

369. TRIPHYLITE, (2Fe + Li)P<sub>3</sub>. Right prismatic. ∞P 133°; chiefly granular. H. -5; G. -3-6. Resinous. Greenish grey with blue spots. C.c.: iron protoxide 40, manganese protoxide 5.5, lithia 7.5, phosphoric acid 45. Bodenmais in Bavaria, Norwich in Massachusetts. Lithiophilite, from Fairfield (Connecticut), is a manganese triphylite.

370. BRZELITE (Kuhnlite), (CaMg)As<sub>2</sub>. Massive. H. -5 to 6; G. -2-52. C.c.: lime 23, magnesia 15, arsenic acid 60. Sol. in n. acid. Langban (Sweden).

371. ARSENIATE OF NICKEL, Ni<sub>3</sub>As<sub>2</sub>. Amorphous. H. -4; G. -4-98. Sulphur-yellow. C.c.: oxide of nickel 48.2, arsenic acid 50.5. Johann-Georgenstadt.

372. NICKELERZ, Ni<sub>2</sub>As<sub>2</sub> + 2Ni. Crystalline massive. G. -4-34. Dark grass-green; streak lighter. C.c.: oxide of nickel 62.1, arsenic acid 36.6. Johann-Georgenstadt.

373. DECHENITE, (PbZn)V<sub>2</sub>. Botryoidal and stalactitic. H. -3 to 4; G. -5-82. Lustre resinous to greasy. Yellowish red, deep red; streak orange to pale yellow. C.c.: 57.7 oxide of lead, 15.8 oxide of zinc, 24.2 of vanadic acid. Wanlockhead, Freiburg (in Baden), Lauter Valley.

374. PSITTACINITE, 3(Pb<sub>2</sub>V<sub>2</sub>) + Cu<sub>2</sub>V<sub>2</sub> + 6CuH<sub>2</sub>. Mammillated and incrusting. Siskin- to olive-green. C.c.: vanadic acid 19.3, lead oxide 53.2, copper oxide 18.95, water 8.58. Silver Star (Montana).

375. PUCHERITE, Bi<sub>2</sub>V<sub>2</sub>. Right prismatic. ∞P 123° 55'. H. -4; G. -6-25. Cl. basal, perfect; vitreous. Red or reddish brown; streak yellow. Easily soluble in acids. C.c.: bismuth oxide 71.7, vanadic acid 28.3. Schneeberg.

376. ATOPITE, Ca<sub>2</sub>Sb<sub>2</sub>. Cubic (figs. 30 with 26 and 33). H. -5.5 to 6; G. -5. Lustre greasy; yellow to resin-brown. Translucent. C.c.: antimonious acid 73.2, lime 17.5, iron protoxide 2.7, magnesia 1.5, soda 4.3. Langban (Wernland).

HYDRATE PHOSPHATES. &c.

377. BRUSHITE, (3Ca + 1/2H<sub>2</sub>)<sub>2</sub>P<sub>2</sub> + 4H<sub>2</sub>. Oblique prismatic, C 62° 45'. Needle crystals. H. -2 to 2.5; G. -2-21. Vitreous. C.c.: lime 32.6, phosphoric acid 41.3, water 26.4. Aves Islands and Sombroero (Antilles).

378. NEWBERYITE, Mg<sub>2</sub>H<sub>2</sub>P<sub>2</sub> + 6H<sub>2</sub>. Right prismatic. Cl. brachydiagonal. C.c.: phosphoric acid 41.25, magnesia 23, water 35.7. From guano, Skipton Caves, Victoria.

379. HADINGERITE, Ca<sub>2</sub>As<sub>2</sub> + 3H<sub>2</sub>. Right prismatic. ∞P 100°. Cl. perfect; sectile, flexible. H. -2 to 2.5; G. -2.8 to 2.9. Otherwise like pharmacolite (sp. 381). C.c.: 85.68 arseniate of lime, and 14.32 water. Joachimsthal.

380. ROSELITE, R<sub>2</sub>As<sub>2</sub> + 2H<sub>2</sub>. Anorthic. Cl. macrodiagonal. Rose-red; streak white. H. -3.5; G. -3-46. C.c.: 25.5 lime, 10.3 cobalt oxide, 3.6 magnesia, 62.4 arsenic acid, 8.2 water. Schneeberg.

381. PHARMACOLITE, 2CaAs<sub>2</sub> + 6H<sub>2</sub>. Oblique prismatic, C 65° 4' (fig. 421). ∞P (r) 117° 24', -P (l) 189° 17', -1/2P (n) 141° 8', 1/2P∞ (o) 83° 14', ∞P∞ (g) 157° 5'. Crystals generally acicular and radiated. Cl. clinodiagonal, perfect; sectile and flexible. H. -2 to 2.5; G. -2.6 to 2.8. Translucent; vitreous. Pearly white. Yields water in the closed tube. C.c.: arsenic acid 51, lime 25, water 24. Andreasberg, Bieber, Markirchen, Wittichen. Generally mixed with erythrite or annabergite.

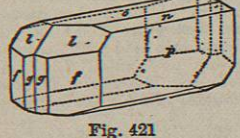


Fig. 421

382. WAPPLERITE, 2CaAs<sub>2</sub> + 8H<sub>2</sub>. Anorthic; ∞P (m), ∞P (M), ∞P<sup>2</sup> (n), ∞P. 2 (N), P∞ (d), P∞ (D), 3P∞ (t), 3P∞ (T), 2P<sup>2</sup> (p), 3P<sup>2</sup> (g), 5P<sup>2</sup> (G), 4P<sup>4</sup> (w), 2P<sup>2</sup> (r), ∞P∞ (b) (fig. 422); also incrusting and globular. Cl. clinodiagonal. H. -2 to 2.5; G. -2-48. Colourless. Vitreous. C.c.: lime 15.6, magnesia 7.4, arsenic acid 47.5, water 29.5. Joachimsthal.

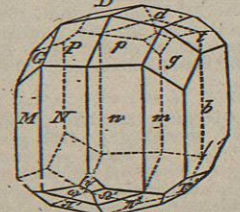


Fig. 422 (sp. 382)

383. HÖRNESITE, Mg<sub>3</sub>As<sub>2</sub> + 8H<sub>2</sub>. Oblique prismatic. ∞P 107°. H. -5 to 1; G. -2-47. White. Translucent; pearly. C.c.: 24.3 magnesia, 29.14 water, 46.56 arsenic acid. Probably from Hungary.

384. VIVIANITE, 3FeP<sub>2</sub> + 8H<sub>2</sub>. Oblique prismatic, C 75° 34'. ∞P (m) 108° 2'; P (v) 120° 26'; P∞ (w) 54° 40'. Crystals prismatic (figs. 423, 424); also fibrous or earthy. Cl. clinodiagonal, perfect; thin laminae flexible. H. -2; G. -2.6 to 2.7. Translucent or transparent; vitreous, or bright pearly on cleavage. Indigo-blue to blackish green; streak bluish white, but soon becomes blue on exposure. C.c.: 33.1 iron protoxide, 12.2 iron peroxide, 29 phosphoric acid, and 25.7 water. Transparent indigo-coloured crystals at St Agnes in Cornwall, and Allentown and Imletown in New Jersey; earthy in Cornwall, Styria, North America, Greenland, and New Zealand; and in peat mosses in northern Germany, Sweden, Norway, and Shetland.

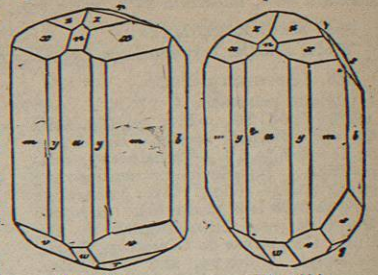


Fig. 423.

Fig. 424.

385. SYMPLESITE, Fe<sub>2</sub>As<sub>2</sub> + 8H<sub>2</sub>. Oblique prismatic; in minute acicular crystals. Cl. clinodiagonal. H. -2.5; G. -2-96. Vitreous. Cleavage face pearly. Celadon-green to pale indigo; streak bluish white. Lobenstein in Reuss, and Lölling in Carinthia.

386. ERYTHRITE, Co<sub>2</sub>As<sub>2</sub> + 8H<sub>2</sub>. Oblique prismatic, C 55° 9'. ∞P∞ (P), ∞P∞ (T), P∞ (M); also ∞P3 (k), and P (h) 118° 23' (fig. 425). Cl. clinodiagonal (P), perfect; sectile; thin laminae flexible. H. -1.5 to 2.5; G. -2.9 to 3. Translucent; vitreous, pearly on the cleavage. Crimson or peachblossom-red. C.c.: 38.2 arsenic acid, 37.8 cobalt protoxide, 24 water, but often with nickel 9. Cornwall, Alston in Cumberland, Alva in Stirlingshire, Schneeberg, Saalfeld, Allemont, Riechelsdorf, the Pyrenees, and Modum in Norway. Kobaltbeslag or Earthy Incrusting Cobalt, reniform, is a mixture of erythrite with arsenious acid. Lavendulan, thin reniform lavender-blue crusts, translucent, resinous, or vitreous (H. -2.5 to 3; G. -2-95 to 3-1), consisting of arsenic acid, protoxides of cobalt, nickel, and copper, with water: from Annaberg.

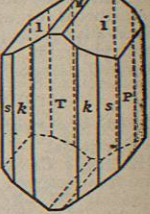


Fig. 425.

387. KÖTTIGITE, (Zn, Co, Ni)<sub>2</sub>As<sub>2</sub> + 8H<sub>2</sub>. Oblique prismatic; massive or in crusts, with crystalline surface and fibrous structure. Cl. clinodiagonal, perfect. H. -2.5 to 3; G. -3-1. Lustre of fracture silky. Colour light carmine and peachblossom-red, of different shades; streak reddish white. Translucent to subtranslucent. C.c.: 30.52 zinc oxide, 6.91 cobalt oxide, 2 nickel oxide, with arsenic acid. Schneeberg.

388. ANNABERGITE (Nickel Ochre), Ni<sub>2</sub>As<sub>2</sub> + 8H<sub>2</sub>. Oblique prismatic; in capillary crystals, also earthy; sectile. H. -2 to 2.5; G. -3 to 3-1. Dull or glistening. Apple-green or greenish white; streak greenish white and shining. C.c.: 38.7 arsenic acid, 37.3 nickel protoxide, and 24 water, but with a little cobalt or iron. Leadhills, Pibble in Kirkcudbright, Andreasberg, Saalfeld, Riechelsdorf.

389. LUDLAMITE, Fe<sub>2</sub>P<sub>2</sub> + 9H<sub>2</sub>. Oblique prismatic, C 79° 27'. ∞P 131° 23'; OP; P 111° 29' (fig. 426). Cl. OP, perfect. H. -3.5; G. -3-12. C.c.: 53.05 oxide of iron, 29.88 phosphoric acid, 17.0 water. Cornwall.



Fig. 426 (sp. 389).

390. FELLOWITE, 3(R<sub>2</sub>P<sub>2</sub>) + H<sub>2</sub>. Oblique prismatic, C 89° 51'; pseudo-rhombohedral. P; -2P8; OP. Cl. basal. H. -4.5; G. -3-43. Resinous to greasy. Wax-yellow to red-brown, or colourless; streak white; translucent. C.c.: phosphoric acid 40.2, iron protoxide 6.8, manganese protoxide 40.2, lime 5.2, soda 5.8, water 1.7. Branchville (Connecticut).

391. HUREAULITE, 5(Mn, Fe)2P<sub>2</sub> + 5H<sub>2</sub>. Oblique prismatic, C 89° 27'. ∞P 61°. Fracture conchoidal. H. -3.5; G. -3-2. Translucent; resinous. Reddish yellow or brown. B.B. fuses easily to a black metallic globule. Soluble in acids. C.c.: 39 phosphoric acid, 8 iron protoxide, 42 manganese protoxide, and 12 water. Hureaux near Limoges.

Heterosite. H. -5; G. -3-5. Opaque; vitreous or resinous. Dark violet or blue to greenish grey; streak violet-blue or crimson-red. Contains more iron and less manganese than the above. Hureaux.

392. DICKINSONITE, 4(R<sub>2</sub>P<sub>2</sub>) + 3H<sub>2</sub>. Oblique prismatic, C 60° 30'. Crystals tabular. Cl. basal, perfect. H. -3.5 to 4; G. -3-34. Vitreous; pearly on cleavage. Olive- to oil-green, and grass-green; streak white. Transparent; brittle. C.c.: phosphoric acid 40, iron protoxide 12.7, manganese protoxide 25, lime 11.8, soda 6.6, water 3.8. Branchville (Connecticut).

393. TRIPLOIDITE, (Mn, Fe)2P<sub>2</sub> + H<sub>2</sub>(Mn, Fe). Oblique prismatic, C 51° 56'. Generally fibrous; transparent; resinous to adamantine. H. -4.5 to 5; G. -3-7. Yellowish-brown. C.c.: 48.45 oxide of manganese, 14.88 protoxide of iron, 32.1 phosphoric acid, 4.1 water. Fairfield (Connecticut).

394. FAIRFIELDITE, R<sub>2</sub>P<sub>2</sub> + 2H<sub>2</sub>. Anorthic; usually foliaceous. H. -3.5; G. -3-15. White to straw-yellow; streak white. Pearly to brilliant-adamantine on cleavage. Transparent; brittle. C.c.: phosphoric acid 38.4, iron protoxide 5.6, manganese protoxide 15.6, lime 30, soda 7, water 10. Fairfield (Connecticut).

395. CHONDRARSENITE, Mn<sub>2</sub>As<sub>2</sub> + 2H<sub>2</sub>. In small grains. H. -3. Yellow to reddish-yellow. Translucent; brittle; fracture conchoidal. Paisberg mines (Wernland).

396. REDDINGITE, Mn<sub>2</sub>P<sub>2</sub> + 3H<sub>2</sub>. Right prismatic. P; P2; ∞P∞. H. -3 to 3.5; G. -3-1. Vitreous; rose-pink to yellowish white. Translucent; fracture uneven; brittle. C.c.: phosphoric acid 34.5, iron protoxide 5.43, manganese protoxide 46.3, lime 8, water 13.1. Branchville.

397. SCORODITE, Fe<sub>2</sub>As<sub>2</sub> + 4H<sub>2</sub>. Right prismatic. P with polar edges 102° 52' and 114° 40'. Crystals P (p), ∞P∞ (a), and ∞P∞ (b); also OP, 1/2P (s), ∞P (n), 2P<sup>2</sup> (s), ∞P<sup>2</sup> (d) 120° 10', and 2P∞ (m) 132° (fig. 427); also columnar and fibrous. Cl. imperfect; brittle. H. -3.5 to 4; G. -3-1 to 3-2. Translucent; vitreous. Leek-green to greenish black, also indigo-blue, red, and brown. B.B. fuses easily, with arsenical odour, to a grey magnetic slag. Sol. in h. acid, to a grey solution. C.c.: 49.8 arsenic acid, 34.6 iron protoxide, and 15.6 water. St Austell in Cornwall, near Limoges in France, Schwarzenberg, Lölling in Carinthia, Brazil, and Siberia.

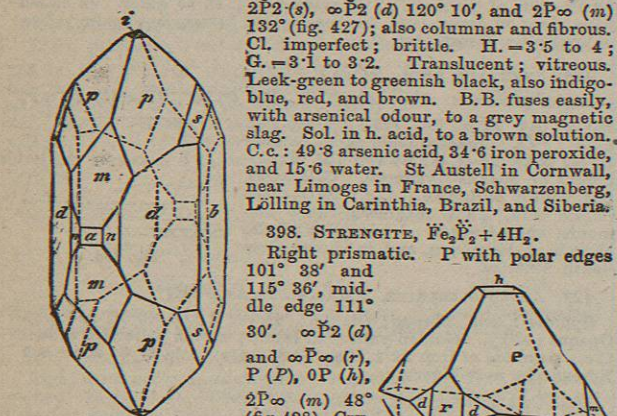


Fig. 427 (sp. 397).

Fig. 428 (sp. 398).

398. STRENGITE, Fe<sub>2</sub>P<sub>2</sub> + 4H<sub>2</sub>. Right prismatic. P with polar edges 101° 38' and 115° 36', middle edge 111° 30'. ∞P<sup>2</sup> (d) and ∞P∞ (r), P (P), OP (h), 2P∞ (m) 48° (fig. 428). Crystals generally r, P, d; r dominant. Cl. r. H. -3 to 4; G. -2-37. Cherry-red. Translucent. C.c.: protoxide of iron 43.18, phosphoric acid 47.42, water 19.4. Rock Bridge (Virginia).

399. DUPRENTITE (Kraurite), 2Fe<sub>2</sub>P<sub>2</sub> + 3H<sub>2</sub>. Right prismatic. ∞P about 123°. Spherical or reniform. Cl. brachydiagonal; brittle. H. -3 to 3.5; G. -3-3 to 3-4. Translucent on the edges, or opaque; shining or dull. Dirty leek-green or blackish green; streak siskin-green. C.c.: 63 iron peroxide, 28 phosphoric acid, and 9 water. Westerwald, Hirschberg, and Limoges.

400. BERAUNITE, 5Fe<sub>2</sub>P<sub>2</sub> + 14H<sub>2</sub>. Occurs in small foliated and columnar aggregates. Cl. plane metallic pearly. H. -2; G. -2-378. Colour hyacinth-red to reddish brown; streak dirty-yellow. C.c.: 54.5 peroxide of iron, 28.65 phosphoric acid, and 16.55 water. Bohemia, Scheibenberg in Saxony.

401. ELEONORITE, 3Fe<sub>2</sub>P<sub>2</sub> + 8H<sub>2</sub>. Oblique prismatic, C 43° 33'. Twin face the orthopinacoid. Cl. ∞P∞. H. -3 to 4. Dark hyacinth-red; streak yellow. Vitreous to pearly. C.c.: 51.94 peroxide of iron, 31.88 phosphoric acid, 16.37 water. Eleonore mine near Bieber.

402. CACOXENE, 2Fe<sub>2</sub>P<sub>2</sub> + 12H<sub>2</sub>. Radiated tufts, of a brownish-yellow colour. H. -3 to 4; G. -3-38. Sol. in h. acid. From the Hrbeck mine near Zbirow in Bohemia.

403. PHARMACOSIDERITE (Cube Ore), 4Fe<sub>2</sub>As<sub>2</sub> + 15H<sub>2</sub>. Cubic and tetrahedral; usually ∞O∞, with O/2, or ∞O. Brittle. H. -2.5; G. -2.9 to 3. Cl. ∞O∞. Semitransparent to translucent; adamantine or resinous. Olive- to emerald-green, honey-yellow, and brown; streak straw-yellow. Pyro-electric. C.c.: 43 arsenic acid, 40 iron peroxide, and 17 water. Carharrack in Cornwall, Burdell Gill in Cumberland, Lobenstein in Reuss, Schwarzenberg in Saxony, North America, and the gold quartz of Australia.

404. CALAITE (Turquoise), 2(Al<sub>2</sub>)<sub>2</sub>P<sub>2</sub> + 5H<sub>2</sub>. Massive, reniform, or stalactitic; fracture conchoidal. H. -3; G. -2.6 to 2.8. Opaque or translucent on the edges; dull or waxy. Sky-blue, greenish blue, rarely green; streak greenish white. C.c.: 47 alumina, 32.5 phosphoric acid, and 20.5 water, but mixed with phosphate of iron and copper. Silesia, Lusatia, and Reuss. Oriental turquoise, in veins, at Meshed, near Herat; in pebbles in Khorasan, Bokhara, and Syrian desert. Takes a fine polish, and is valued as an ornamental stone, but is destroyed by oil, and deteriorated by soap.

405. WAVELLITE (Lasionite), 3Al<sub>2</sub>P<sub>2</sub> + 12H<sub>2</sub>. Right prismatic. ∞P 126° 25'; P∞ 106° 46'. Crystals ∞P∞ (P), ∞P (d), P∞ (o) (fig. 429); but generally small, acicular, and in radiated-hemispherical and stellate-fibrous masses. Cl. along ∞P and P∞, perfect. H. -3.5 to 4; G. -2.3 to 2.5. Translucent; vitreous. Colourless, but generally yellowish or greyish, sometimes green or blue. C.c.: 33 alumina, 35.3 phosphoric acid, and 26.7 water; but generally traces of fluoric acid (2 per cent.). Shiant Islands and Glencoe in Scotland, Barnstaple, St Austell, near Glomel and Portrush, Beraun in Bohemia, Amberg in Bavaria; also in New Hampshire and Tennessee. Caruleolactin, from Nassau, has two equivalents less of water.

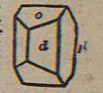


Fig. 429.

406. VARISCITE, Al<sub>2</sub>P<sub>2</sub> + 4H<sub>2</sub>. Right prismatic; reniform; conchoidal fracture. H. -4 to 5; G. -2.34 to 2.38. Apple- and emerald-green; streak white. C.c.: 32.4 alumina, 44.85 phosphoric acid, 22.74 water. Messbach in Reuss, Montgomery county in Arkansas. Zepharovichite from Bohemia contains one equivalent more water; Evansite from Hungary two equivalents more.

407. FISCHERITE, 2Al<sub>2</sub>P<sub>2</sub> + 8H<sub>2</sub>. Right prismatic. ∞P 118° 32'; generally in crystalline crusts. H. -5; G. -2-46. Grass- and olive-green. Vitreous lustre. C.c.: alumina 42, phosphoric acid 29, water 29. Nijni-Tagilsk.

408. PEGANITE, 2Al<sub>2</sub>P<sub>2</sub> + 6H<sub>2</sub>. Right prismatic. ∞P 127°. In thin reniform crusts, of fibrous structure. H. -3 to 4; G. -2-49 to 2-54. Grass- and emerald-green. Vitreous or greasy lustre. C.c.: alumina 45, phosphoric acid 31.3, water 23.7. Striegis in Saxony.

409. HOPEITE, Zn<sub>2</sub>P<sub>2</sub> + 4H<sub>2</sub>. Right prismatic. ∞P 82° 20'; P with polar edges 106° 36' and 140°. Cl. macrodiagonal, perfect. H. -2.5 to 3; G. -2.76 to 2-85. Vitreous or pearly. Greyish white. C.c.: oxide of zinc 35.21, phosphoric acid 31.1, water 15.8. Altenberg.

410. ADAMITE, 4ZnAs<sub>2</sub> + H<sub>2</sub>. Right prismatic. ∞P 91° 52'. Cl. macrodomic. H. -3.5 to 4. Lustre vitreous. Colour honey-yellow to violet; streak white. Transparent. C.c.: oxide of zinc 56.6, arsenic acid 40.2, water 3.2. Cape Garonne in France, Chafarillo in Chili.

411. LIBETHENITE 4CuP<sub>2</sub> + 6H<sub>2</sub>. Right prismatic. ∞P (u) 92° 20', P∞ (o) 109° 52', and P (fig. 430). H. -4; G. -3-6 to 3-8. Translucent on the edges; resinous. Leek, olive, or blackish-green; streak olive-green. C.c.: 66 copper protoxide, 30 phosphoric acid, and 4 water. Gunnislake (Devon), Libethen (Hungary), Nijni-Tagilsk.

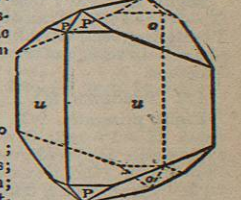


Fig. 430 (sp. 411).



412. OLIVENITE, 4Cu(As<sub>2</sub>P<sub>2</sub>) + H<sub>2</sub>.

Right prismatic. ∞P (P) (r) 92° 30', P∞ (l) 110° 50', ∞P∞ (n) (fig. 431); also spherical and reniform, and columnar or fibrous. Cl. (r) and (l), imperfect. H. = 3; G. = 4.1 to 4.6. Pellucid in all degrees; vitreous, resinous, or silky. Leek-, olive-, or blackish-green, also yellow or brown; streak olive-green or brown. B.B. in the forceps fuses easily to a dark brown adamantine bead, covered with radiating crystalline; on charcoal detonates, emits arsenical vapours, and is reduced. Sol. in acids and ammonia. C.c.: 56.5 copper protoxide, 39.5 arsenic acid, and 4 water; but also 1 to 6 phosphoric acid. Carharrack, Tin Croft, Gwennap, and St Day in Cornwall; Alston Moor, Thuringia, Tyrol, Siberia, Chili.

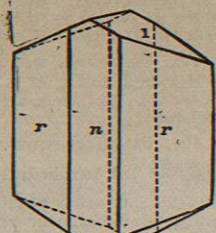


Fig. 431

413. VESELYITE, 9Cu, 6Zn, P<sub>2</sub>, As<sub>2</sub> + 18H<sub>2</sub>.

Oblique prismatic, C 103° 50'. H. = 3.5 to 4; G. = 3.53. Greenish blue. C.c.: copper 37.34, 25.20 zinc oxide, 10.41 arsenic acid, 2.01 phosphoric acid, 17.05 water. Moravizza (Banat).

414. DESOLOIZITE, 2PbV<sub>2</sub> + H<sub>2</sub>.

Right prismatic. ∞P 116° 25'. H. = 3.5; G. = 5.86 to 6.1. Olive-brown to black. C.c.: 56.48 oxide of lead, 16.6 oxide of zinc, 1.16 oxide of manganese, 22.74 vanadic acid. Sierra de Cordoba in the Argentine Republic.

415. VOLBORTHITE, 4(Cu, Ca) V<sub>2</sub> + H<sub>2</sub>.

Hexagonal; small tabular crystals, OP, ∞P, single or in groups. Generally massive. H. = 3; G. = 3.45 to 3.39. Olive-green; streak almost yellow. B.B. on charcoal fuses easily and forms a graphite-like slag, containing grains of copper. Sol. in n. acid, and with water gives a brick-red precipitate. C.c.: 37 to 38 vanadic acid, 39.4 to 46 copper oxide, 18.5 to 13 lime, 3.6 to 5 water. Sissersk (Urals), Nijni-Tagilsk, and Friedrichroda in Thuringia.

416. TAGILITE, 4CuP<sub>2</sub> + 3H<sub>2</sub>.

Oblique prismatic; but botryoidal and radiating-fibrous, or earthy. H. = 3; G. = 4. Emerald-green. C.c.: 61.8 copper protoxide, 27.7 phosphoric acid, and 10.5 water. Nijni-Tagilsk, and near Hirschberg.

417. EUCHROITE, 4CuAs<sub>2</sub> + 7H<sub>2</sub>.

Right prismatic. ∞P (M) 117° 20', P∞ (m) 80° 52', with ∞P2 (l) and OP (P) (fig. 432). Brittle. H. = 3.5 to 4; G. = 3.35 to 3.45. Translucent; vitreous. Emerald- or leek-green; streak verdigris-green. B.B. in forceps fuses to a greenish brown crystallized mass. Easily sol. in n. acid. C.c.: 47 copper protoxide, 84 arsenic acid, and 19 water. Libethen in Hungary.

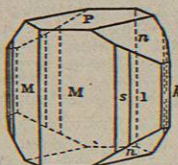


Fig. 432 (sp. 417)

418. ERINITE, 5CuAs<sub>2</sub> + 2H<sub>2</sub>.

Reniform and foliated; conchoidal fracture. H. = 4.5 to 5; G. = 4 to 4.1. Translucent on the edges; dull resinous. Emerald- or grass-green; streak similar. C.c.: 59.9 copper protoxide, 34.7 arsenic acid, and 5.4 water. Cornwall. Cornwallite has 3 or 5 of water.

419. DIHYRITE, 5CuP<sub>2</sub> + 2H<sub>2</sub>.

G. = 4.4. Oxide of copper 69, phosphoric acid 24.7, water 6.25. Rheinbreitenbach and Nijni-Tagilsk.

420. MOTTRAMITE, 5(Cu, Pb)V<sub>2</sub> + 2H<sub>2</sub>.

Black crystalline crusts; streak yellow. H. = 3; G. = 5.5. C.c.: oxide of copper 20.4, oxide of lead 7.2, vanadic acid 18.7, water 3.7. Mottram in Cheshire.

421. EHLITE 5CuP<sub>2</sub> + 3H<sub>2</sub>.

Right prismatic; botryoidal, radiating, ionated. H. = 1.5 to 2; G. = 3.3 to 4.27. Translucent on the edges; pearly on the cleavage. Verdigris-green; streak paler. C.c.: 67 copper protoxide, 24 phosphoric acid, and 9 water. Ehl on the Rhine, Nijni-Tagilsk, Libethen.

422. TYROLITE, 5CuAs<sub>2</sub> + 9H<sub>2</sub>.

Right prismatic. Cl. basal, perfect; reniform. Radiate-foliateous. H. = 1.5 to 2; G. = 3. Lustre pearly on cleavage face. Colour apple-green and verdigris-green to sky-blue; streak paler. Subtranslucent. C.c.: oxide of copper 50.3, arsenic acid 29.2, water 20.5. Tyrol, Hesse, Thuringia.

423. PHOSPHOROCHALCITE (Lunnite), 6CuP<sub>2</sub> + 3H<sub>2</sub>.

Oblique prismatic. Crystals ∞P2 (f) 33° 56', P (P) 117° 49',

with OP (a) and ∞P∞ (c) (fig. 433); usually small and indistinct; more common in spherical or reniform and radiated-fibrous masses. H. = 5; G. = 4.1 to 4.3. Translucent throughout or on the edges; adamantine to resinous. Blackish, emerald-, or verdigris-green. C.c.: 70.8 copper protoxide, 21.2 phosphoric acid, and 8 water. Cornwall, Rheinbreitenbach, Nijni-Tagilsk.

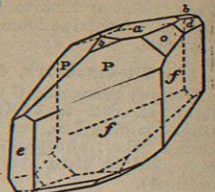


Fig. 433 (sp. 423)

424. CLINOCLASE, 6CuAs<sub>2</sub> + 3H<sub>2</sub>.

Oblique prismatic, C 80° 30'. OP (P), ∞P (m) 56°, P∞ (a) 99° 30', (r) 123° 48' (figs. 434, 435); and hemispherical. Cl. basal, perfect. H. = 2.5 to 3; G. = 4.2 to 4.4. Translucent; vitreous; pearly on cl. Dark verdigris-green to sky-blue; streak blue. C.c.: 62.6 copper protoxide, 30.3 arsenic acid, 7.1 water. Cornwall, Tavistock, Erzgebirge.

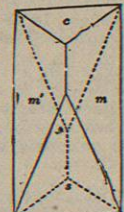


Fig. 434 (sp. 424)

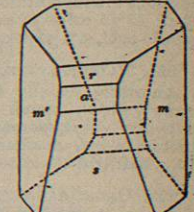


Fig. 435 (sp. 424)

425. MIXITE.

Oblique prismatic or anorthic (l). Radiating, centrally granular. ∞P 125°. H. = 3 to 4; G. = 2.66. Emerald-green to blue-green; streak paler. C.c.: 43.21 copper oxide, 13.1 bismuth oxide, 30.45 arsenic acid, 11.1 water. Geistergang, Joachimsthal.

426. RHAGITE, 5Bi<sub>2</sub>As<sub>2</sub> + 8H<sub>2</sub>.

Grape-like groups of minute crystals. Colour yellowish green; streak white. Lustre wax-like; brittle. H. = 5; G. = 6.32. C.c.: bismuth oxide 79.5, arsenic acid 15.6, water 4.9. Neustädte near Schneeberg.

427. TRÖGERITE, 3UAs<sub>2</sub> + 12H<sub>2</sub>.

Oblique prismatic, C 80°. Crystals thin tabular. Cl. clinodiagonal, perfect. Lustre pearly. G. = 3.3. Lemon-yellow. C.c.: 65.95 oxide of uranium, 17.56 arsenic acid, 16.49 water. In closed tube gives off water, and becomes golden brown, but again yellow on cooling. Neustädte.

428. STRUVITE, (NH<sub>4</sub>, 2Mg) P<sub>2</sub> + 12H<sub>2</sub>.

Right prismatic. P∞ (a) 63° 7', P∞ (c) 95°, 4P∞ (b) 30° 32', ∞P∞ (n), P∞ (m) 123°, OP (o) (fig. 436). Cl. brachydiagonal, perfect. H. = 1.5 to 2; G. = 1.66 to 1.75. Transparent or opaque; vitreous. Colourless, but yellow or brown. C.c.: 29.9 phosphoric acid, 16.3 magnesia, 10.6 ammonia, and 44 water. Under St Nicholas church at Hamburg, and in guano from South America.

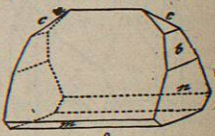


Fig. 436

429. ARSENIOSIDERITE, 3CaAs<sub>2</sub> + 3Fe<sub>2</sub>As<sub>2</sub> + 6H<sub>2</sub>.

Spherical and fibrous; friable. H. = 1.2; G. = 3.52 to 3.88. Opaque; silky. Golden yellowish brown; streak yellowish brown. C.c.: peroxide of iron 39.4, lime 13.8, arsenic acid 37.9, water 8.9. Romanèche near Macon.

430. CHALCOSIDERITE.

Anorthic. Light green oxide of iron, 8.1 oxide of copper, 4.45 alumina, 30.54 phosphoric acid, 15 water. Cornwall.

431. LAZULITE, Al<sub>2</sub>P<sub>2</sub> + (Mg, Fe)P<sub>2</sub> + 2H<sub>2</sub>.

Oblique prismatic, C 88° 2'. ∞P 91° 30', P (c) 99° 40', -P (p) 100° 20'. Crystals often tabular through distortion; twins on OP, and ∞P∞; also massive; fracture splintery. Cl. ∞P. H. = 5 to 6; G. = 3 to 3.1. Translucent; vitreous. Indigo- and small-blue to greenish; streak white. In closed tube yields water, and loses colour. Soluble in acids after ignition. C.c.: 31.7 alumina, 10 magnesia, 6 protoxide of iron, 44 phosphoric acid, and 6 water. Salzburg, Styria, Brazil, Georgia, Lincoln in North Carolina.



Fig. 437 (sp. 431)

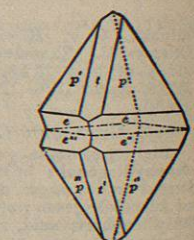


Fig. 438 (sp. 431)

432. CHILDRENITE, 2(Fe, Mn)P<sub>2</sub> + AlP<sub>2</sub> + 15H<sub>2</sub>. P = P<sub>2</sub>H = H<sub>2</sub> &c.

Right prismatic. Polar edges 101° 43', 130° 10', middle 98° 44'; usual form P, 2P∞, ∞P∞ (e, a, P, fig. 439). H. = 4.5 to 5; G. = 3.18 to 3.3. Translucent; vitreous. Yellowish white to wine- or ochre-yellow, brown, or almost black. C.c.: 30.7 iron protoxide, 9 manganese protoxide, 14.5 alumina, 29 phosphoric acid, and 17 water. Tavistock, Crinnis and Callington (Cornwall).

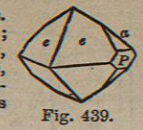


Fig. 439

433. EOPHOSPHITE (Fe, Mn)P<sub>2</sub> + 4H<sub>2</sub>.

Right prismatic. P (p) 133° 32' and 118° 56'; ∞P (s) 104° 19'; ∞P∞ (a), ∞P∞ (b), ∞P2 (g), P2 (t), 2P2 (s) (polar edges 130° 26' and 93° 42') (fig. 440). Cl. macrodiagonal. H. = 5; G. = 3.13. Pale red. Vitreous. C.c.: 23 alumina, 7.4 protoxide of iron, 23.5 oxide of manganese, 31.5 phosphoric acid, 15.6 water. Fairfield (Connecticut).

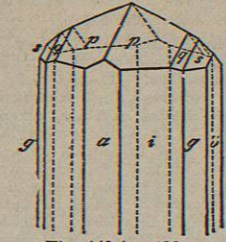


Fig. 440 (sp. 433)

434. LIROCONITE, Cu<sub>3</sub>As + AlAs + 24H<sub>2</sub>.

Oblique prismatic, C 88° 33'. ∞P (d) 61° 31', P∞ (o) 74° 21' (fig. 349). G. = 2 to 2.5; G. = 2.3 to 3. Translucent; vitreous or resinous. Azure-blue to verdigris-green; streak paler. C.c.: 35.6 protoxide of copper, 11.9 alumina, 25.6 arsenic acid, 24.9 water. Redruth, Herregrund in Hungary.

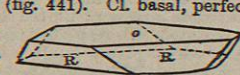


Fig. 441

435. CHALCOPHYLLITE, Cu<sub>3</sub>As + 12H<sub>2</sub>.

Hexagonal rhombohedral; R 69° 48' (fig. 441). Cl. basal, perfect; sectile. H. = 2; G. = 2.4 to 2.6. Transparent; vitreous to adamantine. Pearly on OR (o). Emerald- to grass- and verdigris-green; streak pale green. Soluble in acids and ammonia. C.c.: protoxide of copper 49.6, arsenic acid 18, water 32.4. Redruth in Cornwall, Saïda in Saxony, Moldava in the Banat.

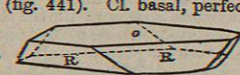


Fig. 441

436. URANITE, (Ca, U<sub>2</sub>) P<sub>2</sub> + 8H<sub>2</sub>.

Right prismatic. ∞P 90° 43'; P middle edge 127° 32'. OP: P 116° 14'; OP: 2P∞ 109° 6'; OP: 2P∞ 109° 19' (figs. 442, 443). Crystals flat. Cl. basal, perfect; sectile. H. = 1 to 2; G. = 3 to 3.2. Translucent; pearly on OP. Sulphur-yellow to siskin-green; streak yellow. C.c.: 15.5 phosphoric acid, 62.6 uranium peroxide, 6.1 lime, and 15.3 water.

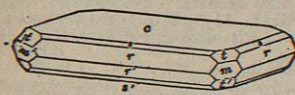


Fig. 442

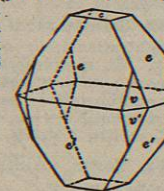


Fig. 443

Cornwall, Autun and Limogès in France, Johann-Georgenstadt and Eibenstock in Saxony, Chesterfield in Massachusetts.

437. URANOSPINITE, (Ca, U<sub>2</sub>) As + 8H<sub>2</sub>.

Right prismatic; quadrangular, scale-like crystals. Cl. basal, perfect. H. = 2.3; G. = 3.45. Siskin-green. C.c.: lime 5.47, sesquioxide of uranium 59.18, arsenic acid 19.37, water 16.29. Neustädte.

438. URANOCROITE, (Ba, U<sub>2</sub>) P<sub>2</sub> + 8H<sub>2</sub>.

Yellowish green crystals, isomorphous with 437. Cl. basal. G. = 3.53. C.c.: sesquioxide of uranium 56.86, baryta 14.57, phosphoric acid 16.1, water 14. Falkenstein in Voigtland.

439. CHALCOLITE, (Cu, U<sub>2</sub>) P<sub>2</sub> + 8H<sub>2</sub>.

Pyramidal. P middle edge 142° 8'; P∞ 128° 14'. Crystals OP, P, ∞P∞, P∞. Cl. basal, perfect; pearly lustre; brittle. H. = 2 to 2.5; G. = 3.5 to 3.6. Grass- to emerald- or verdigris-green; streak apple-green. C.c.: 15.2 phosphoric acid, 61 uranium peroxide, 8.5 copper protoxide, and 15.3 water. Redruth and St Austell, Johann-Georgenstadt, Eibenstock, Schneeberg Bodenmais, Baltimore.

440. ZEUNERITE, (Cu, U<sub>2</sub>) As + 8H<sub>2</sub>.

Pyramidal. P middle edge 142° 6'. OP: P 109° 57'. Crystals tabular. Cl. basal. H. = 2.5; G. = 3.53. Grass-green. Lustre pearly. C.c.: 7.7 oxide of copper, 55.95 sesquioxide of uranium, 14 water. Huel Gouard in Cornwall, Neustädte, Joachimsthal, Zinnwald, Wittichen.

441. WALPURGITE, 5Bi<sub>2</sub>As + 3UAs + 10H<sub>2</sub>.

Anorthic; in scaly crystals. Wax-yellow to pomegranate-red. Adamantine to greasy. H. = 3.5; G. = 5.76. C.c.: sesquioxide of bismuth 60.4, sesquioxide of uranium 20.4, arsenic acid 13, water 4.5. Neustädte.

442. PLOMBGOMME, Pb<sub>3</sub>P<sub>2</sub> + 6AlH<sub>3</sub>.

Reniform or stalactitic; fracture conchoidal and splintery. H. = 4 to 4.5; G. = 6.3 to 6.4. Translucent; resinous. Yellowish or greenish white to reddish brown. C.c.: 38 protoxide of lead, 85 alumina, 3 phosphoric acid, and 19 water; but with 2 chloride of lead. Poullanouen, Nuisserie (near Beaujeu), Georgia.

COMPOUNDS OF PHOSPHATES, VANADIATES, AND ARSENIATES WITH HALOID SALTS.

443. APATITE, 3Ca<sup>2+</sup> + Ca(Cl, F).

Hexagonal and pyramidal-hemihedric. P 80° 26'. The most common forms are ∞P (M); ∞P2 (n); OP (m); P (c); the base OP seldom wanting (figs. 92, 95, 96, 97, 98). The crystals are short-prismatic or thick-tabular; also granular, fibrous, or compact; fracture conchoidal or splintery; brittle. H. = 3; G. = 3.1 to 3.25. Transparent to opaque; vitreous to resinous. Colourless and white, but generally light green, grey, blue, violet, or red. C.c.: phosphate of lime (89 to 92.3), with chloride (to 11) or fluoride (to 7.7) of calcium, or both. Disseminated in granite, gneiss, mica and hornblende slates, primary limestones, and trap rocks; also in beds and veins. Sutherland, Ross, and Aberdeen, in granite and limestone; Cumberland, Devonshire, and Cornwall; in tin-mines in Saxony; Bohemia, St Gotthard, Tyrol; Kragerø in Norway, New York, Canada.

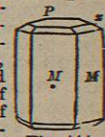


Fig. 444

444. PYROMORPHITE, 3Pb<sub>2</sub>P<sub>2</sub> + PbCl.

Hexagonal; P 80° 44'. Crystals ∞P, OP, with ∞P2, or P (M, P, n, fig. 444), occasionally thicker in the middle, or spindle-shaped; also reniform or botryoidal; fracture conchoidal or uneven. H. = 3.5 to 4; G. = 6.9 to 7. Translucent; resinous or vitreous. Colourless, but generally grass-, pistachio-, olive-, or siskin-green, and clove- or hair-brown, and scarlet (Leadhills). C.c.: 89.7 phosphate and 10.3 chloride of lead, but with 0 to 9 arseniate of lead, 0 to 11 phosphate of lime, and 0 to 1 fluoride of calcium. Elgin, Wanlockhead, also Cornwall, Derbyshire, Yorkshire, Durham, Cumberland, Wicklow, Prizram, Mies, and Bleistadt in Bohemia; Berezoff, Phoenixville in Pennsylvania, and Mexico.

445. VANADINITE, 3Pb<sub>2</sub>V + PbCl.

Hexagonal; P 78° 46'. Forms ∞P, OP (m), P (s), 2P, P (b), ∞P2, ∞P2 (fig. 445). Transparent to opaque; resinous. Honey-yellow to greyish brown; streak white. H. = 3; G. = 6.8 to 7.2. C.c.: oxide of lead 70.83, vanadic acid 19.35, lead 7.2, chlorine 2.62. Wanlockhead, Windischkappel in Carinthia, Haldenwirthshaus in the Black Forest, Bolet in West-Gotland, Berezovsk, Zimapan in Mexico, Cordoba in the Argentine Republic.

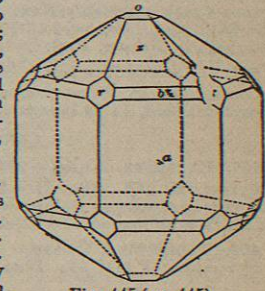


Fig. 445 (sp. 445)

446. MIMETESITE, 3Pb<sub>2</sub>As + PbCl.

Hexagonal; P 81° 48'. Crystals ∞P, OP, P (figs. 91, 444), or P, OP. Cl. P; fracture conchoidal or uneven. H. = 3.5 to 4; G. = 7.19 to 7.25. Translucent. Colourless, but usually honey- or wax-yellow, yellowish green or grey. C.c.: 90.7 arseniate and 9.3 chloride of lead; but part of the arsenic occasionally replaced by phosphoric acid. Leadhills, Huel Alfred and Huel Unity in Cornwall, Roughten Gill and Dry Gill in Cumberland, Beerlston in Devonshire, Johann-Georgenstadt, Zinnwald, Badenweiler, St Prix in France, Nertschinsk, and Zacatecas in Mexico.

447. WAGNERITE, Mg<sub>3</sub>P<sub>2</sub> + MgF.

Oblique prismatic, C 63° 25'. ∞P 57° 35'. Cl. prismatic, and orthodiagonal imperfect; fracture conchoidal or splintery. H. = 5 to 5.5; G. = 3 to 3.2. Translucent or transparent; resinous. Wine-yellow and white. C.c.: 43.3 phosphoric acid, 11.4 fluorine, 37.6 magnesia, and 7.7 magnesium; but with 3 to 4.5 iron protoxide and 1 to 4 lime. Werfen in Salzburg.

448. TRIPLEITE, (Fe, Mn)P<sub>2</sub> + RF.

Oblique prismatic; only granular. Cl. in two directions at right angles; fracture conchoidal. H. = 5 to 5.5; G. = 3.6 to 3.8. Translucent or opaque; resinous. Chestnut- or blackish-brown; streak yellowish grey. C.c.: iron and manganese protoxides, with 33 phosphoric acid, and 7 or 8 fluorine. Limoges, Schlaggenwald.



449. ZWIESELITE, (Fe, Mn)2FeF6. Right prismatic; but only massive. Cl. basal, perfect. H. = 4.5 to 5; G. = 3.95 to 4. Brown; streak yellow. C.c.: like triplite. Zwiesel in Bavaria.

450. AMBYGONITE, Al2Fe3 + (Li, Na)2Fe3 + AlF3 + (Li, Na)F. Anorthic; crystals rare; coarse granular. Cl. OP. pearly, meeting two others at 105° and 87° 40'. Fracture uneven and splintery. H. = 6; G. = 3 to 3.1. Translucent; vitreous. Greyish or greenish white to pale mountain-green. C.c.: 47.9 phosphoric acid, 34.5 alumina, 6.9 lithia, 6 soda, and 8.3 fluorine. Penig, Arendal, Montebrias (Crouse, France), also Hebron and Paris in Maine. Montebrias has no soda.

451. DURANGITE, (R2)As + 2NaF. Oblique prismatic; crystals like keilhauite (sp. 669). ∞P 110° 10'; P 112° 10'. Cl. prismatic. H. = 5; G. = 3.95 to 4. Bright orange-red; streak cream-yellow. Vitreous. C.c.: alumina 17.2, iron protoxide 9.2, arsenic acid 53, soda 13.1, fluorine 7.7. Durango (Mexico).

452. HERDERITE. Right prismatic. P polar edges 77° 20' and 141° 16'; ∞P 115° 53'. Fracture conchoidal. H. = 5; G. = 2.9 to 3. Translucent; vitreous, inclining to resinous. Yellowish or greenish white. Ehrenfriedersdorf in Saxony. An anhydrous phosphate of alumina with lime and fluorine.

PHOSPHATES WITH SULPHATES AND BORATES.

453. SVANBERGITE. Rhombohedral; R 90° 35'. H. = 4.5; G. = 2.57. Vitreous to adamantine. Honey-yellow, reddish brown, and rose-red; streak reddish. Subtransparent. C.c.: 37.8 alumina, 6 lime, 17.3 sulphuric acid, 12.3 soda, 17.8 phosphoric acid, 6.8 water. Horrsjöberg in Wermland.

454. DIADOCHITE, Fe2S2 + 2FeS2 + 32H. Reniform and stalactitic; fracture conchoidal. H. = 3; G. = 1.9 to 2. Resinous; vitreous. Yellow or yellowish brown; streak white. C.c.: 36.7 iron protoxide, 14.8 phosphoric acid 15.2 sulphuric acid, and 30.3 water. Gräfenthal and Saalfeld.

455. PITTCITE, Fe2S2 + 2FeAs + 24H. Reniform and stalactitic; brittle; fracture conchoidal. H. = 2.3; G. = 2.3 to 2.5. Translucent throughout, or on the edges; resinous to vitreous. Yellowish, reddish, or blackish brown, sometimes in spots or stripes; streak light yellow or white. C.c.: 35 iron peroxide, 26 arsenic acid, 14 sulphuric acid, and 24 water. In many old mines, as Freiberg and Schneeberg.

456. BEUDANTITE. Rhombohedral; R 91° 18'. H. = 3.5; G. = 4. Vitreous. Olive-green; streak greenish yellow. C.c.: oxide of iron 40.69, oxide of lead 24.05, sulphuric acid 13.76, phosphoric acid 8.97, water 9.77. Dernbach in Nassau, Cork in Ireland.

457. LÜNEBURGITE (2Mg, H)P + MgB + 7H. Concretions of fibrous structure. C.c.: 25.2 magnesia, 29.33 phosphoric acid, 14.74 boracic acid, 30.23 water. Lüneburg.

ARSENITES.

458. ECDÉMITE, Pb2As2 + 2PbCl2. Pyramidal. Cl. OP. H. = 2.5 to 3; G. = 7.14. Pale green. Vitreous on cleavage; resinous on fracture. C.c.: oxide of lead 59.67, lead 22.2, arsenious acid 10.59, chlorine 7.53. Långban in Wermland.

459. TRIPPKITE, CuAs. Pyramidal; P 111° 56'. Blue-green. Lustrous. Copiapo in Chili.

SILICATES.

ANDALUSITE GROUP.

460. ANDALUSITE, AlSi. Right prismatic. ∞P (m) 90° 50', P ∞ (r) 109° 4'. P ∞ (s) 109° 51'.

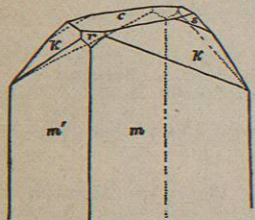


Fig. 446.

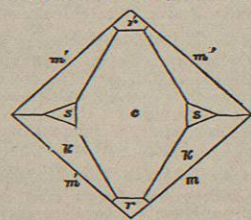


Fig. 447.

Also columnar. Cl. m; fracture splintery. H. = 7 to 7.5; G. = 3.1 to 3.2. Pellucid; vitreous. Grey, green, red, or blue. B.B. infusible.

Not affected by acids. C.c.: alumina 63.1, silica 36.9. Clashnaree (figs. 446 to 449) and Clova in Aberdeenshire, Marnoch and Botrinth-

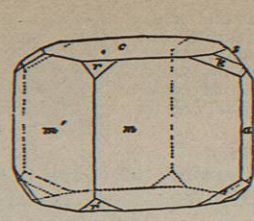


Fig. 448.

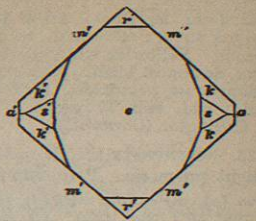


Fig. 449.

nie in Banffshire, Killiney Bay in Wicklow, Andalusia, Tyrol, Penig, Massachusetts, Litchfield in Connecticut.

Chiasolite. H. = 5 to 5.5; G. = 3. Pale grey, yellow, green, and red. A compound structure, formed of four double wedge-shaped crystals, arranged in contact with the angles of a square conoidal crystal placed in their centre, and imbedded in a paste of clay slate. The section of the compound structure forms a tessellated cross, the appearance of which varies with the portion of the crystal which is cut. Portsoy (fig. 450) and Boharm in Banffshire, Wicklow, Keswick and Skiddaw, Brittany, Pyrenees, Maine, New Hampshire, Nova Scotia, Canada.



Fig. 450.

461. CYANITE (Disthene), AlSi. Anorthic; generally broad-prismatic lengthened crystals, formed by two faces (m, l). m: l 106° 15'; m: l 145° 41'; p: m 93° 15' (fig. 451). Hemitropes common, united by m. Also radiated. Cl. m, perfect; brittle. H. = 7, on cl. planes 5; G. = 3.5 to 3.7. Pellucid; vitreous. Cl. pearly. Colourless, and red, yellow, green, grey, and blue. B.B. infusible. Not affected by acids. C.c. same as andalusite. Hillswick in Shetland, Mount Battock, Tarfside (fig. 451), Botriphnie (Banffshire), Tyrol, St Gotthard, Bohemia, Pontivy in France.

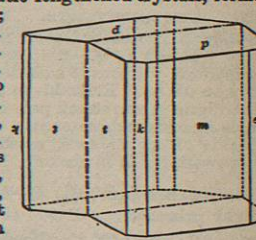


Fig. 451.

462. SILLIMANITE, AlSi. Right prismatic; ∞P 111°. Crystals fibrous, columnar, and radiating. Cl. macrodiagonal. H. = 7; G. = 3.2 to 3.26. Translucent; resinous; on cl. vitreous. Greyish, greenish, clove, or hair-brown. C.c. and chemical characters like cyanite. Tvedestrand, Norway; Chester and Norwich, Connecticut. Al2O3, SiO2, is thus trimorphous. Monroite, Xenotime, Bucholite, Fibrolite, and Bamite are varieties.

463. TOPAZ, 5AlSi + AlF3 + SiF2. Right prismatic. ∞P (M) 124° 17', 2P ∞ (n) 92° 42', ∞P 2 (l) 93° 14', P (o). Crystals always prismatic (fig. 122), often hemimorphic. Cl. basal, perfect; fracture conchoidal. H. = 8; G. = 3.4 to 3.6. Transparent; vitreous. Colourless, honey-yellow, amber, pink, asparagus-green, blue. Becomes electric by heat or friction, and the yellow colours become pink. B.B. infusible. Not affected by h. acid; by digestion in s. acid gives traces of fluorine. The formula requires 33.2 silica, 56.7 alumina, 17.5 fluorine. Part of the oxygen must be replaced by fluorine, as the total of the above is 107.4. Ben-a-bour and Arran, Scotland; Mourne Mountains, Ireland; St Michael's Mount, Cornwall; Siberia, Saxony, Bohemia, Connecticut, Australia, Ceylon, Brazil, Peru. The finest topazes are the blue from Scotland and Siberia, the pink, the yellow from Brazil, and the colourless from Peru. The last-named when cut may be distinguished at once from diamond by their electricity. Pyrophyllite is a massive opaque cleavable variety from Falun. Pycnite is a columnar straw-yellow to reddish white variety from Zinnwald in Saxony and Durango in Mexico.

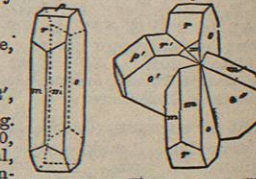


Fig. 452. (Sp. 404.) Fig. 453.

464. STAUROLITE, (Al, Fe)Si + (Fe, Mg)Si. Right prismatic. ∞P (m) 128° 42', P ∞ (r) 70° 46', ∞P ∞ (o), 0P (p) (fig. 452). Twins common, as figs. 140, 144, 187, 453. Cl. brachydiagonal, perfect; fracture conchoidal to splintery. H. = 7; G. = 3.5 to 3.8. Transparent to opaque; vitreous to resinous. Reddish brown; streak white. B.B. infusible. Not affected by h. acid, partially by s. acid.

C.c.: silica 30, alumina 43.5, with 5.5 iron peroxide, 12.5 iron protoxide, 3.5 magnesia; often impure. Bixeter Voe and Unst in Shetland, Boharm and Marnoch in Banffshire, St Gotthard, Greiner in Tyrol, Finistère, Urals, and North America. Xantholite is a yellow variety from Urquhart (Inverness).

465. SAPPHIRE, 4Mg, 5Al, 2Si. Oblique prismatic; granular. H. = 7 to 8; G. = 3.4 to 3.5. Vitreous; pale blue or green; translucent; dichroic. C.c.: alumina 53.2, magnesia 19.3, silica 14.9. Fiskehaes in Greenland.

TOURMALINE GROUP

466. TOURMALINE, R3Si + RSi. Rhombohedral; R 133 10'. Crystals of OR (l'), -1/2R; usually long prismatic, and striated (fig. 45, and 249 to 252). Generally hemimorphic; also radiating and fibrous; fracture conchoidal to uneven. H. = 6.5 to 7.5; G. = 3 to 3.3. Black varieties opaque, others transparent; vitreous. Generally black; but colourless, yellow, brown, blue, green, and rose-red; streak white. Different colours often disposed in layers parallel to the axis; and portions of one crystal differing also in colour along the axis. By friction acquires positive electricity; and becomes electrically polar when heated. Powder insol. in h. acid; imperfectly in s. acid. C.c. complex, but all with water and fluorine, some with boracic acid. Coarse black columnar varieties, called Schorl, very common in granite and gneiss. Black occur at Portsoy in Banff, Clova, Cabrach, and Rubislaw in Aberdeenshire, Bovey in Devonshire, St Just in Cornwall, in Greenland, Arendal, Tyrol, and North America; blue or Indicolite at Utö in Sweden; green at Glen Skiag in Cromarty. Crystals ruby-red within, surrounded by green or red at one extremity and green at the other, also blue and pink, at Albany, Paris, and Hebron in Maine. Currant-red or Rubellite in India and Ceylon, also in Siberia and Brazil.

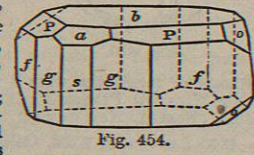


Fig. 454.

467. DATHOLITE, CaH + CaSi + H. Oblique prismatic, C 89° 51'. ∞P (g) 115° 22', ∞P 2 (f) 76° 33', P (P) 120°, -P ∞ (a) 45° 8', ∞P ∞ (s), 2P ∞ (o) (fig. 454); or rhombic with b:f 90°, b:a 135°, b:c 141° 9', and f:g 160° 39'. Fracture uneven, or conchoidal. H. = 5 to 5.5; G. = 2.9 to 3. Transparent or translucent; vitreous. Colourless and tinted greenish, yellowish, or pink. In closed tube yields water. B.B. intumesces and melts easily to a clear glass, colouring the flame green; the powder gelatinizes in h. acid. C.c.: 38.1 silica, 21.6 boracic acid, 34.7 lime, and 5.6 water. Bishopton in Renfrew, Glen Farg in Perthshire (fig. 455), Salisbury Crags and Corstorphine Hill near Edinburgh, Arendal, Utö, Andreasberg, Seisser Alp, Connecticut, and New Jersey. Figs. 238, 239 are pseudomorphs of quartz after datholite termed Haytorite.

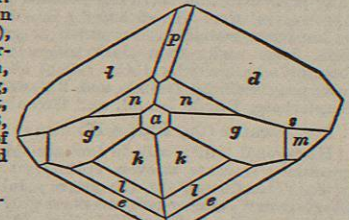


Fig. 455 (sp. 467).

468. EUCLASE, 2Gsi + AlH. Oblique prismatic, C 79° 44'. ∞P 2 (s) 115°; 3P 3 (f) 105° 49'. Crystals specially of ∞P 2, ∞P ∞ (T), 3P 3. Cl. clinodiagonal, perfect; very brittle and fragile; fracture conchoidal.

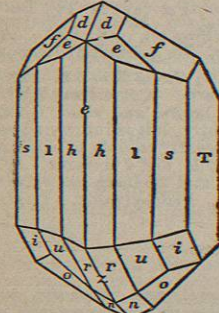


Fig. 456.

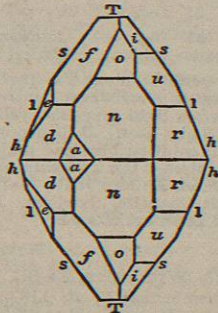


Fig. 457.

H. = 7.5; G. = 3 to 3.1. Transparent; splendent; vitreous.

Mountain-green, passing into blue, yellow, or colourless. B.B. intumesces, becomes white, and melts in thin splinters to a white enamel. Not affected by acids. C.c.: 42 silica, 35 alumina, 18 glucina, 6 water. Peru and Brazil, and Southern Urals. Cannot be used as a gem on account of its brittleness; whence its name.

469. HOMILITE. Oblique prismatic, C 89° 21'. H. = 5.5; G. = 3.28. Black and brownish black. Vitreous. C.c.: 27.28 lime, 16.25 protoxide of iron, 31.37 silica, 18.1 boracic acid. Stokö and Brevig (Norway).

470. BOTRYOLITE. Fine fibrous, botryoidal, or reniform. Snow-white to hair-brown. Chemical and physical characters like datholite, but 10.64 of water,—being 2 equivalents Arendal.

471. GADOLINITE, (Y, Ce, Fe)2Si. Oblique prismatic, C 89° 28'. ∞P 116°; P 120° 56' (fig. 458). Fracture conchoidal, or splintery. H. = 6.5 to 7; G. = 4 to 4.4. Translucent on the edges; vitreous to resinous. Black; streak greenish grey. B.B. the conchoidal (vitreous) varieties incandesce; gelatinizes in h. acid. C.c.: 36 to 51 yttria, 10 to 15 iron protoxide, 5 to 17 protoxide of cerium with lanthanum, 0 to 12 glucina, and 25 to 29 silica. Hitterö in Norway, Ytterby, Broddö and Finbo near Falun.

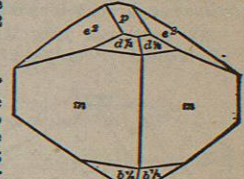


Fig. 458 (sp. 471).

EPIDOTE GROUP.

472. ZOISITE, 4Ca, 3Al, 6Si + H. Right prismatic. ∞P 116° 26'; ∞P 2 145° 24'; ∞P 3 156° 40'; P ∞ 122° 4'; 2P ∞ 111° 6' (fig. 459). Cl. brachydiagonal, perfect. H. = 6; G. = 3.2 to 3.4. White, brownish grey, and dark green. B.B. intumesces, and forms a white or yellow porous mass; and on the edges fuses to a clear glass. C.c.: 29.8 alumina, 24.35 lime, 2.8 oxide of iron, 40.3 silica, and 2.1 water. Glen Urquhart, Dalnain, and Allt Gonolan, Inverness; Sterzing in Tyrol, the San Alp in Carinthia, the Urals, and Connecticut. Thulite, peachblossom-red, from Souland in Thelemark (Norway), is similar.

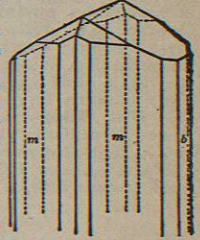


Fig. 459 (sp. 472).

473. EPIDOTE, 4Ca, 3Al, 6Si + H. Oblique prismatic, C 89° 27'. ∞P ∞ (M), ∞P 2 (c) 63° 1', P ∞ (T) 64° 36', -P (n) 70° 25', -P ∞ (r) 63° 42', P (z) 70°. Crystals complex, with many partial forms. Hemitropes united by T; also columnar and granular. Cl. M, perfect; also T, forming 115° 24'; fracture conchoidal to splintery. H. = 6 to 7; G. = 3.2 to 3.5. Pellucid; vitreous. Green to yellowish grey. B.B. fuses and swells to a dark brown slag; after fusion soluble with gelatinization in h. acid. C.c.: 27.4 alumina, 8.5 iron peroxide, 23.9 lime, 38.3 silica, 1.9 water. Shetland, Glenelgin Inverness, Tilquilly in Aberdeenshire, in gneiss; in amygdaloid in Mull and Skye; in granite at Cassenary in Kirkcubright; Arendal, Dauphiné, Greenland, the Urals, North America. Withamite from Glencoe is a red, strongly dichroic variety. Piedmontite or Manganese Epidote, brownish violet, from St Marcel, has 20 per cent. of manganese peroxide.

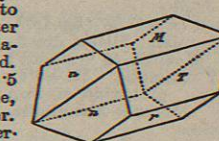


Fig. 460.

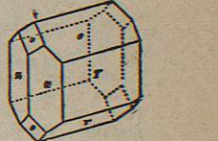


Fig. 461.

474. ALLANITE (Orthite, Cerine), R2Si2 + RSi. Oblique prismatic, O 65°. ∞P (z) 70° 48', P (n) 71° 27', -P (d)

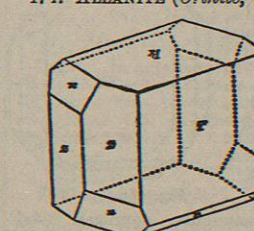


Fig. 462.

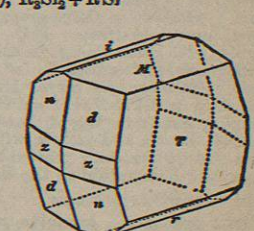


Fig. 463.

Oblique prismatic, O 65°. ∞P (z) 70° 48', P (n) 71° 27', -P (d)