96° 40′, 0P (*M*), P∞ (*r*), ∞P∞ (*T*). *M* : *T* 115°, *T* : *n* 111° 21′, *T*′ : *d* 130° 18′. Often massive or granular; fracture conchoidal. H. —6; G. —3·4 to 3·8. Translucent on edges; vitreous to resinous. Black to brown or greenish; streak brownish grey. B.B. froths and melts to a brown glass. Gelatinous with h. acid. C.c.: 12 to 18 alumina with peroxide of iron, 13 to 26 oxide of cerium and lanthanum, 2 to 12 yttria, 4 to 20 protoxide of iron, 30 of silica. Small crystals common in the syenitic granites of Scotland; as at Lairg, Boat of Garten (fig. 463), Aboyne, and Criffel. In limestone at Urquhart (fig. 462), Greenland, Hitterö and Snarum, Thuringia, Pennsylvania, New Jersey. *Orthite* (massive) at Finbo, Kragerö, and Falun. *Cerine* (granular) at Riddarhyttan. *Pyrorthite* has carbonaceous matter. *Bodenite* is a variety.

475. Idocrase, $3(\dot{C}a, \dot{M}g)_2\ddot{S}i + 2\dot{A}l\ddot{S}i$.

Pyramidal; P (*c*) 74° 27′ (figs. 464 to 466). Crystals ∞P (*d*),

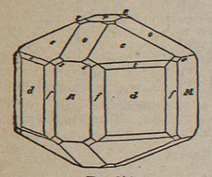

Fig. 464.

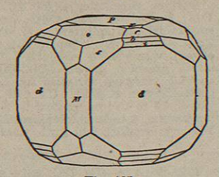

Fig. 465.

∞P∞ (*M*), P (*c*), 0P (*p*), P∞ (*o*) 56° 29′, ∞P2 (*f*). Prismatic, striated; also granular; fracture uneven. H. —6·5; G. —3·35 to 4. Pellucid; vitreous to resinous. Brown, green, yellow; streak white. B.B. fuses easily, with intumescence, to a green or brown glass. Partially sol. in h. acid; after ignition totally, gelatinizing. C.c.: alumina 16, peroxide of iron 7, lime 34, silica 38. Glen Gairn and Crathie, Aberdeenshire, in limestone; Broadford, Skye; Wicklow and Donegal, Ireland; Egg, Norway; Mussa, Piedmont; Vesuvius; Wilui river, near Lake Baikal (fig. 463). *Cyprine* from Thelemark is azure-blue, from copper.

Fig. 466.

Olivine Group.

476. Forsterite, $\dot{M}g_2\ddot{S}i$.

Right prismatic. Like olivine (sp. 478). H. —6 to 7; G. —3·2 to 3·3. Vitreous; transparent. White, wax-yellow, greenish; streak white. C.c.: magnesia 57·1, silica 42·86. Vesuvius. *Boltonite*, red, is from Massachusetts.

477. Fayalite, $\dot{F}e_2\ddot{S}i$.

Right prismatic; *n* : *n*′ 49° 36′ (fig. 467). Massive. Cl. rectangular. Black, greenish, or brownish. Metallic to resinous; fracture conchoidal; magnetic. H. —6·5; G. —4 to 4·1. C.c.: protoxide of iron 70·5, silica 29·5. Mourne Mountains, Ireland; Fayal, Azores.

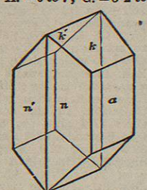

Fig. 467 (sp. 477).

478. Chrysolite (*Olivine*, *Peridote*), $(\dot{F}e, \dot{M}g)_2\ddot{S}i$.

Right prismatic. P (*c*) 85° 16′ and 189° 54′; middle 108° 30′. ∞P (*n*) 130° 2′, P∞ (*d*) 76° 54′, 2P∞ (*k*) 80° 53′, ∞P∞ (*M*) (fig. 468). Also massive. Cl. brachydiagonal, perfect; fracture conchoidal. H. —6·5 to 7; G. —3·3 to 3·5. Transparent; vitreous. Olive-green, yellow, brown, and colourless. B.B. infusible. Soluble, with gelatinizing, in acids. C.c.: 47 magnesia, 12 protoxide of iron, 40 silica. Talisker in Skye, Haaliva in Rum, Elie in Fife, Unkel on the Rhine, Vesuvius, Esneh in Egypt, Brazil. *Hyalosiderite*, brown and yellow, with metallic lustre and 30 per cent. protoxide of iron, is from the Kaiserstuhl in the Breisgau.

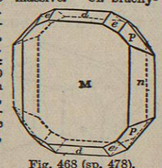

Fig. 468 (sp. 478).

479. Tephroite, $\dot{M}n_2\ddot{S}i$.

Right prismatic; granular, with rectangular cleavages. Ash-grey, rose-red. Adamantine; translucent. H. —5·5 to 6; G. —4 to 4·1. C.c.: protoxide of manganese 70·2, silica 29·8. Franklin and Sparta in New Jersey.

480. Knebellite, $\dot{F}e_2\ddot{S}i + \dot{M}n_2\ddot{S}i$.

Massive. Grey, brown, green, black. Glistening; brittle. H. —6·5; G. —3·71. C.c.: protoxide of iron 35·5, protoxide of manganese 35, silica 29·5. Ilmenau, Dannemora in Sweden.

481. Monticellite, $\dot{C}a_2\ddot{S}i + \dot{M}g_2\ddot{S}i$.

Right prismatic. P (*f*) 110° 43′ and 97° 55′, ∞P (*s*) 98° 7′, ∞P2 (*n*) 133° 6′, P∞ (*k*) 81° 57′, $\frac{1}{2}$P∞ (*h*) 120° 8′, P2 (*c*) 141° 47′ and 82°, ∞P∞ (*b*) (fig. 469). Vitreous. Grey, yellowish and greenish, and white; streak white. Translucent. H. —5 to 5·5; G. —3 to 3·25. C.c.: lime 35, magnesia 21·9, protoxide of iron 5·6, silica 37·5. Sol. in h. acid, gelatinizing. Somma (Milan).

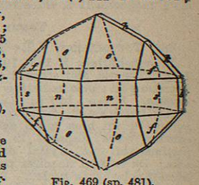

Fig. 469 (sp. 481).

482. Chondrodite (*Humite*), $\dot{M}g_3\ddot{S}i_2$.

Right prismatic. P middle edge 156° 38′, polar edges 131° 34′ and 54° 28′ (figs. 470 to 472). Crystals monoclinic in habit, often granular-massive. H. —6·5; G. —3·16 to 3·25. Translucent; vitreous to resinous. Yellow, red, brown, green, and black; streak white. B.B. infusible. Decomposed by acids. C.c.c

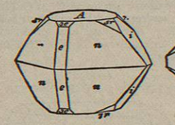

Fig. 470.

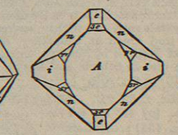

Fig. 471.

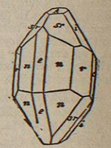

Fig. 472.

silicate of magnesia, with 2 to 3 of fluorine. From limestone on Loch Ness (1); Pargas, Finland; Gullsjö and Aker, Sweden; New York; Sparta, New Jersey. *Humite*, from Somma.

483. Lievrite, $3(\dot{F}e, \dot{C}a)_2\ddot{S}i + \dot{F}e\ddot{S}i + \dot{H}$.

Right prismatic. P (*o*) polar edges 139° 30′ and 117° 27′; ∞P 112° 38′, P∞ (*d*) 112° 49′, ∞P2 (*s*) 106° 15′. Crystals (fig. 124) are long-prismatic and vertically striated; also radiated, columnar, or fibrous; brittle. H. —5·5 to 6; G. —3·9 to 4·2. Opaque; resinous or imperfect metallic. Brownish or greenish black; streak black. B.B. fuses easily to a black magnetic globule. Sol. in h. acid, forming a yellow jelly. C.c.: 29·3 silica, 19·6 iron peroxide, 35·2 iron protoxide, 13·7 lime, and 2·2 water. Rio in Elba, Fossum, Kupferberg, Rhode Island, and Greenland.

484. Cerite $(\dot{C}e, \dot{R})_2\ddot{S}i + \dot{H}$.

Hexagonal; 0P; ∞P; in low six-sided prisms. Generally fine-granular; fracture uneven, splintery; brittle. H. —5·5; G. —4·9 to 5. Translucent on the edges; dull, adamantine, or resinous. Clove-brown, cherry-red, or pearl-grey. Sol. in h. acid, leaving gelatinous silica. C.c.: 20·5 silica, 73·5 protoxide of cerium (with didymium and lanthanum), and 6 water. Bastnaes near Riddarhyttan.

485. Galmei, $\dot{Z}n_2\ddot{S}i + \dot{H}$.

Right prismatic, and hemimorphic; 2P2 (*P*) with polar edges 101° 35′ and 132° 26′, ∞P (*d*) 103° 50′, P∞ (*o*) 117° 14′, P∞ (*f*) 128° 55′ (fig. 46); common form ∞P∞ (*s*), ∞P, P∞. Also columnar, fibrous, granular, and earthy. Cl. prismatic along ∞P, very perfect; along P∞ perfect. H. —5; G. —3·3 to 3·5. Transparent to translucent; vitreous and pearly. Colourless or white, but often light grey, also yellow, green, brown, and blue; becomes electric by heat. B.B. decrepitates slightly, but is infusible; with cobalt solution blue and partly green; readily soluble in acids, and gelatinizes. C.c.: 25 silica, 67·5 zinc oxide, and 7·5 water. Wanlockhead, Mendip Hills, Matlock, Raibl and Bleiberg in Carinthia, Aix-la-Chapelle, Iserlohn, Nertchinsk, Pennsylvania, Virginia. Used as an ore of zinc.

Willemite Group.

486. Willemite, $\dot{Z}n_2\ddot{S}i$.

Rhombohedral; R 116° 1′. Cl. basal, and prismatic, ∞R; brittle. H. —5·5; G. —3·9 to 4·2. White, yellow, brown, and red. Vitreous lustre. C.c.: oxide of zinc 73, silica 27. Altenberg, Liége, Greenland, New Jersey.

487. Troostite, $\dot{Z}n\ddot{S}i + \dot{M}n\ddot{S}i$.

Rhombohedral; R 116°. Cl. prismatic, ∞P2; brittle. H. —5·5; G. —4·1. Asparagus-green, grey, and reddish brown. Vitreous. C.c.: oxide of zinc 58, oxide of manganese 13, silica 28. New Jersey.

488. Centrolite $(\dot{P}b\dot{M}n)\ddot{S}i$.

Right prismatic; ∞P 115° 18′. Form ∞P, P, ∞P∞. H. —5; G. —6·2. Red-brown. Cl. prismatic; splendent on P. Southern Chili.

489. Phenacite, $\dot{G}l_2\ddot{S}i$.

Hexagonal and tetartohedral; R (*p*) 116° 36′ (fig. 473). Crystals R, ∞P2, $\frac{1}{2}$P2. Twins with parallel axes, and intersecting. Cl. R, and ∞P2; fracture conchoidal. H. —7·5 to 8; G. —2·97. Transparent or translucent; vitreous. Colourless, and wine-yellow or brown when fresh, but colouf soon lost on exposure. B.B. infusible; not affected by acids. C.c.: glucina 45·8, silica 54·2. Framont in Alsace, Takovaya in Urals, Miask, Durango in Mexico.

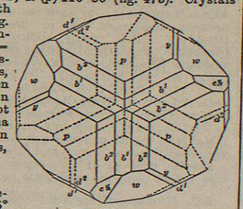

Fig. 473 (sp. 489).

490. Dioptase, $\dot{C}u\ddot{S}i + \dot{H}$.

Hexagonal and rhombohedral; R 125° 54′, −2R (*r*) 95° 28′, ∞P2, −2R$\frac{2}{3}$ (*s*) (fig. 474). Cl. R, perfect; brittle. H. —5; G. —3·2 to 3·3. Transparent or translucent; vitreous. Emerald-green, rarely verdigris-green or blackish green; streak green. C.c.: 38·7 silica, 50 copper protoxide, and 11·3 water. Altyn-Tübeh in the Kirghiz Steppe, Muroshnaya, Copiapo.

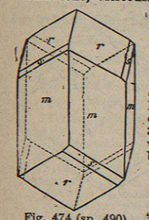

Fig. 474 (sp. 490).

491. Chrysocolla, $\dot{C}u\ddot{S}i + 2\dot{H}$.

Botryoidal or investing; brittle; fracture conchoidal. H. —2 to 3; G. —2 to 2·3. Translucent; resinous. Verdigris- to emerald-green or azure-blue; streak greenish white. C.c.: 34·83 silica, 44·94 copper protoxide, and 20·23 water. Leadhills, Lackentyre in Kirkcudbright, Cornwall, Saxony, Hungary, Spain, Urals, Australia, Chili.

492. Bogoslovskite (*Kupferblau*).

Massive; fracture conchoidal; brittle. H. —4 to 5; G. —2·256. Sky- to ultramarine-blue; streak smalt-blue, and shining. A silicate of copper, with 45·5 per cent. copper oxide. Schaphach Valley in Baden, Bogoslovsk in the Urals. *Demidowite* may be the same.

Garnet Group.

493. Garnet, $\dot{R}_3\ddot{S}i_2 + \ddot{R}\ddot{S}i$.

Cubic; most common forms ∞O and 202 (figs. 33, 40, 60, 475). Also granular. Cl. dodecahedral; fracture conchoidal, or splintery. H. —6·5 to 7·5; G. —3·5 to 4·3. Pellucid; vitreous or resinous. Rarely colourless or white; generally red, brown, black, green, or yellow. B.B. in general fuses to a glass, black or grey in those containing much iron, green or brown in the others, and often magnetic; imperfectly soluble in h. acid. C.c. exceedingly variable, but generally forming two series, according as R_2O_3 is chiefly alumina or chiefly iron peroxide; and these are again divided according as RO is more especially lime, iron protoxide, magnesia, or a similar base. The more important varieties are—

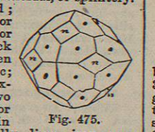

Fig. 475.

(1) *Lime-Alumina Garnet*, $\dot{C}a_3\ddot{S}i_2 + \ddot{A}l\ddot{S}i$, with 40 silica, 23 alumina, and 37 lime. To this subdivision belong—

(*a*) *Water Garnet.*—Colourless to white. Craig Mohr, Aberdeen; Thelemark in Norway.

(*b*) *Grossular.*—Olive- to gooseberry-green. Craig Mohr: Wilui river; America.

(*c*) *Cinnamon Stone.*—Hyacinth-red to orange-yellow. Glen Gairn (Aberdeen), Allt Gonolan and Ord Ban (Inverness), Ceylon, Wermland. *Romanzowite*, from Kimito (Finland), is the same. This variety when polished is often sold as *Hyacinth*.

(*d*) *Common Lime Garnet.*—Here one half of the alumina is replaced by iron peroxide. Colours red, brown, yellow. Piedmont, Vesuvius, the Urals.

(2) *Magnesia-Alumina Garnet*; RO chiefly magnesia. Arendal.

(3) *Manganese-Alumina Garnet*; RO = MnO; reddish-b Spessart (Bavaria), Sweden.

(4) *Magnesia-Iron-Lime-Alumina Garnet, Pyrope.*—Colour port-wine to purplish red. Elie in Fife, Zoblitz in Saxony, Bohemia.

(5) *Iron-Alumina Garnet, Almandine, Noble Garnet.*—Columbine-red, inclining to violet, blood-red, and reddish brown. Common in mica-slate, gneiss, and granite. Shetland, Ross, Inverness, Aberdeen, Falun, Arendal. Tyrol, the Urals, North America, Pegu, and Ceylon.

(6) *Lime-Chrome-Alumina Garnet*, $\dot{C}a_3\ddot{S}i_2 + (\dot{C}r, \dot{A}l)\ddot{S}i$, *Uwarowite.* Emerald-green; with 22 per cent. chrome oxide. Bissersk and Kyshtimsk in the Urals, India, and California.

(7) *Lime and Iron Garnet*, $\dot{C}a_3\ddot{S}i_2 + \dot{F}e, \ddot{S}i$. This includes—

(*a*) *Common Iron-Garnet, Rothoffite, Allochroite.*—Subtranslucent or opaque. Green, brown, yellow, or black; with white, grey, or yellow streak. Sweden and Arendal.

(*b*) *Melanite.*—Black; opaque; in thin splinters translucent; streak grey; slightly magnetic. Albano near Frascati, Vesuvius, France, Lappmark.

(*c*) *Colophonite.*—Yellowish-brown to pitch-black, also yellow or red; resinous; streak white. G. —3·43. Arendal.

The red varieties, when cut *en cabochon*, are termed *Carbuncles*.

494. Axinite, $(\dot{A}l, \dot{B})\ddot{S}i + 2(\dot{C}a, \dot{F}e)\ddot{S}i$

Anorthic. Crystals unsymmetrical. *u* : *P* 135° 31′; *u* : *r* 115° 38′, *P* : *r* 134° 45′ (figs. 136, 137). Cl. distinct along planes truncating the sharp edges between *P* and *u* and *P* and *r*. H. —6·5 to 7; G. —3·2 to 3·3. Pellucid; vitreous. Clove-brown, inclining to smoke-grey or plum-blue; but often cinnamon-brown in one direction, dark violet-blue in a second, and pale olive-green in a third (*trichroism*). B.B. colours flame green; intumesces, and fuses easily to a dark green glass, becoming black in the ox. flame; not sol. in h. acid till after ignition, when it gelatinizes. C.c.: 45·9 silica, 5·9 boracic acid, 17·5 alumina, 9·3 iron (with manganese) protoxide, and 21·4 lime. Botallack and other mines in Cornwall, Bourg d'Oisans in Dauphiné, Kongsberg, Arendal, Nordmark in Sweden, Pyrenees, St Gotthard, Tyrol. Thum in Saxony, Urals, and North America.

495. Danburite $(\dot{C}a, \dot{B})2\ddot{S}i$.

Right prismatic. ∞P (*l*) 122° 52′, ∞P̆2 (*e*) 94° 52′, P∞ (*d*) 97° 7′, 4P̆∞ (*w*) 54° 58′, 0P (*c*), P (*o*), 2P̆2 (*r*), ∞P∞ (*a*), ∞P̆4 (*n*).

Fig. 476.

Fig. 477.

Fig. 478.

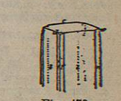

Fig. 479.

Cl. basal; fracture uneven to subconchoidal; vitreous to greasy lustre. H. —7 to 7·5; G. —2·986 to 3·021. Pale yellow to reddish brown. Translucent; brittle. C.c.: 22·76 lime, 28·46 boracic acid, 48·76 silica. Danbury in Connecticut, Russell in New York.

Helvine Group.

496. Helvine, $\dot{M}nS + 3\dot{R}_2\ddot{S}i$.

Cubic and tetrahedral. $\frac{O}{2}$ or $\frac{O}{2} - \frac{O}{2}$ (fig. 64 and with 66). Imbedded or attached. Cl. octahedral. H. —6 to 6·5; G. —3·1 to 3·3. Translucent on the edges; resinous. Wax-yellow, siskin-green, or yellowish brown. B.B. in the red. flame fuses with intumescence to a yellow obscure pearl; sol. in h. acid, evolving sulphuretted hydrogen, and gelatinizes. C.c.: 34 silica, 10 glucina, 8 iron protoxide, 43 manganese protoxide, and 5 sulphur. Schwarzenberg in Saxony, and near Modum in Norway

497. Danalite, $3\dot{R}_2\ddot{S}i + \dot{Z}nS$.

Cubic. In octahedra, with striated dodecahedral planes. H. —5·5 to 6; G. —3·43. Yitreous to resinous. Flesh-red to grey; streak lighter. Translucent; brittle. C.c.: protoxide of iron 29, of manganese 6·5, of zinc 19, silica 31·5, sulphur 5·5. Rockport in Massachusetts.

498. Eulytine, $\ddot{B}i_2\ddot{S}i_3$.

Cubic and tetrahedral. $\frac{202}{2}$ and $-\frac{202}{2}$. The crystals (fig. 66) small, and often with curved faces; fracture conchoidal. H. —4·5 to 5; G. —5·9 to 6·1. Transparent and translucent; adamantine. Clove-brown, yellow, grey, or white; streak white or grey. C.c.: 16·2 silica and 83·8 bismuth peroxide. Schneeberg and Brandorf near Freiberg.

Scapolite Group

498. Sarcolite, $8\dot{C}a, 3\dot{A}l, \dot{N}a, 9\breve{S}i$.

Pyramidal. P 102° 54′; ∞P∞ ; 0P; P, and other faces as in fig. 480, many of the faces being alternately hemihedral. H. — 5·5 to 6 ; G. — 2·93. Vitreous. Grey to rose-red. Translucent ; very brittle. C.c. : alumina 21·5, lime 32·4, soda 3·3, silica 40·5. B.B. fuses to a white enamel ; gelatinizes with acids. Somma.

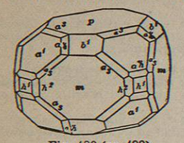

Fig. 480 (sp. 499).

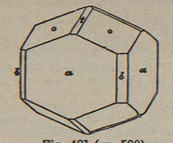

Fig. 481 (sp. 500).

500. Meionite, $6(\dot{C}a, \dot{N}a), 4\dot{A}l, 9\breve{S}i$.

Pyramidal. P (*o*) 63° 42′; P∞ (*t*); ∞P (*a*); ∞P (*b*) (fig. 481). Cl. macrodiagonal. H. — 5·5 to 6; G. — 2·6 to 2·74. Vitreous. Colourless or white. Transparent. Much cracked. C.c. : 31·9 alumina, 26·2 lime, 41·9 silica. Gelatinizes in acids. Somma.

501. Mizzonite, $6(Ca, \dot{N}a), 4\dot{A}l, 15\breve{S}i$.

Pyramidal ; P 64° 4′ (fig. 482). Similar to meionite. C.c. : alumina 23·8, lime 8·8, soda 9·8, silica 54·7. Insoluble in h. acid. Somma.

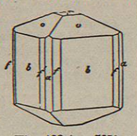

Fig. 482 (sp. 501).

502. Scapolite, $3(\dot{C}a, \dot{N}a)\breve{S}i + \dot{A}l_2\breve{S}i_3$.

Pyramidal. P 63° 42′ ; ∞P∞ ; P ; ∞P ; also massive. Cl. ∞P∞ , perfect; and ∞P. H. — 5 to 5·5; G. — 2·6 to 2·8. Transparent or translucent ; vitreous, pearly, or resinous. Colourless, but also pale grey, green, yellow, or red. B.B. melts with effervescence to a vesicular glass; in the closed tube may show traces of fluorine; with solution of cobalt becomes blue. Sol. in h. acid. C.c. : 49 silica, 28 alumina (with iron peroxide), and 23 lime (with soda). Tiree (Scotland), Arendal, Tunaberg, Pargas, Massachusetts, and New York. Known by its rectangular cleavage, resinous lustre on fractured surfaces, and action B.B. *Dipyre*, P 64° 4′, is a variety.

503. Mellilite (*Humboldtilite*), $2(\dot{C}a, \dot{M}g)\breve{S}i_2 + (\dot{A}l, \dot{F}e)\breve{S}i$.

Pyramidal. P 65° 30′; 0P; ∞P∞ . Cl. basal, perfect. H. — 5 to 5·5; G. — 2·91 to 2·95. Translucent on edges ; vitreous to resinous. Honey-yellow, orange-brown, and yellowish white. C.c. : 32 lime, 7 magnesia, 9 alumina, 7 iron peroxide, 40 silica. Capo di Bove, and Vesuvius.

504. Gehlenite, $(\dot{C}a, \dot{F}e)_3\breve{S}i + (\dot{A}l, \dot{F}e)\breve{S}i$.

Pyramidal. P. 59° ; 0P; ∞P∞ ; ∞P3 ; 2P. Cl. basal. H. — 5·5 to 6 ; G. — 2·9 to 3·1. Translucent on edges. Dull resinous. Mountain-, leek-, or olive-green, and liver-brown. C.c. : 22 alumina, 5 iron peroxide, 35 lime, 4 magnesia, 31·4 silica. Monzoni in the Fassa Valley.

Nepheline Group.

505. Leucite, $\dot{A}l, \breve{S}i_2 + \dot{K}\breve{S}i$.

Pyramidal. Combination of the ditetragonal pyramid (*s*) with the tetragonal pyramid (*o*), and 2P∞ (*u*) with ∞P (*m*). Hemitropes united

Fig. 483.

Fig. 484.

by (*u*). Fracture conchoidal. H. — 5·5 to 6; G. — 2·4 to 2·5. Translucent to translucent on the edges; vitreous, inclining to resinous. Colourless, but greyish, yellowish, or reddish white ; streak white. B.B. infusible ; with cobalt solution becomes blue. Sol. in h. acid, without gelatinizing. C.c. : 54·9 silica, 23·6 alumina, and 21·5 potash. Abundant in the lavas of Vesuvius, the tufas near Rome, and the peperino of Albano ; also at the Kaiserstuhl, and near Lake Laach. Readily distinguished from analcime by its infusibility, and by never showing faces of the cube.

506. Nepheline (*Elæolite*), $\dot{A}l\breve{S}i + 4(\dot{N}a, \dot{K})\breve{S}i$.

Hexagonal. P 88° 10′. ∞P, 0P, P common ; also fig. 485. Crystals imbedded, or in druses ; also massive-granular; fracture conchoidal, or uneven. H. — 5·5 to 6; G. — 2·58 to 2·64. Transparent or translucent ; vitreous and resinous. Colourless or white (nepheline) ; or opaque, dull resinous, and green, red, or brown (elæolite). B.B. melts difficultly (nepheline), or easily with slight effervescence (elæolite), into a vesicular glass. Sol. and gelatinizes in h. acid. C.c. : 41·2 silica, 35·3 alumina, 17 soda, 6·5 potash. Nepheline at Monte Somma, Capo di Bove, Katzenbuckel in the Odenwald, Aussig, and Lusatia. Elæolite in the zircon syenite at Laurvig, Fredriksvärn, Brevig, and Miask.

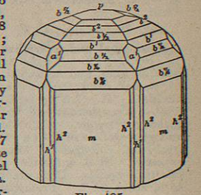

Fig. 485.

Davine, with ½P 51° 46′, seems only a variety; as also *Cancrinite*, bright blue, and with some carbonate of lime.

507. Microsommite, $\dot{K}\breve{S}i + \dot{A}l\breve{S}i + NaCl$.

Hexagonal. ∞P ; 0P ; ∞P2 ; ∞P½ . Cl. ∞P. H. — 6 ; G. — 2·42 to 2·53. Colourless to yellow; lustre silky. Somma and Vesuvius.

508. Sodalite, $3(\dot{A}l\breve{S}i + \dot{N}a\breve{S}i) + NaCl$.

Cubic ; ∞O_2 and fig. 486 ; generally distorted ; also massive and granular. Cl. ∞O ; fracture conchoidal or uneven. H. — 5·5; G. — 2·13 to 2·29. Translucent; vitreous. White, grey, and rarely green or blue. C.c. : 37 silica, 31·8 alumina, 19·2 soda, 4·7 sodium, and 7·3 chlorine. Greenland, Vesuvius, Ilmen Hills, Fredriksvärn, and Litchfield in Maine.

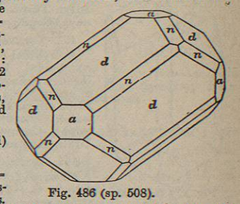

Fig. 486 (sp. 508).

509. Nosean, $3(\dot{A}l\breve{S}i + \dot{N}a\breve{S}i) + \dot{N}a\breve{S}$.

Cubic ; and granular. H. — 5·5; G. — 2·28 to 2·40. Translucent ; vitreous to resinous. Ash or yellowish grey, sometimes blue, brown, or black. C.c. : 36 silica, 31 alumina, 25 soda, and 8 sulphuric acid. Lake Laach, and Rieden near Andernach, on the Rhine. Occurs in phonolites, in minute crystals.

510. Hauyne, $2(\dot{A}l\breve{S}i + \dot{N}a\breve{S}i) + \dot{C}a\breve{S}$.

Cubic ; chiefly ∞O ; also fig. 487; but more common in grains. Cl. ∞O. H. — 5 to 5·5; G. — 2·4 to 2·5. Semitransparent or translucent; vitreous or resinous. Azure- or sky-blue; streak bluish white. C.c. : 34·2 silica, 28·5 alumina, 11·5 soda, 4·3 potash, 10·4 lime, and 11·1 sulphuric acid.* Vesuvius, Mount Vultur near Melfi, the Campagna of Rome, and Niedermendig near Andernach.

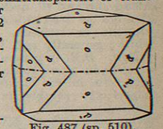

Fig. 487 (sp. 510).

511. Lapis-Lazuli.

Cubic ; O∞ ; generally massive, granular. H. — 5·5; G. — 2·38 to 2·42. Translucent on edges; dull resinous or vitreous. Ultramarine, or azure-blue ; streak light blue. B.B. fuses readily to a white porous glass. In h. acid the powder is dissolved and gelatinizes, evolving sulphuretted hydrogen. C.c. : 45·50 silica, 5·89 sulphuric acid, 31·76 alumina, 9·09 soda, 3·52 lime, 0·86 iron, 0·42 chlorine, 0·95 sulphur, 0·12 water. Near Lake Baikal, China, Tibet, Tartary, Monte Somma, and Chili. It is used for ornamental purposes, and in the preparation of ultramarine. The colour in it and hauyne seems due to some compound of sulphur with sodium and iron.

Mica Group.

512. Biotite (*Magnesia-Mica*), $\dot{A}l_2\breve{S}i_3 + (\dot{M}g, \dot{K}, \dot{F}e)_2\breve{S}i_2$.

Oblique prismatic, C 89° 59′. 0P (*c*), 98° 41′ P (*m*), $-\frac{1}{2}$P (*o*), ∞P∞ (*b*), $\breve{P}\infty$ (*r*), $-\frac{1}{2}\breve{P}3$ (*x*). Cl. basal, perfect; sectile; thin plates elastic. H. — 2·5 to 3; G. — 2·85 to 2·9. Transparent, but often only

in very thin plates. Generally uniaxal, sometimes with divergence — 56°. Metallic, pearly. Usually dark green, brown, or black; streak greenish grey or white. B.B. difficultly fusible to a grey or black glass. Completely sol. in concentrated s. acid, leaving white

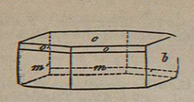

Fig. 488.

Fig. 489.

pearly plates of silica. C.c. : 39 silica, 17 alumina, 10 iron protoxide, 20 magnesia, 9 potash. Hillswick, Shetland, in gneiss; Sutherland, Ross, Inverness, in limestone; Skye and Fife in trap; Pargas, Bodenmais, Greenland, New York. *Rubellan* is a decomposed variety.

513. Haughtonite, $(\dot{A}l, \dot{F}e)\breve{S}i + (\dot{F}e, \dot{K})_2\breve{S}i$

Oblique prismatic. Cl. basal, perfect. H. — 3; G. — 3·1. Vitreous to adamantine. Chocolate-brown to black. Weathers pale green and ochry. Difficultly soluble in acids. B.B. fused with difficulty to a highly magnetic bead. C.c. : silica 36, alumina 18, ferric oxide 4·5, ferrous oxide 18, magnesia 9, potash 8, water 3. Common in the granites of Scotland. Black Forest, Harzburg, Tyrberger

514. Lepidomelane, $(\dot{A}l, \dot{F}e)\breve{S}i + (\dot{F}e, \dot{K})\breve{S}i$.

Oblique prismatic. Cl. basal, perfect ; brittle. H. — 3; G. — 2·97. Vitreous; transparent to opaque. Rich brown to raven-black. B.B fuses easily to a black feebly-magnetic bead. Sol. in h. acid, leaving pearly scales of silica. C.c. : 37 silica, 17 alumina, 24 iron peroxide, 3 protoxide of iron, 8 potash, 10 magnesia, 4 water. Rarely in gneiss, Scotland, common in granite, Ireland ; and Persberg, Sweden.

515. Anomite, $12Mg, 3\dot{A}l, 2\dot{K}, \dot{H}, 12\breve{S}i$.

Oblique prismatic. *c m* 98° 42′. Form *c*, *m*, *o*, *b* (see fig. 488); divergence of optic axes 12° to 16°. Monroe (New York), Lake Baikal.

516. Phlogopite, $(\frac{2}{3}\dot{R}_2 + \frac{1}{3}\dot{H})\ \breve{S}i_2$.

Oblique prismatic. 0P (*c*), P (*m*), $-\frac{1}{2}$P (*o*), ∞P∞ (*b*). *c* : *m* 98° 30′ to 99°. Cl. basal, perfect. H. — 2·5 to 3; G. — 2·75 to 2·97. Pearly to submetallic. Yellowish brown with copper-like reflexion; also green, white, and colourless. Transparent. Divergence of optic axes 3° to 20°. C.c. : 14 alumina, 2 protoxide of iron, 28 magnesia, 8·6 potash, 2·57 fluorine, 41 silica. B.B. whitens, and fuses on edges. Decomposed by s. acid, leaving the silica in scales. Pargas (Finland), Passa Valley, New York, Canada, Ceylon Characteristic of serpentine and of dolomitic limestones.

517. Zinnwaldite.

Oblique prismatic. Forms as in figs. 490, 491; also 2P∞ (*H*) and $3P^3$ (*x*). *m* : *c* 98° to 99°. Divergence of optic axes 65°. G. — 2·82 to 3·2. C.c. similar to muscovite (sp. 519), but with 4 to

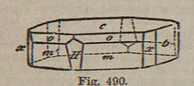

Fig. 490.

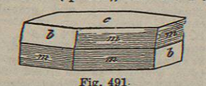

Fig. 491.

8 fluorine, 2 to 5 lithia, and traces of rubidium, cæsium, and thallium. Altenberg and Zinnwald, St Just and Trewavas in Cornwall. *Cryophyllite* from Cape Ann in Massachusetts is similar.

518. Lepidolite.

Oblique prismatic. Forms like muscovite. Divergence of optic axes 50° to 77°. Cl. basal, perfect. H. — 2·5 to 4; G. — 2·84 to 3. Often massive; scaly granular, coarse or fine. Lustre pearly. Colour rose-red, violet, lilac, yellow, greyish white. Contains 5 to 6 per cent. lithia, with rubidium, cæsium, and thallium, also fluorine. B.B. colours flame red. Mourne Mountains. Rozena (Moravia). Utö (Sweden), Ekaterinburg, Maine.

519. Muscovite (*Muscovy-Glass*), $3\dot{A}l\breve{S}i + \dot{K}\breve{S}i$.

Right prismatic, with monoclinic habit. 0P (*c*); ∞P (*M*); ∞P^∞ (*b*); P (*m*); $2P^\infty$ (*y*). ∞P nearly 120°. Twin-face *c*. Cl. basal, perfect; elastic. Angle of optic divergence from 44° to 77°. Metallic, pearly. Colourless, and tinged of various shades to black. B.B. fuses to an opaque enamel. Not affected by acids. C.c. : 36·6 alumina, 11·8 potash, 45·1 silica, 4·5 water, with traces of fluorine. Shetland, Loch Glass in Sutherland, Glen Skiag (crystals 15 inches in length) and Struay Bridge in Ross, Aberdeen, Cornwall, St Gotthard, Norway, Sweden, Siberia. Crystals over a yard in diameter in China, where it is used for windows. *Fuchsite*, bright green, has 6 per cent. of chrome oxide. *Margarodite* contains 4 to 6 water. *Gilbertite*, Cornwall, may be different.

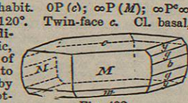

Fig. 492.

520. Paragonite (*Soda-Mica*), $3\dot{A}l_2\breve{S}i_3 + (\dot{N}a, \dot{H})\breve{S}i$.

Massive; foliated. Lustre pearly. H. — 2·5 to 3 ; G. — 2·78 to 2·9. Yellowish, greyish, and greenish. C.c. : 40·1 alumina, 6·1 soda, 47·75 silica, 4·6 water. Monte Campione, St Gotthard.

521. Sandbergerite (*Baryta-Mica*).

White minute scaled aggregates. G. — 2·894. C.c. : 30·2 alumina, 4·9 magnesia, 5·9 baryta, 7·6 potash, 42·6 silica, 4·43 water. Pfitsch Valley in Tyrol, and the Swiss Alps

522. Margarite (*Lime-Mica*).

Right prismatic Cl. basal perfect. H. — 3·5 to 4·5; G. — 2·99 to 3·1. Lustre of cl. pearly. Lateral planes, vitreous. Snow-white, reddish white, and pearl-grey. Laminæ brittle. Optic axial angle 109° to 129°. C.c. : 51·2 alumina, 11·6 lime, 2·6 soda, 30·1 silica, and 4·5 water. Greiner in Tyrol, Naxos, Asia Minor, Greece, Pennsylvania, North Carolina. *Diphanite* is similar.

523. Euphyllite $(\frac{1}{3}\dot{R}_3 + \frac{2}{3}\dot{H})_2\breve{S}i_2 + \frac{1}{2}\dot{H}$.

Like muscovite, but laminæ not easily separable. H. — 3·5 to 4·5; G. — 2·83 to 3. Lustre of cl. pearly to adamantine. White to colourless. Transparent to opaque. Laminæ brittle. Optic axial angle 71½°. C.c. : alumina 42·3, lime 1·5, potash 3·2, soda 5·9, silica 41·6, water 5·5. Unionville in Pennsylvania.

524. Clintonite, $(\frac{1}{3}\dot{R}_3 + \frac{2}{3}\dot{A}l)_2\breve{S}i + \frac{1}{2}\dot{H}$.

Oblique prismatic; in hexagonal tables, or massive foliated. Cl. basal, perfect. H. — 5 to 5·5; G. — 3·15. Translucent ; pearly to metallic on the cleavage. Angle of the optic axes 3° to 13°. Reddish brown to yellow. C.c. : 39·7 alumina, 21·1 magnesia, 13·1 lime, 19·2 silica, 2 protoxide of iron, 4·9 water. Amity and Warwick in New York. *Brandisite* is similar.

525. Xanthophyllite.

Oblique prismatic, C about 90°. Crystalline aggregates. Radiate lamellar. H. — 4·5 to 6; G. — 3·1. Lustre pearly. Colour yellowish to copper-red. Angle of optic axes 0° to 20°. C.c. : alumina 43·6, lime 13, magnesia 17·5, silica 16·9, water 5·1. Zlatoust.

526. Chloritoid, $\dot{F}e\breve{S}i + \dot{A}l\dot{H}$.

Right prismatic ; in foliated crystals ; brittle. Cl. basal. Lustre greasy to pearly. H. — 5·5 to 6 ; G. — 3·52 to 3·56. Dark green ; streak greenish white. C.c. : 40 alumina, 27 protoxide of iron, 25 silica, 7 water. B.B. infusible, but becomes magnetic. Decomposed by s. acid. Hillswick in Shetland, Pregratten in Tyrol, Ekaterinburg, Canada.

527. Masonite.

Broad plates. H. — 6·5 ; G. — 3·53. Grey-green. Streak grey. Pearly to vitreous. C.c. : 26·4 alumina, 19 peroxide of iron, 16·7 protoxide of iron, 32·68 silica, 4·5 water. Middletown in Rhode Island.

528. Ottrelite, $\dot{A}l_2\breve{S}i_2 + 3(\dot{F}e, Mn)Si + 3\dot{H}$.

Thin hexagonal tables. Cl. parallel to the prismatic faces. H. — 5·5 ; G. — 4·4. Translucent; vitreous. Greenish or blackish grey. C.c. : 24·3 alumina, 16·8 protoxide of iron, 11·1 protoxide of manganese, 43·4 silica, 5·65 water. Ottrez in the Ardennes (Luxemburg), Aste in the Pyrenees, Ebnat in Bavaria, Newport (Rhode Island), Vardhos (Greece).

529. Pyrosmalite, $7\dot{R}\breve{S}i + R\dot{C}l_2 + 5\dot{H}$.

Hexagonal. P 101° 34′; crystals ∞P, 0P; tabular; also granular. Cl. basal, perfect ; brittle. H. — 4 to 4·5 ; G. — 3 to 3·2. Translucent to opaque ; resinous, or metallic-pearly. Liver-brown to olive-green. C.c. : 35·5 silica, 27·5 iron protoxide, 21·5 manganese protoxide, 8 chloride of iron or manganese, and 7·5 water. Nordmark in Sweden.

530. Astrophyllite, $(\dot{R}_4, \dot{H})_3\breve{S}i_2$.

Right prismatic, with oblique habit. In long tabular prisms, and in stellate groups. Cl. basal, perfect. H. — 3·5; G. — 3·33. Submetallic to pearly. Tombac-brown to gold-yellow. Pellucid. Axial divergence 118° to 124°. C.c. : peroxide of iron 9·3, protoxide 23·6, protoxide of manganese 10, soda 3·9, potash 5·9, titanic acid 7·90, silica 39·2. Brevig, El Paso in Colorado.

Chlorite Group.

531. Chlorite, $2\dot{R}\breve{S}i + \dot{R}_2\dot{A}l + 3\dot{H}$.

Hexagonal. P 106° 50′; crystals tabular of 0P, ∞P or 0P, P (fig. 493); often in comb-like or other groups ; generally foliated and scaly. H. — 1 to 1·5; G. — 2·78 to 2·96. Leek-green to blackish green ; streak greenish grey. C.c. : 21 alumina, 20 protoxide of iron, magnesia 18, silica 24, water 11. Tarnside, Bute, and Jura in Scotland. Cornwall, Cumberland, Wales, Fassa Valley, Urals, America.

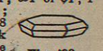

Fig. 493.

532. Pennine, $4\dot{M}gSi + \dot{M}g_3\dot{A}l + 5\dot{H}$

Hexagonal, rhombohedral; R 65° 28′. Crystals chiefly very acute rhombohedrons, with or without the base. Lustre resinous. H. = 2 to 3; G. = 2·6 to 2·77. Streak greenish white. B.B. exfoliates, becomes white, and fuses on the edges to a white enamel. Completely sol. in warm s. acid. C.c.: 33·6 silica, 14·4 alumina, 39·4 magnesia, and 12·6 water; but with 5 to 6 iron protoxide replacing magnesia. Scalpa in Harris, Glen Lochy in Perthshire, Zermatt in Valais, Tyrol, Ala di Stura in Piedmont, Mauléon in the Pyrenees. *Leuchtenbergite* is the same. *Kämmererite*, with 5 to 8 chromium sesquioxide, is violet-blue or green; Unst, Siberia, Pennsylvania. *Rhodochrome* and *Tabergite* are also varieties.

533. Clinochlore (*Ripidolite*), $3\dot{M}gSi + \dot{M}g_2\dot{A}l + 4\dot{H}$.

Oblique prismatic, C. 76° 4′. ∞P 121° 28′. 0P : P 113° 55′; 0P : ∞P 192° 8′. Crystals − 2P, P, 4P∞, 0P (*n*, *m*, *t*, P, fig. 494). Twins common; lustre vitreous or resinous. H. = 2 to 3; G. = 2·6 to 2·8. B.B. becomes white, and fuses on thin edges to a greyish yellow enamel. C.c.: 30·3 silica, 17·3 alumina, 40·3 magnesia, and 12·1 water. Edentian and Blair Athole in Scotland, Traversella in Piedmont, Akhmatovsk in Urals, West Chester in Pennsylvania. *Corundophyllite*, *Epichlorite*, and *Kotschubeyite* are varieties.

Fig. 494

534. Pyrosclerite, $(\frac{3}{4}\dot{R}, \frac{1}{4}\dot{H})_2Si_3 + 3\dot{H}$

Right prismatic. Cl. basal, perfect; fracture uneven; brittle; sectile. H. = 3; G. = 2·7 to 2·8. Pearly; translucent. Apple-, emerald-, and grey-green. C.c.: alumina 13·4, chrome oxide 1·4, protoxide of iron 3·5, magnesia 31·6, silica 37, water 11. Porto-Ferrajo in Elba, China.

535. Chonicrite.

Massive; crystalline-granular and globular-radiated. H. = 2·5 to 3; G. = 2·91. Weak silky. White, with yellowish spots; greenish blue. C.c.: 17·1 alumina, 22·6 magnesia, 12·6 lime, 35·7 silica, 9 water. B.B. fuses easily, with intumescence, to a grey glass. Decomposed by h. acid, with separation of silica. Colmonell (Ayrshire), Porto-Ferrajo.

536. Pycnotrop.

Large grained aggregates. Cl. along two rectangular faces; fracture hackly, splintery. Greyish white to brown-red. Vitreous to greasy. H. = 2 to 2·3; G. = 2·6 to 2·7. C.c.: alumina 29·3, magnesia 12·6, potash 4·4, silica 45, water 7·8. Waldheim in Saxony.

537. Thuringite, $(\frac{1}{2}\dot{R}, \dot{H}_3 + \frac{1}{2}(\dot{A}l, \dot{F}e))_4\dot{S}i_3 + 4\dot{H}$

Massive; scaly. H. = 2 to 2·5; G. = 3·2. Pearly. Olive-green to pistachio-green; streak paler. Very tough. Powder greasy. C.c.: alumina 16, peroxide of iron 14, protoxide of iron 33, silica 23, water 11. Schmiedefeld in Thuringia, Harper's Ferry on the Potomac, Hot Springs in Arkansas.

538. Delessite, $(\dot{F}e^{\frac{1}{3}}_{\frac{2}{3}}, \dot{M}g^{\frac{2}{3}}_{\frac{1}{3}})_2\dot{S}i_2 + (\dot{A}l^{\frac{1}{3}}_{\frac{2}{3}}, \dot{F}e^{\frac{2}{3}}_{\frac{1}{3}})Si + 3\dot{H} + 2\dot{M}g\dot{H}$.

Massive; scaly. H. = 2 to 2·5; G. = 2·6 to 2·89. Olive-green to dark green, passing to dark brick-red; streak light green. C.c.: alumina 16·3, protoxide of iron 12·6, magnesia 21, silica 31·5, water 15·8. Common in igneous rocks of Old Red Sandstone and Coal-measure age in Scotland. Oberstein, Zwickau, Lagrève near Mielin.

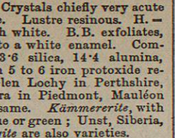
Fig. 495. (Sp.539.) Fig. 496.

539. Cronstedtite, $\dot{F}eSi + (\dot{F}e, Mg)_3\dot{S}i + 3\dot{H}$.

Rhombohedral; radiated columnar. In tapering hexagons, and hemihedral (figs. 495, 496). Cl. basal, perfect; elastic. H. = 2·5; G. = 3·3 to 3·5. Vitreous. Coal-black and brownish black; streak dark olive-green. C.c.: protoxide of iron 39, peroxide of iron 29, silica 22, water 11. Huel Maudlin in Cornwall. Przibram. Brazil (*Side ochhroite*).

Talc and Serpentine Group.

540. Talc, $Mg_3\dot{S}i_4 + \dot{H}$.

Right prismatic (?); rarely found in six-sided or rhombic tables; generally massive, granular, or scaly. Rarely fibrous. Cl. basal, perfect; soft, sectile, and flexible in thin plates. H. = 1; G. = 2·6 to 2·8. Transparent in thin plates, and optically binaxal; pearly or resinous. Colourless, but generally greenish or yellowish white to apple- or olive-green. Feels very greasy. B.B. emits a bright light, exfoliates, and hardens (H. = 6), but is infusible; with cobalt solution becomes red. Not sol. in h. or s. acid before or after ignition. C.c.: 63·5 silica, 31·7 magnesia, and 4·8 water. Unst in Shetland, green; Cairnie in Aberdeenshire, brown; Greiner in Tyrol, Sala and Faluu, the Pyrenees. Used as crayons, also for forming crucibles and for porcelain.

Steatite.—Massive. Grey, red, yellow, or green. Shetland, Sutherland, Portsoy, and near Kirkcaldy, Scotland; the Lizard Point, Cornwall; Briançon, Wunsiedel. Savage nations cut the steatite into culinary utensils.

Potstone is a mixture of talc, chlorite, and other minerals.

541. Picrophyll, $3\dot{R}\dot{S}i + 2\dot{H}$.

Right prismatic. H. = 2·5; G. = 3·75. Dark green. Foliated, shining. C.c.: magnesia 30·1, protoxide of iron 6·9, silica 49·8, water 9·8. Sala in Sweden.

542. Picrosmine, $2MgSi + \dot{H}$.

Right prismatic, but massive. Cl. ∞P∞ perfect, less so in other directions; sectile. H. = 2·5 to 3; G. = 2·5 to 2·7. Translucent or opaque; vitreous, but pearly on ∞P∞. Greenish white, grey, or blackish green; streak colourless. Yields a bitter odour when breathed on; hence the name. C.c.: 55·8 silica, 36·1 magnesia, and 8·1 water. Presnitz in Bohemia, and Greiner in Tyrol.

543. Monradite, $4(\frac{3}{4}Mg, \frac{1}{4}Fe)\dot{S}i + \dot{H}$.

Massive, foliated, translucent, and yellowish-grey. H. = 6; G. = 3·27. C.c.: silica 55·2, magnesia 31·9, protoxide of iron 8·8, water 4·1. B.B. infusible. Bergen in Norway.

544. Meerschaum, $2\dot{M}g_2\dot{S}i_3 + 4\dot{H}$.

Fracture earthy; sectile. H. = 2 to 2·5; G. = 0·8 to 1 (when moist nearly 2). Opaque, dull. Yellowish and greyish white; streak slightly shining. Feels rather greasy, and adheres strongly to the tongue. C.c.: 54·2 silica, 24·7 magnesia, and from 9 to 21·7 water. Negropont, Anatolia, near Madrid and Toledo, Moravia, Wermland.

545. Aphrodite, $4MgSi + \dot{H}$.

Soft and earthy. G. = 2·21. Milk-white; opaque. C.c.: 52·9 silica, 35·3 magnesia, 11·9 water. Langban (Sweden), Elba.

546. Spadaite, $\dot{M}g_3\dot{S}i_4 + 4\dot{H}$.

Massive; fracture splintery; sectile. H. = 2·5. Translucent; resinous. Red, with white streak. C.c.: 57 silica, 31·6 magnesia, 11·4 water. Capo di Bove near Rome.

547. Gymnite.

Massive. H. = 2 to 3; G. = 1·9 to 2·2. Translucent; resinous. Dull orange-yellow. C.c.: 41 silica, 37 magnesia, 22 water. Tyrol, Passau, Texas, Barehills near Baltimore. *Nickel Gymnite* has 29 of nickel oxide, replacing the water. Unst, Texas, Pennsylvania.

548. Saponite, $(\dot{F}eCaMg)_6\dot{S}i_6 + (\dot{A}l_2\dot{F}e)\dot{S}i + 18\dot{H}$

Massive; sectile, and very soft. H. = 1·5; G. = 2·2 to 2·3. White, orange-yellow, pale green, and reddish brown. Feels greasy; does not adhere to the tongue; falls to pieces in water. C.c.: silica 40·8, alumina 7·5, ferric oxide 3·9, magnesia 20·6, water 22·7. Occurs in all the above colours in the later igneous rocks of Scotland, commonly. Lizard Point and St Clear in Cornwall. and Dalecarlia in Sweden. *Pimelite* has 2·8 oxide of nickel.

549. Serpentine, $2\dot{M}g\dot{S}i + \dot{M}g\dot{H}_2$.

Crystallization uncertain; pseudomorphic after olivine, &c.; generally massive, and granular or fibrous; fracture flat-conchoidal, uneven, or splintery; sectile, and slightly brittle. H. = 3 to 3·5; G. = 2·5 to 2·7. Translucent to opaque; dull resinous. Green, grey, yellow, red, or brown; often in spots, stripes, or veins; streak white, shining. Feels greasy, and does not adhere to the tongue. In the closed tube yields water, and becomes black. C.c.: 43·5 silica, 43·5 magnesia, and 13 water; but with 1 to 8 iron protoxide, and also carbonic acid, bitumen, and chrome oxide.

Varieties are—(1) *Noble Serpentine*, brighter coloured, $16H_2O$, and more translucent; (2) *Picrolite*, or fibrous (H. = 3·5 to 4·5); (3) *Common*, or compact; (4) *Chrysotile* (*Baltimorite*, *Metaxite*), in fine asbestiform fibres, easily separated, with a metallic or silky lustre (G. = 2·219).

Common in Shetland, Urquhart, Portsoy, Ballantrae; Lizard Point in Cornwall; Norway, Sweden, North America. Chrysotile at Colafirth and Fetlar, Shetland, Portsoy, Towanreiff, in Scotland; Reichenstein in Silesia, the Vosges Mountains, and North America. Serpentine is often a product of decomposition or pseudomorph of various minerals, as augite, hornblende, olivine, spinel, enstatite, garnet, &c. It forms whole rocks and mountains, and is manufactured into various ornamental articles.

550. Marmolite, $3\dot{M}g\dot{S}i + 2\dot{M}g\dot{H}_2$.

Oblique prismatic; often foliated. H. = 2·5 to 3; G. = 2·41 to 2·47. Lustre pearly. Greenish white, bluish white, and asparagus-green. C.c.: silica 42·1, magnesia 38·5, water 17·5. In veins in serpentine of Urquhart and Portsoy (Scotland) Cornwall, Finland, Hoboken.

551. Antigorite.

Thin flat laminæ. H. = 2·5; G. = 2·6. Translucent. Green with brown spots; streak white. C.c.: silica 40·8, magnesia 36·3, protoxide of iron 5·8, water 12·4. Antigorio in Piedmont.

552. Hydrophite, $(Mg, Fe)_3Si_3 + 4\dot{H}$.

Massive and fibrous. H. = 3 to 4; G. = 2·65. Mountain-green to blue-black; streak paler. C.c.: silica 36·2, magnesia 21·1, protoxide of iron 22·7, water 16. Taberg in Sweden, New York.

553. Villarsite, $2\dot{M}g_6\dot{S}i + \dot{H}$.

Right prismatic; crystals P, 0P, meeting at 136° 32′, often twins in triple combination; also granular. H. = 3; G. = 2·9 to 3. Translucent. Greenish to greyish yellow. C.c.: silica 39·6, magnesia 47·4, protoxide of iron 3·6, water 5·8. Totaig, Ross-shire; Traversella, Piedmont; Forez, France.

554. Pyrallolite.

Oblique prismatic, C 72° 56′; columnar and granular. Cl. basic and hemidomatic, meeting at 94° 36′; fracture splintery; brittle. H. = 3·5 to 4; G. = 2·6. Translucent on edges; resinous. Greenish to yellow-grey. C.c.: silicate of magnesia and water. Storgard in Finland.

555. Dermatine, $(\dot{M}g, Fe)\dot{S}i + 2\dot{H}$.

Reniform; stalactitic; fracture conchoidal; brittle. H. = 2·5; G. = 2·1. Resinous. Blackish green; streak yellow. Does not adhere to tongue. C.c.: silica 38, magnesia 22, protoxide of iron 12, water 23. Waldheim in Saxony.

556. Chlorophæite, $\dot{R}\dot{S}i + \dot{H}_2\dot{S}i_3 + 4\dot{H}$.

Massive, rarely reniform. Coating or filling up geodes in amygdaloidal cavities. H. = 1·5; G. = 2·02 to 2·3. Sectile; fracture conchoidal. On first exposure transparent and olive-green to orange-yellow, but soon changes to black and opaque, splitting in so doing. Vitreous to shining. B.B. melts to a black glass. C.c.: silica 36·2, alumina 8·9, peroxide of iron 13·8, protoxide of iron 2·4, lime 3·8, magnesia 10, water 24·8. Rum and Canna in the Hebrides, Giant's Causeway. The original mineral from Rum has 22·8 iron peroxide and no alumina.

557. Forchhammerite, $\dot{F}eSi + 6\dot{H}$.

Granular massive. Subresinous to dull. Dark green. H. = 2; G. = 1·8. C.c.: silica 32·8, protoxide of iron 21·6, magnesia 3·4, water 42·2. Faroes.

558. Kirwanite.

Fills druses in amygdaloids with divergent sheaf-like crystals. H. = 2; G. = 2·9. Opaque. Olive-green to dark green. C.c.: silica 40·5, alumina 11·1, protoxide of iron 23·9, lime 19·8, water 4·4. Loch Baa in Mull; Mourne Mountains in Ireland.

559. Glauconite.

Round grains. Dull resinous. Light green. C.c.: silicate of protoxide of iron and potash. Ashgrove near Elgin; greensand of England, France, Germany, and America.

560. Celadonite, $3\dot{R}\dot{S}i_2 + \dot{H}_2\dot{S}i_2 + 5\dot{H}$

Massive, forming crusts, as of agates. Earthy, sectile. H. = 1 to 2; G. = 2·6 to 2·8. Opaque, shining. Bright green. Feels greasy. C.c.: silica 54, alumina 3·8, ferric oxide 11·9, ferrous oxide 5·4, magnesia 6·8, potash 7·9, water 10. Orkney, Rum, and Fifeshire in Scotland. Giant's Causeway, Verona, Faroes, Iceland, Cyprus, Bohemia.

561. Stilpnomelane, $2(Fe, \dot{M}g)\dot{S}i + \dot{A}l\dot{S}i + 2\dot{H}$.

Massive or radiating-foliated. One cl. perfect; brittle. H. = 3 to 4; G. = 3 to 3·4. Opaque; vitreous to pearly. Greenish black. C.c.: 45·3 silica, 6·9 alumina, 38·3 iron protoxide (with 2 to 3 magnesia), and 9·5 water. Zuckmantel in Silesia and Weilburg in Nassau.

562. Chamoisite.

Oolitic and massive. H. = 3; G. = 3 to 3·4. Greenish grey to black; streak paler. C.c.: silica 14·2, alumina 7·8, protoxide of iron 60·5, water 17·4. Chamoison (or Chamoson) in Valais, the Vosges. *Berthierine* has 75 protoxide of iron and 5 of water; Moselle.

Augite and Hornblende Group.[1]

Hornblende and augite rather represent groups of mineral substances than single species. They are best distinguished when imperfectly formed, by the cleavage and angles of the prisms.

563. Enstatite (*Chladnite*), $\dot{M}gSi$.

Right prismatic. ∞P (*m*) 93° 30′, $\dot{P}2$ (*c*), $2\dot{P}2$ (*s*), $\frac{1}{2}\dot{P}\frac{2}{3}$ (*u*) ∞P2 (*n*), $\frac{1}{2}\dot{P}\infty$ (*h*), ∞P∞ (*a*), ∞$\breve{P}$∞ (*b*), $\frac{1}{2}\breve{P}\infty$ (*k*), $2\breve{P}\infty$ (*d*). Granular or disseminated. Cl. brachydiagonal very perfect, prismatic ∞P distinct, macrodiagonal very imperfect. H. = 6; G. = 3·3 to 3·4. Opaque or translucent on thin edges; vitreous or resinous, but metallic pearly on the cleavage planes, of which one is copper-coloured to violet or silvery. Pitch-black and greyish black; streak greenish grey or pinchbeck-brown, inclining to copper-red. Not affected by acids. B.B. melts more or less easily to a greenish black glass, often magnetic. C.c.: generally 46 to 58 silica, 0 to 4 alumina, 11 to 26 magnesia, 1 to 5 lime, 13 to 34 iron protoxide, 0 to 6 manganese protoxide. Portsoy and Craig Buroch in Banffshire, Barra Hill in Aberdeenshire, Paul's Island, Labrador, and Greenland. Crystals occur in sanadine bombs at Lake Laach (*Amblystegite*), and in meteorites of Breitenbich. Hypersthene rock in Norway, Elfdal in Sweden, Cornwall (?), the Harz, and Canada. Chemically enstatite and paulite pass into one another; the essential difference is that the axial dispersion is uniformly $\rho < \nu$ in the former, and the opposite in the latter.

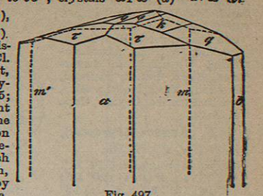

Fig. 497.

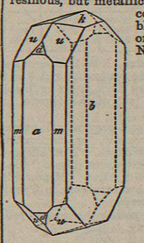

Fig. 498

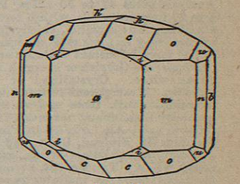

Fig. 499.

566. Wollastonite (*Tabular Spar*), $\dot{C}a\dot{S}i$.

Oblique prismatic, C 84° 30′. ∞P 87° 18′, 0P (*u* or *h'*), ∞P∞ (*x* or *p*), ∞P$\frac{3}{2}$ (*s*) 110° 7′, ∞P∞ (*z* or *e'*) 51°, − P∞ (*v*) 44° 27′, $\frac{1}{2}\breve{P}\infty$ (*a*) 69° 56′ (fig. 500). Rarely crystallized, mostly broad prismatic or laminar. Frequently fibrous. Cl. along 0P and ∞P∞ perfect, but planes uneven or rough; meet at 95° 23′. H. = 4·5 to 5; G. = 2·8 to 2·9. Translucent; vitreous or pearly on cleavage. White, inclining to grey, yellow, red, or brown; streak white.

Fig. 500

[1] Hornblende and augite agree so closely in crystalline forms and chemical composition that it has sometimes been proposed to unite them in one species. They, however, differ too widely to justify their union. Hornblende is more fusible, and ranges lower in specific gravity (hornblende from 2·931 to 3·445, augite 3·185 to 3·329). Though both possess a cleavage parallel to their vertical prisms, yet these differ in angular dimensions:—hornblende 124° 12′, augite 87° 5′. They also occur in distinct geognostic positions:—hornblende in rocks containing quartz or free silica, and mostly with minerals that are neutral compounds of silica, as orthoclase and albite; augite in rocks that do not contain free silica, and mostly with minerals that are not neutral silicates, as labradorite, olivine, and leucite. Hence there are two distinct series of massive or igneous rocks:—the hornblende series, including granite, syenite, diorite, diorite-porphyry, and red porphyry; and the augite series or hypersthene rock, gabbro, dolerite, nepheline rock, augite-porphyry, and leucite-porphyry.