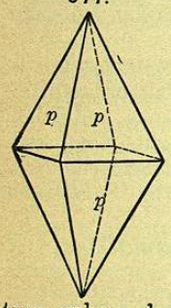
Plattnerite. Lead dioxide, PbO_2. Rarely in prismatic crystals, usually massive. H. = 5–5·5. G. = 8·5. Luster submetallic. Color iron-black. Streak chestnut-brown. From Leadhills and Wanlockhead, Scotland. Also at the "As You Like" mine, Mullan, Cœur d'Alêne Mts., Idaho.

Baddeleyite. Zircon dioxide, ZrO_2. In tabular monoclinic crystals. H. = 6·5. G. = 5·5–6·0. Colorless to yellow, brown and black. From Ceylon; also Jacupiranga, Brazil (*brazilite*) where it is associated with *zirkelite*, $(Ca,Fe)0.2(Zr,Ti,Th)O_2$.

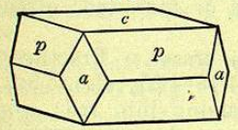
OCTAHEDRITE. Anatase.

Tetragonal. Axis $\dot{c} = 1·7771$.

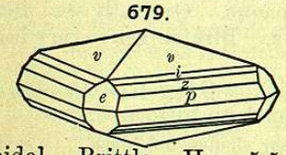
677.



678.



679.



Commonly octahedral in habit, either acute (p, 111), or obtuse (v, 117); also tabular, c predominating; rarely prismatic crystals; frequently highly modified.

ee', $101 \wedge 011 = 76° 5'$.
ee'', $101 \wedge \bar{1}01 = 121° 16'$.
pp', $111 \wedge \bar{1}11 = 82° 9'$.
pp'', $111 \wedge 1\bar{1}1 = 136° 36'$.
zz', $113 \wedge \bar{1}13 = 54° 1'$.
vv' $117 \wedge \bar{1}17 = 27° 39'$.

Cleavage: c and p perfect. Fracture subconchoidal. Brittle. H. = 5·5–6. G. = 3·82–3·95; sometimes 4·11–4·16 after heating. Luster adamantine or metallic-adamantine. Color various shades of brown, passing into indigo-blue, and black; greenish yellow by transmitted light. Streak uncolored. Transparent to nearly opaque. Optically —. Birefringence rather high. Indices: $\omega_y = 2·554$, $\epsilon_y = 2·493$. Sometimes abnormally biaxial.

Comp.—Titanium dioxide, TiO_2 = Oxygen 40·0, titanium 60·0 = 100.

Pyr., etc.—Same as for rutile.

Obs.—Most abundant at Bourg d'Oisans, in Dauphiné, with feldspar, axinite, and

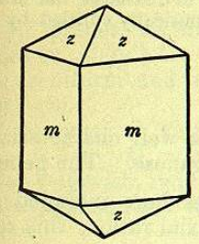
ilmenite; near Hof in the Fichtelgebirge; Norway; the Urals; in chlorite in Devonshire, near Tavistock; with brookite at Tremadoc, in North Wales; in Cornwall, near Liskeard and at Tintagel Cliffs; in Brazil in quartz, and in detached crystals. In Switzerland in the Binnenthal the variety *wiserine*, long supposed to be xenotime; also Cavradi, Tavetsch; Rauris, Salzburg, in the Eastern Alps; also at Pfitsch Joch.

In the U. States, at the Dexter lime rock, Smithfield, R. I., in dolomite; in the washings at Brindletown, Burke Co., N. C., in transparent tabular crystals.

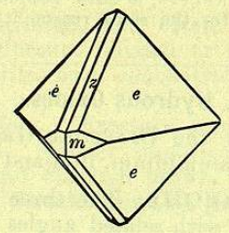
BROOKITE.

Orthorhombic. Axes $\dot{a} : \bar{b} : \dot{c} = 0·8416 : 1 : 0·9444$.

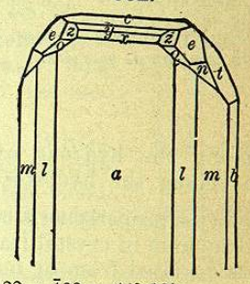
680.



681.



682.



mm''', $110 \wedge 1\bar{1}0 = 80° 10'$.
zz', $112 \wedge \bar{1}12 = 53° 48'$.
zz''', $112 \wedge 1\bar{1}2 = 44° 46'$.

ee', $122 \wedge \bar{1}22 = 44° 23'$.
ee''', $122 \wedge 1\bar{2}2 = 78° 57'$.
me, $110 \wedge 122 = 45° 42'$.

Only in crystals, of varied habit.

Cleavage: m indistinct; c still more so. Fracture subconchoidal to uneven. Brittle. H. = 5·5–6. G. = 3·87–4·08. Luster metallic-adamantine to submetallic. Color hair-brown, yellowish, reddish, reddish brown, and translucent; also brown to iron-black, opaque. Streak uncolored to grayish or yellowish. Optical characters, see p. 225.

Comp.—Titanium dioxide, TiO_2 = Oxygen 40·0, titanium 60·0 = 100.

Pyr.—Same as for rutile.

Obs.—Occurs at Bourg d'Oisans in Dauphiné; at St. Gothard, with albite and quartz; Maderaner Thal, Switzerland; in the Ural, district of Zlatoust, near Miask, and in the gold-washings in the Sanarka river and elsewhere; at Fronolen, near Tremadoc, Wales.

In the U. S., in thick black crystals (*arkansite*) at Magnet Cove, Ozark Mts., Arkansas, with elæolite, black garnet, schorlomite, rutile, etc.; in small crystals from the gold-washings of North Carolina; at the lead mine at Ellenville, Ulster Co., N. Y., on quartz, with chalcopyrite and galena; at Paris, Maine.

Named after the English mineralogist, H. J. Brooke (1771–1857).

PYROLUSITE.

Orthorhombic, but perhaps only pseudomorphous. Commonly columnar, often divergent; also granular massive, and frequently in reniform coats.

Soft, often soiling the fingers. H. = 2–2·5. G. = 4·73–4·86. Luster metallic. Color iron-black, dark steel-gray, sometimes bluish. Streak black or bluish black, sometimes submetallic. Opaque.

Comp.—Manganese dioxide, MnO_2, like polianite (p. 345). Commonly contains a little water (2 p. c.), it having had usually a pseudomorphous origin (after manganite).

It is uncertain whether pyrolusite is an independent species, with a crystalline form of its own, or only a secondary mineral derived chiefly from the dehydration of manganite; also from polianite (Breith.). Pseudomorphous crystals having distinctly the form of manganite are common.

Pyr., etc.—Like polianite, but most varieties yield some water in the closed tube.

Diff.—Hardness less than that of psilomelane. Differs from iron ores in its reaction for manganese B.B. Easily distinguished from psilomelane by its inferior hardness, and usually by being crystalline. Its streak is black; that of manganite is more or less brown.

Obs.—This ore is extensively worked at Elgersberg near Ilmenau, and other places in Thuringia; at Vorderehrensdorf in Moravia; at Platten in Bohemia, and elsewhere; near Johanngeorgenstadt; at Hirschberg in Westphalia; Matzka, Transylvania; in Australia; in India.

Occurs in the United States with psilomelane, abundantly in Vermont, at Brandon, etc.; at Plainfield and West Stockbridge, Mass.; Augusta Co., Virginia; Pope, Pulaski, Montgomery Cos., Arkansas. In New Brunswick, 7 m. fr. Bathurst. In Nova Scotia, at Teny Cape; at Walton, etc.

The name is from *πῦρ, fire*, and *λούειν, to wash*, because used to discharge the brown and green (FeO) tints of glass; and for the same reason it is whimsically entitled by the French *le savon de verriers*.

B. Hydrous Oxides.

Among the hydrous oxides the DIASPORE GROUP is well characterized. Here belong the hydrates of aluminium, iron and manganese. The general formula is properly written $\overset{III}{R}O(OH)$. The three species here included are orthorhombic in crystallization with related angles and axial ratios; this relation is deviated from by manganite in the prismatic zone.

Another less prominent group is the BRUCITE GROUP, including the rhombohedral species Brucite, Mg(OH), and Pyrochroite, Mn(OH).

Gibbsite, $Al(OH)_3$, and Sassolite, $B(OH)_3$, are also related, and further Hydrotalcite and Pyroaurite.

Diaspore Group. $\overset{III}{R}O(OH)$ or $R_2O_3.H_2O$. Orthorhombic.

		$\breve{a} : \bar{b} : \dot{c}$	$\frac{c}{a}$
Diaspore	$Al_2O_3.H_2O$	0·9372 : 1 : 0·6039	or 0·6443
Göthite	$Fe_2O_3.H_2O$	0·9185 : 1 : 0·6068	or 0·6606
Manganite	$Mn_2O_3.H_2O$	0·8441 : 1 : 0·5448	or 0·6463

DIASPORE.

Orthorhombic. Axes: $\breve{a} : \bar{b} : \dot{c} = 0{\cdot}9372 : 1 : 0{\cdot}6039$. Crystals prismatic, $mm''' = 86° 17'$; usually thin, flattened $\parallel b$; sometimes acicular. Also foliated massive and in thin scales; sometimes stalactitic.

Cleavage: b eminent; h (210) less perfect. Fracture conchoidal, very brittle. H. = 6·5–7. G. = 3·3–3·5. Luster brilliant; pearly on cleavage-face, elsewhere vitreous. Color whitish, grayish white, greenish gray, hair-brown, yellowish, to colorless. Pleochroic. Transparent to subtranslucent. Optically +. Birefringence high. Ax. pl. $\parallel b$. Bx $\perp a$. Dispersion $\rho < v$, feeble. $2H_{a.y} = 103° 53'$. $\beta = 1{\cdot}722$.

Comp.—AlO(OH) or $Al_2O_3.H_2O$ = Alumina 85·0, water 15·0 = 100.

Pyr., etc.—In the closed tube usually decrepitates strongly, separating into white pearly scales, and at a high temperature yields water. Infusible; with cobalt solution gives a deep blue color. Not attacked by acids, but after ignition soluble in sulphuric acid.

Diff.—Distinguished by its hardness and pearly luster; also (B.B.) by its decrepitation and yielding water; by the reaction for alumina with cobalt solution. Resembles some varieties of hornblende, but is harder.

Obs.—Commonly found with corundum or emery. Occurs near Kossoibrod, in the Ural; at Schemnitz, Hungary; with corundum in dolomite at Campolongo, Tessin, in Switzerland; Greiner in the Zillerthal. In the U. S., with corundum and margarite at Newlin, Chester Co., Pa.; at the emery mines of Chester, Mass.; in cavities in massive corundum at the Culsagee mine, near Franklin, Macon Co., N. Carolina; with alunite forming rock masses at Mt. Robinson, Rosita Hills, Colorado.

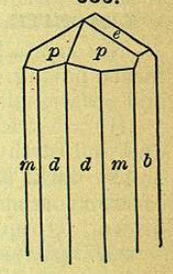
Named by Haüy from *διασπείρειν, to scatter*, alluding to the usual decrepitation before the blowpipe.

GÖTHITE.

Orthorhombic. Axes $\breve{a} : \bar{b} : \dot{c} = 0{\cdot}9185 : 1 : 0{\cdot}6068$.

mm''', $110 \wedge 1\bar{1}0 = 85° 8'$. pp', $111 \wedge \bar{1}11 = 58° 55'$.
ee', $011 \wedge 0\bar{1}1 = 62° 30'$. pp''', $111 \wedge 1\bar{1}1 = 53° 42'$.

683.



In prisms vertically striated, and often flattened into scales or tables $\parallel b$. Also fibrous; foliated or in scales; massive, reniform and stalactitic, with concentric and radiated structure.

Cleavage: b very perfect. Fracture uneven. Brittle. H. = 5–5·5. G. = 4·0–4·4. Luster imperfect adamantine. Color yellowish, reddish, and blackish brown. Often blood-red by transmitted light. Streak brownish yellow to ocher-yellow.

Var.—In thin scale-like or tabular crystals, usually attached by one edge. Also in acicular or capillary (not flexible) crystals, or slender prisms, often radiately grouped: the *Needle-Ironstone*. It passes into a variety with a velvety surface: the *Przibramite* (*Sammetblende*) of Přibram is of this kind. Also columnar, fibrous, etc., as above.

Comp.—FeO(OH) or $Fe_2O_3.H_2O$ = Oxygen 27·0, iron 62·9, water 10·1 = 100, or Iron sesquioxide 89·9, water 10·1 = 100.

Pyr., etc.—In the closed tube gives off water and is converted into red iron sesquioxide. With the fluxes like hematite; most varieties give a manganese reaction, and some, treated in the forceps in O.F., after moistening in sulphuric acid, impart a bluish-green color to the flame (phosphoric acid). Soluble in hydrochloric acid.

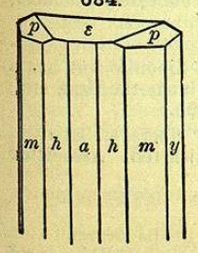
Diff.—Distinguished from hematite by its yellow streak; from limonite by crystalline nature; it also contains less water than limonite.

Obs.—Found with the other oxides of iron, especially hematite or limonite. Occurs at Eiserfeld near Siegen, in Nassau; at Clifton, near Bristol, England; in Cornwall. In the U. S., at the Jackson Iron mine, Negaunee, L. Superior; in Conn., at Salisbury; in Penn., near Easton; inothe Pike's Peak region, Colorado. Named *Göthite* (Goethite) after the poet-philosopher Goethe (1749–1832).

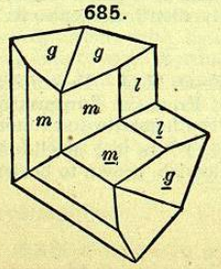
MANGANITE.

Orthorhombic. Axes $\breve{a} : \bar{b} : \dot{c} = 0{\cdot}8441 : 1 : 0{\cdot}5448$.

684.



685.



hh''', $410 \wedge 4\bar{1}0 = 23° 50'$.
mm''', $110 \wedge 1\bar{1}0 = 80° 20'$.
$\epsilon\epsilon'$, $205 \wedge \bar{2}05 = 28° 57'$.
ee', $011 \wedge 0\bar{1}1 = 57° 10'$.
pp', $111 \wedge \bar{1}11 = 59° 5\frac{1}{2}'$.

Crystals commonly prismatic, the faces deeply striated vertically; often grouped in bundles. Twins: tw. pl. e (011). Also columnar; stalactitic.

Cleavage: b very perfect; m perfect. Fracture uneven. Brittle. H. = 4. G. = 4·2–4·4. Luster submetallic. Color dark steel-gray to iron-black. Streak reddish brown, some-

times nearlyblack. Opaque; in minute splinters sometimes brown by transmitted light.

Comp.—$MnO(OH)$ or $Mn_2O_3.H_2O$ = Oxygen 27·3, manganese 62·4, water 10·3 = 100, or Manganese sesquioxide 89·7, water 10·3 = 100.

Pyr., etc.—In the closed tube yields water; manganese reactions with the fluxes, p. 263.

Obs.—Occurs at Ilefeld in the Harz; Ilmenau in Thuringia; Cornwall, at various places; also in Cumberland, etc. In the L. Superior mining region at the Jackson mine, Negaunee; Devil's Head, Douglas Co., Colorado. In Nova Scotia, at Cheverie, Hants Co., and Walton. In New Brunswick, at Shepody mountain, Albert Co., etc.

LIMONITE. Brown Hematite. Brauneisenstein *Germ.*

Not crystallized. Usually in stalactitic and botryoidal or mammillary forms, having a fibrous or subfibrous structure; also concretionary, massive; and occasionally earthy.

H. = 5–5·5. G. = 3·6–4·0. Luster silky, often submetallic; sometimes dull and earthy. Color of surface of fracture various shades of brown, commonly dark, and none bright; sometimes with a nearly black varnish-like exterior; when earthy, brownish yellow, ocher-yellow. Streak yellowish brown. Opaque.

Var.—(1) *Compact.* Submetallic to silky in luster; often stalactitic, botryoidal, etc. (incl. brauner Glaskopf *Germ.*). (2) *Ocherous* or earthy, brownish yellow to ocher-yellow, often impure from the presence of clay, sand, etc. (3) *Bog ore.* The ore from marshy places, generally loose or porous in texture, often petrifying leaves, wood, nuts, etc. (4) *Brown clay-ironstone,* in compact masses, often in concretionary nodules.

Comp.—$2Fe_2O_3.3H_2O$ = Oxygen 25·7, iron 59·8, water 14·5 = 100, or Iron sesquioxide 85·5, water 14·5 = 100. In the bog ores and ochers, sand, clay, phosphates, oxides of manganese, and humic or other acids of organic origin are very common impurities.

Pyr., etc.—Like göthite. Some varieties leave a siliceous skeleton in the salt of phosphorus bead, and a siliceous residue when dissolved in acids.

Diff.—Distinguished from hematite by its yellowish streak, inferior hardness, and its reaction for water. Does not decrepitate B.B., like turgite. Not crystallized like göthite and yields more water.

Obs.—In all cases a result of the alteration of other ores, or minerals containing iron, through exposure to moisture, air, and carbonic or organic acids; derived largely from the change of pyrite, magnetite, siderite, ferriferous dolomite, etc.; also various species (as mica, pyroxene, hornblende, etc.), which contain iron in the ferrous state (FeO). It consequently occupies, as a bog ore, marshy places, into which it has been borne by streamlets from the hills around. It is often associated with manganese ores. Limonite is a common ore in Bavaria, the Harz, Luxembourg, Scotland, Sweden, etc.

Abundant in the United States. Extensive beds exist at Salisbury and Kent, Conn., also in the neighboring towns of New York, and in a similar situation in Berkshire Co., Mass., and in Vermont; in Pennsylvania widely distributed; also in Tennessee, Alabama, Ohio, etc.

Named *Limonite* from $\lambda\epsilon\iota\mu\acute{\omega}\nu$, *meadow.*

TURGITE. Hydrohematite. $Fe_4H_2O_7$ or $2Fe_2O_3.H_2O$. Resembles limonite but has a red streak. G. = 4·14–4·6. Decrepitates B.B. From the Turginsk mine in the Ural, etc.; also from Salisbury, Conn. Intermediate between hematite and limonite.

Xanthosiderite. Gelbeisenstein. $Fe_2O_3.2H_2O$. In fine needles or fibers, stellate and concentric; also as an ocher. Color golden yellowish, brown to brownish red. Associated with manganese ores at Ilmenau, etc.

BAUXITE. Beauxite.

In round concretionary disseminated grains. Also massive, oölitic; and earthy, clay-like. G. = 2·55. Color whitish, grayish, to ocher-yellow, brown, and red.

Var.—1. In concretionary grains, or oölitic; *bauxite.* 1 Clay-like, *wocheinite;* the purer kind grayish, clay-like, containing very little iron oxide; also red from the iron oxide present.

Comp.—Essentially $Al_2O_3.2H_2O$ = Alumina 73·9, water 26·1 = 100; some analyses, however, give $Al_2O_3.H_2O$ like diaspore.

Iron sesquioxide is usually present, sometimes in large amount, in part replacing alumina, in part only an impurity. Silica, phosphoric acid, carbonic acid, lime, magnesia are common impurities.

Obs.—From Baux (or Beaux), near Arles, and elsewhere in France, disseminated in grains in compact limestone, and also oölitic. *Wocheinite* occurs in Carniola, between Feistritz and Lake Wochein. The purest bauxite is used for the manufacture of aluminium (aluminum), and is called *aluminium ore.* In the U. S., bauxite occurs in Saline and Pulaski Cos., Arkansas; also in Cherokee and Calhoun Cos., Alabama, and in Floyd, Barton and Walker Cos., Georgia.

Brucite Group. $R(OH)_2$. Rhombohedral.

BRUCITE.

Rhombohedral. Axis $\dot{c} = 1·5208$; $cr = 60° 20\frac{1}{2}'$, $rr' = 97° 37\frac{1}{2}'$.

Crystals usually broad tabular. Also commonly foliated massive; fibrous, fibers separable and elastic.

H. = 2·5. G. = 2·38–2·4. Cleavage: c eminent. Folia separable and flexible, nearly as in gypsum. Sectile. Luster ‖ c pearly, elsewhere waxy to vitreous. Color white, inclining to gray, blue, or green. Transparent to translucent. Optically +. Indices: $\omega_r = 1·559$, $\epsilon_r = 1·5795$.

Comp., Var.—Magnesium hydrate, $Mg(OH)_2$ or $MgO.H_2O$ = Magnesia 69·0, water 31·0 = 100. Iron and manganese protoxide are sometimes present.

Var.—*Ordinary,* occurring in plates, white to pale greenish in color; strong pearly luster on the cleavage surface. *Nemalite* is a fibrous variety containing 4 to 5 p. c. iron protoxide, with G. = 2·44 Nuttall. *Manganbrucite* contains manganese; occurs granular; color honey-yellow to brownish red.

Pyr., etc.—In the closed tube gives off water, becoming opaque and friable, sometimes turning gray to brown; the manganesian variety becomes dark brown. B.B. infusible, glows with a bright light, and the ignited mineral reacts alkaline to test-paper. With cobalt solution gives the pale pink color of magnesia. The pure mineral is soluble in acids without effervescence.

Diff.—Distinguished by its infusibility, softness, cleavage, and foliated structure. Is harder than talc and differs in its solubility in acids; the magnesia test and optical characters separate it from gypsum, which is also somewhat softer.

Obs.—Accompanies other magnesian minerals in serpentine, also found in limestone. At Swinaness in Unst, Shetland Isles; at the iron mine of Cogne, Aosta, Italy; near Filipstadt in Sweden. At Hoboken, N. J., in serpentine; at the Tilly Foster iron mine, Brewster, N. Y., well crystallized; Richmond Co., N. Y.; at Wood's mine, Texas, Pa., in large plates or masses, and often crystallizations several inches across; at Low's mine with hydromagnesite. *Nemalite,* the fibrous variety, occurs at Hoboken, and at Xettes in the Vosges. *Manganbrucite* occurs with hausmannite and other manganese minerals in the granular limestone of Jakobsberg, Nordmark, Sweden.

Named after the early American mineralogist, A. Bruce (1777–1818).

Pyrochroite. Manganese hydrate, $Mn(OH)_2$. Usually foliated, like brucite. Luster pearly. Color white, but growing dark on exposure. Occurs in magnetite at Pajsberg, Sweden; also at Nordmark; and at Franklin Furnace, N. J.

GIBBSITE. Hydrargillite.

Monoclinic. Axes $\dot{a} : \dot{b} : \breve{c} = 1·7089 : 1 : 1·9184$; $\beta = 85° 29'$. Crystals tabular ‖ c, hexagonal in aspect. Occasionally in spheroidal concretions. Also stalactitic, or small mammillary, incrusting, with smooth surface, and often a faint fibrous structure within.

Cleavage: c eminent. Tough. H. = 2·5–3·5. G. = 2·3–2·4. Color white,

grayish, greenish, or reddish white. Luster of *c* pearly; of other faces vitreous; of surface of stalactites faint. Translucent; sometimes transparent in crystals. A strong argillaceous odor when breathed on.

Comp.—Aluminium hydrate, $Al(OH)_3$ or $Al_2O_3.3H_2O$ = Alumina 65·4, water 34·6 = 100.

Pyr., etc.—In the closed tube becomes white and opaque, and yields water. B.B. infusible, whitens, and does not impart a green color to the flame. With cobalt solution gives a deep blue color. Soluble in concentrated sulphuric acid.

Obs.—The crystallized gibbsite (hydrargillite) occurs in the Shishimsk mountains near Zlatoust in the Ural; also in crystals filling cavities in natrolite in the Langesundfiord, Norway; Ouro Preto, Minas Geraes, Brazil. In the U. S., in stalactitic form at Richmond, Mass., in a bed of limonite; at the Clove Mine, Union Vale, Dutchess Co., N. Y., on limonite; in Orange Co., N. Y.

Named after Col. George Gibbs.

Sassolite. Boric acid, $B(OH)_3$. Crystals tabular ‖ *c* (triclinic). Usually small white, pearly scales. G. = 1·48. From the waters of the Tuscan lagoons of Monte Rotondo and Castelnuovo. Exists also in other natural waters, as at Clear Lake, in Lake Co., California. Occurs also abundantly in the crater of Vulcano, Lipari isles.

Hydrotalcite. Perhaps $Al(OH)_3.3Mg(OH)_2.3H_2O$. Lamellar-massive, or foliated, somewhat fibrous. H. = 2. G. = 2·04–2·09. Color white. Luster pearly. Occurs at the mines of Shishimsk, district of Zlatoust, Ural; at Snarum, Norway, in serpentine (*hydrotalcite*).

Pyroaurite. Perhaps $Fe(OH)_3.3Mg(OH)_2.3H_2O$. Occurs at the Långban iron-mine, Wermland, Sweden, in gold-like submetallic scales (*pyroaurite*). In thin seams of a silvery white color in serpentine in the island Haaf-Grunay, Scotland (*igelströmite*).

Chalcophanite. Hydrofranklinite. $(Mn,Zn)O.2MnO_2.2H_2O$. In druses of minute tabular rhombohedral crystals; sometimes octahedral in aspect. Also in foliated aggregates; stalactitic and plumose. G. = 3·907. Luster metallic, brilliant. Color bluish black to iron-black. Streak chocolate-brown, dull. Occurs at Sterling Hill, near Ogdensburg, Sussex Co., N. J.

PSILOMELANE.

Massive and botryoidal; reniform; stalactitic. H. = 5–6. G. = 3·7–4·7. Luster submetallic, dull. Streak brownish black, shining. Color iron-black, passing into dark steel-gray. Opaque.

Comp.—A hydrous manganese manganate in which part of the manganese is often replaced by barium or potassium, perhaps conforming to H_4MnO_5. The material is generally very impure, and the composition hence doubtful.

Pyr., etc.—In the closed tube most varieties yield water, and all lose oxygen on ignition; with the fluxes reacts for manganese. Soluble in hydrochloric acid, with evolution of chlorine.

Obs.—A common but impure ore of manganese; frequently in alternating layers with pyrolusite. From Devonshire and Cornwall; Ilefeld in the Harz; also at Ilmenau, Siegen, etc. Forms mammillary masses at Brandon, etc., Vt. In Independence Co., and elsewhere in Arkansas. With pyrolusite at Douglas, Hants Co., Nova Scotia. Named from ψιλός, *smooth* or *naked*, and μέλας, *black*.

The following mineral substances here included are mixtures of various oxides, chiefly of manganese (MnO_2, also MnO), cobalt, copper, with also iron, and from 10 to 20 p. c. water. These are results of the decomposition of other ores—partly of oxides and sulphides, partly of manganesian carbonates, and can hardly be regarded as representing distinct mineral species.

WAD. In amorphous and reniform masses, either earthy or compact; also incrusting or as stains. Usually very soft, soiling the fingers; less often hard to H. = 6. G. = 3·0–4·26; often loosely aggregated, and feeling very light to the hand. Color dull black, bluish or brownish black.

BOG MANGANESE consists mainly of oxide of manganese and water, with some oxide of iron, and often silica, alumina, baryta

ASBOLITE, or *Earthy Cobalt*, contains oxide of cobalt, which sometimes amounts to 32 p. c.

LAMPADITE, or *Cupreous Manganese*, is a wad containing 4 to 18 p. c. of oxide of copper, and often oxide of cobalt also.

VI. Oxygen-salts.

The Sixth Class includes the salts of the various oxygen acids. These fall into the following seven sections: 1. Carbonates; 2. Silicates and Titanates; 3. Niobates and Tantalates; 4. Phosphates, Arsenates, etc.; also the Nitrates; 5. Borates and Uranates; 6. Sulphates, Chromates and Tellurates; 7. Tungstates and Molybdates.

1. CARBONATES.

A. Anhydrous Carbonates.

The Anhydrous Carbonates include two distinct isomorphous groups, the CALCITE GROUP and the ARAGONITE GROUP. The metallic elements present in the former are calcium, magnesium, iron, manganese, zinc and cobalt; in the latter, they are calcium, barium, strontium and lead.

The species included are as follows:

Calcite Group. RCO_3. Rhombohedral.

			rr'	*c*
Calcite	$CaCO_3$		74° 55′	0·8543
Dolomite	$(Ca,Mg)CO_3$	Tri-rhombohedral	73° 45′	0·8322
Normal Dolomite	$CaCO_3.MgCO_3$			
Ankerite	$CaCO_3.(Mg,Fe)CO_3$		73° 48′	0·8332
Magnesite	$MgCO_3$		72° 36′	0·8112
Breunnerite	$(Mg,Fe)CO_3$			
Mesitite	$2MgCO_3.FeCO_3$		72° 46′	0·8141
Pistomesite	$MgCO_3.FeCO_3$		72° 42′	0·8129
Siderite	$FeCO_3$		73° 0′	0·8184
Oligonite	$(Fe,Mn)CO_3$			
Rhodochrosite	$MnCO_3$		73° 0′	0·8184
Manganosiderite	$(Mn,Fe)CO_3$			
Manganocalcite pt.	$(Mn,Ca)CO_3$			
Smithsonite	$ZnCO_3$		72° 20′	0·8063
Monheimite	$(Zn,Fe)CO_3$			
Sphærocobaltite	$CoCO_3$			

This list gives not only the prominent species of this group, but also some of the isomorphous intermediate compounds.

The CALCITE GROUP is characterized by rhombohedral crystallization. All the species show, when distinctly crystallized, perfect rhombohedral cleavage, the angle varying from 75° (and 105°) in calcite to 73° (and 107°) in siderite. This is exhibited in the table above.

2. Aragonite Group. RCO_3. Orthorhombic.

		mm'''	$\breve{a} : \breve{b} : \breve{c}$
Aragonite	$CaCO_3$	63° 48′	0·6224 : 1 : 0·7206
Bromlite	$(Ca,Ba)CO_3$		
Witherite	$BaCO_3$	62° 12′	0·6032 : 1 : 0·7302
Strontianite	$SrCO_3$	62° 41′	0·6090 : 1 : 0·7239
Cerussite	$PbCO_3$	62° 46′	0·6100 : 1 : 0·7230