Robert Troup Paine
to Harvard College

ELEMENTS

OF

MINERALOGY,

ADAPTED TO THE USE OF SEMINARIES

AND

Private Students:

By J. L. COMSTOCK, M. D.

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MDCCCXXVII.

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ADVERTISEMENT.

In the execution of the following work, the author has endeavoured, 1st. To make the subject easily understood by avoiding scientific terms, when common words would convey the meaning. 2d. To condense its size as much as possible, by the employment of method in the language of description, and by the omission of all useless words, and 3d. To make the book interesting to common readers, by the insertion of curious particulars.

In offering the result of his labors to the public, the author hopes to contribute in some small degree, towards a more general diffusion of taste for Mineralogy, by affording a cheaper and more easy introduction to its elements, than has before existed in this country.

The work of Professor Cleveland, though undoubtedly the best which has been published, is too expensive, and voluminous for general circulation. That of Phillips, is entirely wanting in respect to distinctive characters, nor have his late editions yet been printed in this country. The Manual of Aikin, is too concise, to give the learner a proper knowledge of the science. These are the only books which have been published in this country on Mineralogy.

Under such circumstances, it was thought that a work containing the elements of the science, and of such a size as to come within the means of almost every one, was much wanted, and if well done, would facilitate the progress of science in our country. How far the following performance is adapted to these views, must now be left to the judgment of the public.

The general plan of arrangement, is that of Phillips, though in particular instances, the places of species have been changed.

In respect to authorities, the following works have been consulted and quoted.

Hauy, Jameson, Cleveland, Phillips, Mohs, Lucas, Aikin, Lowry, Mawe, Bakewell, Pinkerton, Brongniart, Rees', and the Edinburgh Encyclopedias, Silliman's Journal, Brand's Journal, Annals of the New York Lyceum, Robinson's Localities, and Dana's Mineralogy, of Boston.

Among these, the systems of Cleveland, Phillips, Hauy, and Mohs, have been chiefly depended on.

Among the gentlemen from whom information and advice have been received, it is with much pleasure I particularize Professor Hall, of Washington College, who has rendered me essential assistance, during the progress of the work, and by whose kindness I had ready access to the extensive cabinet of the College.

A full list of localities could not have been introduced, without so much enlarging the volume as materially to derange the original plan. It was thought, also, that Dr. Robinson's Catalogue of American localities, in a good degree, rendered such a list unnecessary.

Hartford, January 1st, 1826.

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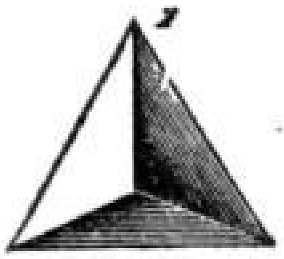
of the Introduction.

PRELIMINARY EXPLANATIONS.

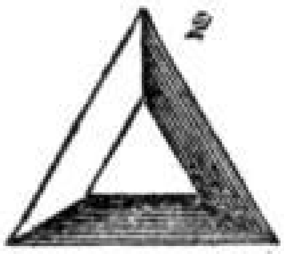
Obs. The pupil in Mineralogy, will find his progress greatly facilitated, by acquiring, in the first place, such a knowledge of Crystallography as to be able to understand and explain the following figures. For this purpose let him take any soft substance, as a piece of pine wood, and with a knife, form the solid figures as he proceeds. In this way he will at once obtain more correct ideas than could be conveyed by the most labored descriptions.

1



The *Regular Tetrahedron.* This figure is bounded by four oblique planes or faces, has four points, or solid angles, and six edges.

2

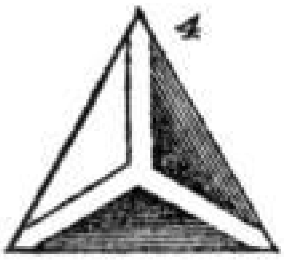


The same with the summit truncated* or cut off.

3

The same with all the corners, or solid angles truncated.

4



The same with the edges truncated.

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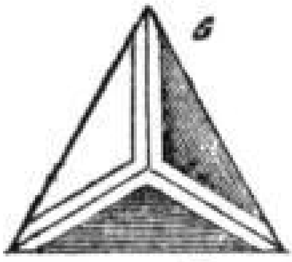
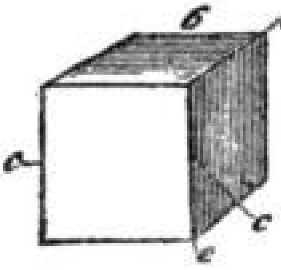


The same with the edges bevelled.*

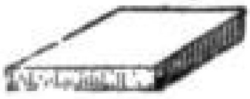
6



The *Cube* has six equal, square faces, eight corners, or solid angles, and twelve edges. *c* the edges; *e* the solid angles.

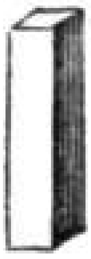
* For the explanation of these terms, see Introduction, page XLII.

7



The *Regular Square Table.* It has the same number of solid angles and edges with the cube. If the cube be divided in the middle, two square tables would be formed.

8



A Regular Quadrangular Prism. This has the same number of faces, angles, and corners, with the cube. If two, or three cubes be laid, one on the other, this figure would be formed.*

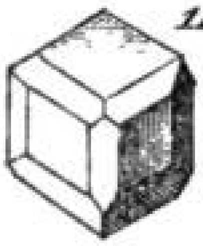
9

The *Cube*, with the corners truncated.

10

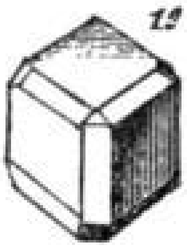
The same, more deeply truncated.

11



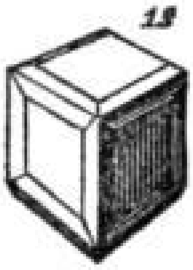
The same, with the edges truncated.

12



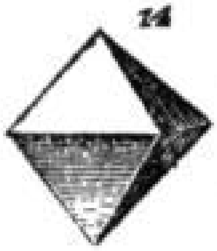
The same, with the corners and edges truncated.

13



The *Cube*, with the edges bevelled, forming two planes and three edges, instead of one edge.

14



The *Regular Octohedron.* This figure is contained under eight triangular planes, or faces, six solid angles, and twelve edges.

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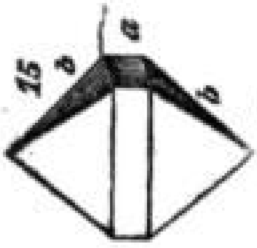
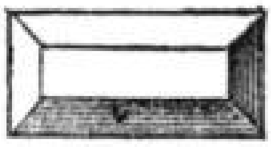
*See page XI.

15


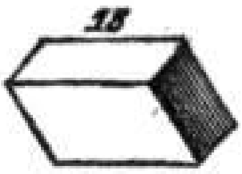
The *Octohedron*, with a short prism interposed between the pyramids—*a* the prism, *bb* the pyramids.

16

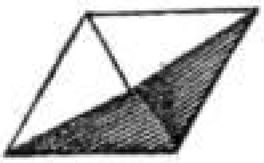

The *Elongated Octohedron*. This differs from the *regular octohedron*, in beiug extended more in one dire ction than in the others.

17


The *Elongated Octohedron*, with the summits truncated.

18


The *Rhomb*. This figure differs from the cube, in having its contiguous faces inclined to each other under various angles, instead of being at right angles.

19


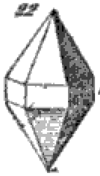
The *Rhomboidal Octohedron*. This is a combination of the *regular octohedron*, and the *rhomb*, forming an irregular solid of eight sides.

20


A figure bounded by *twenty-four* sides. The garnet sometimes is found under this form.

21


The *Dodecahedron*, with the triangular faces—*d* the angles of incidence, *f* the summit.



The same, with a short prism interposed, on which the *a* two pyramids stand—*a* the prism.

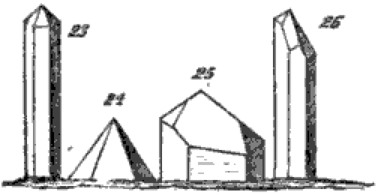


Fig. 23. The *Hexahedral*, or *Six-sided Prism*, terminated by a six-sided pyramid.
24. A *Pyramid.*
25. An *Irregular Pyramid*, standing on a short prism.
26. The same, but still more irregular. Crystals of Quartz are found in these shapes.

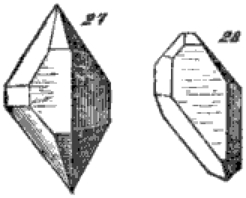
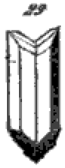
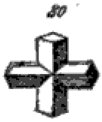


Fig. 27. An *Irregular Dodecahedron.*
28. The same, but more irregular.



A *Macle*, or *Hemitrope* crystal, formed by the junction of two halves, one of which is inver.ed.



Two crystals crossing each other. Staurotide occurs in this form.

By obtaining, and examining closely the solids represented by the above cuts, the Student will not only gain a general knowledge of crystalline forms, but will also understand the right application of the terms by which they are designated. Thus, the difference between the *Tetrahedron*, and the *Tetrahedral*, or *Four-sided Prism*, is obvious. The *Tetrahedron* has four sides only, while the *Tetrahedral Prism* has four sides, more or less extended, surrounding its axis, besides its terminations, which may consist of from one to four, or more faces at each extremity. This figure is also called the *Quadrangular Prism*.

The *Hexahedron*, or *Cube*, has six equal faces, while the *Hexahedral*, or *Six-sided Prism*, has six sides surrounding its axis, besides its terminations.

The *Octohedron* is bounded by eight faces, while the *Octohedral Prism* has eight contiguous planes, besides its terminations.

EXPLANATIONS.

Ext. Char.	stands for . .	External Characters
Chem. Char.	. . . .	Chemical Characters
Dist. Char.	. . . .	Distinctive Characters
Obs.	. . . . . .	Observation
Local.	. . . . .	Localities
H.	. . . . . .	Hauy
J.	. . . .	Jameson
C.	. . . . . .	Cleveland
A.	. . . . . .	Aikin
Bt.	. . . . . .	Brongniart
M.	. . . .	Mohs
P.	. . . . . .	Philips
N. H.	. . . . .	New-Hampshire
Ver. or *Vt.*	. . . .	Vermont
Mass.	. . . . .	Massachusetts
R. I.	. . . . . .	Rhode Island
Con. or *Ct.*	. . . .	Connecticut
N. Y.	. . . . .	New-York
N. J.	. . . . .	New-Jersey
Penn.	. . . .	Pennsylvania
Del.	. . . . . .	Delaware
Md.	. . . . . .	Maryland
D. C.	. . . . . .	District of Columbia
Vir. or *Va.*	. . .	Virginia
N. C.	. . . . . .	North-Carolina
S. C.	. . . . .	South-Carolina
Geo.	. . . . . .	Georgia
Ken.	. . . . . .	Kentucky
Ten.	. . . . .	Tennessee
Mich.	. . . .	Michigan

INTRODUCTION.

DEFINITIONS.

§ 1. *Mineralogy*, is that science by which we gain a systematic knowledge of the mineral kingdom.

Remark. The object of Mineralogy is to obtain such an acquaintance with individual specimens, as to be able to know their names, composition, and place, in a systematic arrangement.

§ 2. Mineralogy, in its widest sense, includes a knowledge of all the inorganic substances of the earth.

Remark The study of *Fossils*, by which is understood the organic remains of animals, fish, and wood, found in the earth, is more properly a subject of geology. Individual specimens of this kind, which most frequently occur, are however sometimes described in works on mineralogy.

§ 3. Minerals may be divided into Simple, and Compound or Aggregated.

Obs. 1. *Simple* minerals, are strictly such, as are composed of one kind of matter only, as native gold, native copper, silex, &c. but by common consent, this term is made to include all such minerals as are homogenous, in their qualities and aspect, though composed of several chemical constituents, as carbonate of lime, octahedral iron, felspar, sulphuret of lead, &c.

2. *Compound* minerals, are such, as are composed of several simple ones closely connected, as *granite*, consisting of the simple minerals, *quartz*, *felspar*, and *mica*. These individuals are generally obvious to the eye, and their study belongs strictly to the science of geology, under the name of *rocks*, or *aggregates*.

§ 4. Geology, is a science, which has for its object, the investigation of the structure of the earth, and the relative position, of the materials of which it is formed.

Obs. 1. The different objects of the two sciences are obvious.—Mineralogy investigates, and determines the nature, and classification of fragments, or cabinet specimens, while geology investigates the constitution, and structure, of the crust of the globe itself.

2. Mineralogy, is therefore absolutely necessary for the study of geology; nor can mineralogy become a profitable, or interesting pursuit, without including so much of geology, as relates to the situation, locality, and nature of the minerals, from among which each cabinet specimen has been taken.

2. CHARACTERS OF MINERALS.

§ 5. The characters of minerals are determined by a close inspection of their external, and obvious properties, as color, form lustre, hardness, &c. and by chemical analysis, by which their composition is ascertained.

Obs. In describing minerals, it is convenient to divide their characters into *external, and chemical.*. Under the first, all such properties, as can be observed, by the sight, touch, fracture, &c. are arranged; and under the second, such chemical characters as can be observed most easily, as fusibility, or infusibility and solubility in acids.

3. EXTERNAL CHARACTERS.

§ 6. The external characters of minerals are numerous, and require great precision in the language of their descriptions.

Obs. Mineralogy is indebted to the celebrated Werner, for the descriptive language employed in the designation of the external, or physical characters of minerals.

§ 7. The following list of external characters is supposed to embrace all those of importance belonging to the mineral kingdom, viz.

1. Color.
2. Lustre.
3. Transparency.
4. Form.
5. Fracture.
6. Structure.
7. Frangibility.
8. Shape of the Fragments.
9. Surface.
10. Touch.
11. Odor.
12. Coldness.
13. Taste.
14. Adhesion to the Tongue.
15. Soil.
16. Hardness.
17. Sound.
18. Tenacity.
19. Streak and Powder.
20. Flexibility and Elasticity.
21. Shape of Fragments.
22. Electricity.
23. Magnetism.
24. Specific gravity.
25. Phosphorescence.
26. Double Refraction.

Obs. 1. Some of these characters are general, and belong to every mineral, as color, structure, form and weight. Others as phosphorescence, electricity, and double refraction, are particular, and belong only to a few individual species.

2. The beginner will find much difficulty in the application of these

several characters to the specimen before him, and will no doubt find it much more easy to satisfy himself what a mineral is not, than what it is. This, however, is an acquisition of knowledge, for every decision, that a specimen does not agree with a given description, is a step towards ascertaining what it is. Perseverance, and the habit of close inspection, with a few simple tests, will however, soon enable the pupil to distinguish the common specimens, a knowledge of which, will greatly assist him in distinguishing the more rare and curious.

4. COLORS.*

§ 7. Colors, have been divided into *metallic*, and *non-metallic*.

Obs. Werner assumed eight fundamental, or principal colors, as the ground of that great variety of shades, which are observed in minerals. These are, *white, grey, black, blue, green, yellow, red, and brown.*

5. METALLIC COLORS.

§ 8. The metallic colors, are, 1. Copper-red ; 2. Bronze-yellow ; 3. Brass-yellow ; 4. Gold-yellow ; 5. Silver-white ; 6. Tin-white ; 7. Lead-grey ; 8. Steel-grey, and 9. Iron-black.

1. *Copper-red.* The color of metallic copper. Ex. Octohedral copper. Native copper.
2. *Bronze-yellow.* The color of bronze, darker than that of brass. Ex. Some varieties of Iron pyrites.
3. *Brass-yellow.* Ex. Copper pyrites. Brass.
4. *Gold-yellow.* The color of pure gold.

Obs. This color is sometimes pale, approaching to silver-white.

5. *Silver-white.* The color of pure silver. Ex. Native silver. Arsenical pyrites.
6. *Tin-white.* The color of pure tin. Ex. Fluid mercury. Native antimony.
7. *Lead-grey.* The color of metallic lead. Ex. Molybdena. Galena.

Obs. This color has several shades, as *blackish* lead-grey, and *whitish* lead-grey.

8. *Steel-grey.* The color of broken steel. Ex.Native platina. Steel grained galena.
9. *Iron-black.* The color of black oxide of iron. Ex. Octohedral iron ore. Magnetic iron.

6. NON-METALLIC COLORS.

§ 9. In the description of minerals, the distinction, *non-metallic*, is not made. The distinction of *metallic* col-

* This description of colors, is, in part, from Mohs' Mineralogy.

ors, is however important, in descriptive language, and the division becomes necessary here, on that account.

A. *White.*

1. *Snow-white.* Pure white. Ex. Carrara marble. Gypsum.
2. *Reddish-white.* White, with a blush of red.
3. *Yellowish-white.* Ex. Several varieties of Carbonate of lime, and Quartz.
4. *Greyish-white.* Ex. Several varieties of marble, and amorphous quartz.
5. *Greenish-white.* Ex. Foliated talc. Nephrite. Prehnite.
6. *Milk-white.* The color of skim-milk, somewhat inclining to blue. Ex. Common opal. Common quartz.

B. *Grey.*

1. *Bluish-grey.* Grey, with a tinge of blue, commonly not very distinct; dull. Ex. Limestone. Felspar. Hornstone.
2. *Pearl-grey.* A mixture of grey, with blue, and a tinge of red, very distinct in the pearl. Ex. Muriate of silver. Sulphate of barytes.
3. *Smoke-grey.* Grey, mixed with brown. Ex. Flint. Smoky quartz.
4. *Greenish-grey.* Ex. Cat's-eye. Talc. Asbestus.
5. *Yellowish-grey.* Ex. Common, in compact limestone, and gypsum.
6. *Ash-grey.* A mixture of white and black, the purest grey color. Ex. Zoisite. Leucite.

C. *Black.*

1. *Velvet-black.* The purest black color. Ex. Schorl. Jet. Obsidian.
2. *Greyish-black.* Black, mixed with grey, without tints of brown, green, or blue. Ex. Basalt. Variety of Magnetic iron. Some varieties of Marble.
3. *Greenish-black.* Black, with a tinge of green. Ex. Hornblende. Hypersthene. Augite.
4. *Brownish-black.* Black, mixed with brown. Ex. Bituminous mineral coal. Black oxide of manganese.
5. *Bluish-black.* This is a rare color. Ex. Dark indicolite. Black cobalt.

D. *Blue.*

1. *Prussian-blue,* or Berlin-blue. Next to ultra-marine, the purest blue color. Ex. Sapphire. Cyanite, and the blue variety of Rock-salt.
2. *Blackish-blue.* Blue, mixed with black. Ex. Dark azure malachite. Phosphate of iron.
3. *Azure-blue.* Bright blue, with a tinge of red. Ex. Lapis lazuli.
4. *Violet-blue.* Blue, mixed with red. Ex. Amethyst. Purple fluor-spar.
5. *Lavender-blue.* Blue, mixed with a little red, and much grey. Ex. Lithomarge. Porcelain Jasper.

6. *Plumb-blue.* Blue, mixed with a little brown. Ex. Fluor-spar.
7. *Smalt-blue.* Pale clear blue.
8. *Indigo-blue.* Blue, mixed with black, and a tinge of green. Ex. Indicolite.
9. *Sky-blue.* Pale blue, with a little green, the color of clear sky. Ex. Octahedral Arseniate of Copper. Fluor-spar.

E. *Green.*

1. *Emerald-green.* The purest green color. Ex. Beautifully distinct, in the finest colored Emerald. Green carbonate of copper.
2. *Verdigris-green.* Green, with a shade of blue. Ex. Amazon stone, or green felspar.
3. *Mountain-green.* Green, with considerable portion of blue. Ex. Beryl.
4. *Leek-green.* Green, with a little brown. Ex. Prase.
5. *Apple-green.* Light green, with a little yellow. Ex. Chrysoprase. Vesuvian. Chrysoberyl.
6. *Pistachio-green.* Green, mixed with yellow and brown. Ex. Crysolite. Epidote.
7. *Blackish-green.* Ex. Serpentine. Hypersthene.
8. *Olive-green.* Pale green, with brown and yellow. Ex. Olivine. Some varieties of Pitchstone.

F. *Yellow.*

1. *Lemmon-yellow.* The purest yellow color. Ex. Orpiment.
2. *Sulphur-yellow.* Yellow, with a tinge of green. Ex. Native sulphur.
3. *Straw-yellow.* Light yellow, with a little grey. Ex. Pycnite. Amber.
4. *Honey-yellow.* Yellow, with a little red and brown. Ex. Honeystone.
5. *Ocre-yellow.* Yellow, with brown. Ex. Yellow quartz.
6. *Wine-yellow.* Yellow, with a little red and grey. Ex. Topaz.
7. *Orange-yellow.* Yellow, with a portion of red. Ex. Molybdate of lead.

G. *Red.*

1. *Carmine-red.* The purest red color. Ex. Ruby. Octahedral copper.
2. *Aurora-red.* Red, with much yellow, like the tints given the clouds by the setting sun. Ex. Realger.
3. *Hyacinth-red.* Red, with yellow, and a little brown. Ex. Hyacinth. Garnet.
4. *Brick-red.* Red, with brown and grey. Ex. Stilbite.
5. *Scarlet-red.* Bright red, with a tint of yellow. Ex. Cinnabar. Ruby silver.
6. *Blood-red.* Red, with a little black. Ex. Pyrope.
7. *Flesh-red.* Pale red, with tints of yellow and grey. Ex. Carnelian.

8. *Cochineal-red.* Red, with a little blue and grey. Ex. Spinelle. Dodecahedral garnet.

9. *Rose-red.* Pale red, with a light tint of yellow and grey. Ex. Rose quartz. Carbonate of manganese.

10. *Crimson-red.* Carmine-red, with a tint of blue. Ex. The finest color of the Ruby. Arseniate of cobalt.

11. *Brownish-red.* Red, with much brown. Ex. Red hæmatite. Jasper.

H. *Brown.*

1. *Chesnut-brown.* The color of ripe chesnuts. The purest brown color. Ex. Egyptian jasper. Brown hæmatite.

2. *Yellowish-brown.* Brown, with much yellow. Ex. Common jasper.

3. *Reddish-brown.* Brown, mixed with much red. Ex. Jasper. Zircon.

4. *Clove-brown.* Brown, with a little blue, and red. Ex. Hornstone.

5. *Hair-brown.* Brown, with a little yellow, and grey. Ex. Brown oxide of iron.

6. *Wood-brown.* Color, of old exposed wood. Ex. Ligniform asbestus.

7. *Liver-brown.* Greenish brown. Ex. Common jasper.

8. *Blackish brown.* Ex. Brown coal. Bituminous wood.

7. LUSTRE.

§ 10. Lustre is a character of more importance, than color because in the same species, it is more uniform.

Obs. The vitreous lustre of quartz, to a practised eye, is generally a pretty decisive character of the mineral, under all its variety of colors.

§ 11. In the description of minerals, reference is made to the *kind*, and to the *intensity* of lustre.

The kinds of lustre are,

1. Metallic. 2. Adamantine. 3. Resinous. 4. Vitreous. 5. Pearly.

1. *Metallic lustre.* It has the aspect of a metal. Ex. Sulphuret of copper. Galena. Silver, Brass, &c.

2. *Imperfect,* or *Semi-metallic lustre.* Ex. Titanium. Hæmatite. Blende.

3. *Pseudo-metallic lustre.* This is applied to several minerals, which give a degree of metallic lustre, only when the reflection, is in a certain direction. Ex. Bronzite. Mica.

4. *Adamantine lustre.* It is difficult to describe, but is readily distinguished in those minerals, where it is present. Ex. Diamond. Corundum. Carbonate of lead.

5. *Resinous lustre.* It resembles the lustre of fractured resin, or a substance smeared with oil. Ex. Pitchstone. Vesuvian.

6. *Vitreous lustre.* It is the lustre of fractured glass. Ex. Quartz. Beryl. Topaz.

7. *Pearly lustre.* It is changeable, and some minerals possess it, in a certain direction only. Ex. Cyanite Actynolite. Argentine.

8. *Silky lustre.* It resembles the lustre of satin. Ex. Satin-spar. Amianthus.

§ 12. The degrees, or intensity, of lustre are, 1. Splendent. 2. Shining. 3. Glistening. 4. Glimmering. 5. Dull.

1. *Splendent lustre.* This is intended to convey an idea of the highest polish, which minerals possess, in the native state. *Ex.* Galena. Specular oxide of iron. Rock crystal. Volcanic Hornblende.

2. *Shining.* It is a degree less than splendent. *Ex.* Mica. Sulphate of Barytes. Blende.

3. *Glistening.* It does not reflect sufficiently to define an image. Ex. Felspar. Fractured Quartz. Carbonate of Lime.

4. *Glimmering.* Somewhat less than the above. Ex. Flint. Hornstone. Asbestus.

5. *Dull.* The entire absence of lustre. Ex. Chalk. Ochre, Marl.

8. PLAY OF COLORS.

§ 11. Several minerals display very extraordinary phenomena, in respect to color. These peculiarities are *Play, or Change of Colors*, *Opalescence*, *Iridescence* and *Tarnish.*

1. *Play, of Colors.* This property consists in the transmission of differently colored rays of light, as the mineral is turned in different directions.

This curious and beautiful property appears to depend on the structure of the mineral, and is possessed only by a few species.—*Ex. Precious Opal.* This beautiful stone presents, as it is turned in various directions towards the light, intense and playful changes of color, which proceed from the interior, presenting as it is turned, most of the colors of the rainbow.

Labradorite. When this is cut in a convex eliptical form, it presents a still more remarkable play of colors, consisting in some specimens, of most of the prismatic rays, several of which are seen at the same instant. These colors appear to proceed from just within the polished surface, but not from the axis of the gem, as is the case with the opal.

2. *Opalescence, or Chatoyment.* This property is analagous to the above, but is not confined to the reflection of brilliant colors. It means more particularly a changeful play of light from the interior. Ex. *Cat's-eye.* This beautiful little stone illustrates the meaning of this property in perfection. It reflects, as it is turned towards the light, milky white, greenish, and brownish colors, in succession. The *Diamond*, some varieties of *Corundum*, and opal, also Moonstone,

which is a variety of Adularia, and that variety of sapphire called *Asteria*, possess more, or less the same qualities. This property is highly valued by the lapidaries, and often greatly enhances the prices of particular specimens.

Obs. In the Cat's-eye, this changeful play of light, is supposed to proceed from minute fibres of amianthus which run through the stone. In opal and labradorite, no adequate explanation of this phenomonon has yet been given.

3. *Iridescence.* This property consists in the actual separation of the rays of light into the prismatic colors, and depends on the principle of the common glass prism, or perhaps, on that of Newton's colored rings, when two plates of glass are pressed together. It pre-supposes separations, or fissures, in the interior of the mineral, and is often entirely accidental. Ex. *Rock-crystal*, often displays these colors in great beauty. In some specimens, it appears to arise from the natural structure of the mineral, in others it is evidently owing to fissures caused by a blow from the hammer.

3. *Tarnish.* This is an alteration of the color of the mineral, on the surface merely, and probably arises from different degrees of oxidation. It mostly belongs to metallic minerals, or such as contain a portion of metal in their composition, or investing their surfaces. Sometimes the color is uniform, as in *carbonate of iron*: in other instances it is of different shades, in the same specimen, presenting a vivid and very beautiful display of all the colors of the rainbow. It is then called *irised*, or iridescent, from *iris*, the rainbow. Ex. *Specular oxide of iron. Anthracite* or *coal. Copper Pyrites*, and many other substances.

Obs. Pieces of ancient window glass, on the exposed side, and pieces of common glass, which have lain a few years in the dirt, exposed to the rain, have the same appearance. Some specimens of this kind have a thin crust, of yellowish decomposed glass, over the colors, which is easily removed. This substance forms a kind of jelly in sulphuric acid. Probably the alteration is owing to the loss of a part of the potash, which the glass contains.

9. TRANSPARENCY.

§ 12. This is an important property, in the descriptive part of Mineralogy; for although, in some minerals, it is an uncertain character, in others it is quite distinctive. It has several degrees, depending on the quantity of light which is transmitted through the mineral.

1. *Transparent.* When objects can be distinctly seen through the specimen. Ex. Sihenite. Iceland spar. Rock crystal.

2. *Semi-transparent.* When objects can be seen through the mineral, however indistinctly. Ex. Adularia. Sulphate of Strontian.

3. *Translucent.* When the light passes through it, but not in sufficient quantity to permit objects to be seen. Ex. Chalcedony. Hornstone. Alabaster. Felspar.

4. *Translucent on the edges.* When by holding the thin edge of the mineral, between the eye and the light, some rays are transmitted. Ex. Flint. Heliotrope. Obsidian. Blende

5. *Opake.* When no light at all is transmitted. Ex. Hornblende. Jasper. The ores of Iron, Sulphuret of Lead, and Copper. Coal. Lignite.

Obs. Some minerals generally described as opake, transmit a small quantity of colored light, as *specular oxide of iron*, which between the eye, and a strong light, appears blood red, and gold in thin leaves, appears green, in the same position.

10. FORM.

§ 13. This is a very important character, and may be divided into three kinds or varieties, viz. *regular*, *imitative*, and *amorphous*.

The *regular* forms, all arise from crystallization, and are of some determinate geometrical figure, being bounded by planes, or faces, which meet, forming the edges, or angles of the crystals.

Of the regular forms, two kinds are distinguished, viz. the *primitive*, and the *secondary*, or *external*.

The *primitive* form, is the nucleus, or centre of the crystal, and is obtained by mechanical division, or cleavage. It often differs from the actual, or external form of the crystal, as presented to the eye. In many cases, however, the primitive and external forms, are the same.

The *secondary*, or *external* form, is that, under which the crystal appears, when entire. In some instances, however, crystals exhibit the primitive form, in the natural state.

Imitative forms. These are the result of confused, or disturbed crystallization, or are merely concretions.

Amorphous, or *Indeterminate* form. When the mineral is neither regular, nor imitative, it is called *amorphous*.

11. PRIMITIVE FORM.

§ 14. It has long been known that some minerals, when broken, presented smooth shining faces in certain directions, and that by particular management, they might be cleaved, or separated into plates, or slices, leaving solids of definite, geometrical shapes. By pursuing this method, it has been ascertained, that almost every crystallized substance, will yield to cleavage in one direction or another, and that by continuing this operation, solids of regular, and certain shapes, are obtained. The solid so obtained, is the primitive crystal.

§ 15. The figure of the primitive crystal, belonging to the same species, is invariably the same.

Obs. Some species, however, yield several varieties of form; such is the case with fluor-spar, which affords the regular octohedron, the tetrahedron, and the acute rhomboid. Of these, the octohedron has been selected as the primitive.

§ 16. The individual species of crystals, do not each possess a primitive form, peculiar to themselves.

On the contrary, it is found that the same primitive, is common to many different species, possessing various external forms, and being composed of entirely different chemical consituents.

Obs. The primitive form of *fluor-spar, red oxide of copper, oxide of tin*, and *oxide of iron*, is the octohedron.

§ 17. Notwithstanding the immense variety of external forms, under which crystallized bodies appear, the number of primitive forms, so far as is yet known, amount only to six.

The primitive forms, are as follows:

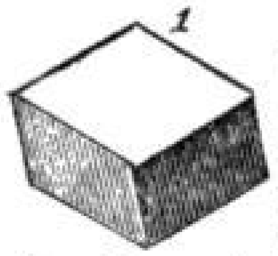


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Fig. 1. The *parallelopiped.*—This form offers a variety of modifications. It includes the *cube*, the *four-sided prism*, and the *rhomb*. When its angles in every direction, are the same, and the size of its planes are alike, it is a cube. When it is elongated, or extended in length, it is the four-sided prism, and when its angles are oblique, it becomes a rhomb. The four-sided prism may be *right*, or *oblique*, a square, or a rhomb. The rhomb may be *acute*, or *obtuse*, as its angles differ from 90°.

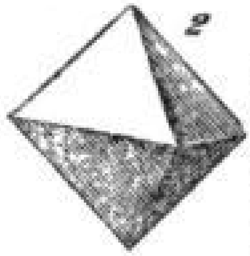

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Fig. 2. The *octohedron.*—This figure, being composed of two similar, four-sided pyramids, joined base to base, is subject to various modifications. Thus the two pyramids, may be depressed, or elongated. The base may be square, or oblique; or the faces of the pyramids, may be scalene, or isosceles triangles.

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Fig. 3. The *regular tetrahedron.*—The faces of this figure, are always similar to each other, the solid being contained under four equilateral triangles. It is not, therefore, subject to any variety of form.

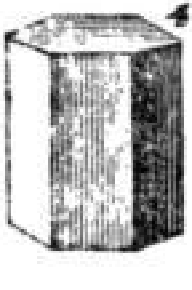

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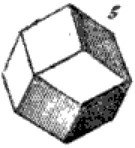
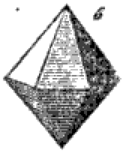
Fig. 4. The *regular hexahedral prism.*—This figure, is contained under eight planes, viz. six lateral ones, surrounding the crystal, and two terminal ones, by which each end is bounded. It is variable, in the proportions between the height of the prism, and the extent of the terminal planes.



5 *Fig*. 5. The *dodecahedron, with rhombic faces*. This figure is contained under twelve equal, and similar rhombic faces, and is, therefore, not subject to variations.



6 *Fig*. 6. The *dodecahedron, with triangular faces*.—This solid, is bounded by twelve triangular planes. It may be considered, as two six-sided pyramids, joined base to base, and is variable in the proportions of its height and breadth.

12. MECHANICAL DIVISION, OR CLEAVAGE.

§ 17. To obtain the primitive form, it is of course, necessary to cleave, or mechanically divide the crystal. Many crystals, it will be found, are composed of layers or slices, lying over, or on each other, with natural joints between them. It is between these natural joints, that mechanical division is effected.

Obs 1. These natural joints, are very obvious in some minerals, as in felspar, galena, and fluor. In others, as quartz, they are not perceptible. By close examination, however, the direction of these joints can be ascertained in most minerals.

2. In some instances, it is necessary to take the advantage of a strong light, by the reflection of which, the face of a natural joint may be found, and the direction of the layers ascertained. It is generally necessary, when the joints are obscure, to fracture the mineral, and then by close inspection, the shining faces of some of the layers will be found, and consequently the direction in which cleavage is to be attempted.

§ 18. The mode of effecting cleavage, depends on the nature of the substance, on which the operation is to be performed.

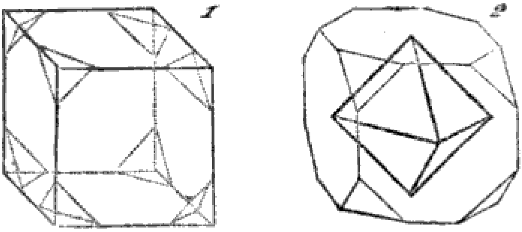
Obs. *Galena* and *blende*, may be held in the hand, and divided by a sharp knife, carefully introduced between the natural joints. Fluor spar, and many varieties of carbonate of lime, require to be laid on a table, and are easily separated by a slight blow on the knife. Oxide of tin, and some other substances, are best cleaved by the pressure of pincers, along the natural joints.

§ 19. When a mineral can be cleaved only in directions, producing a particular form, that form is the *primary crystal*.

Obs. 1. As an example, calcareous spar may be taken. This substance, when all its sides present plane shining faces, showing that it has been separated at the natural joints, is always in the form of an obtuse rhomboid. In some specimens, where the natural connection is not strong, striking with a hammer, answers all the purposes of cleavage, and it will be found on close inspection, that the smallest particles which the eye can distinguish, are still rhombs, of precisely the same shape, with the larger masses.

2. In the present instance, therefore, the primary and secondary forms are the same, or rather the mineral always appears under the primary form.

§ 20. Although in the above instance, the primary and secondary forms are the same, yet in many, if not in a majority of the species, they differ widely, and indeed, often appear to have not the least connection with each other.



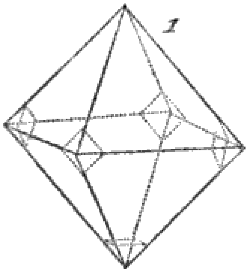
Obs. 1. The common secondary form of fluor-spar, is the cube. The primary form, is the octohedron. To ascertain this fact, and to illustrate the practical part of our subject, take a square crystal of fluor, and with a knife, cleave off each corner, or solid angle. Before we begin this operation, it may be remarked, that the cube is a solid, having six equal sides, and eight solid angles, or corners. By cleaving off each corner, we obtain a new figure, consisting of 14 faces, (fig.1.) viz. eight new triangular planes instead of the corners, and a part of the six original planes of the cube. If we continue the operation, and take off slice after slice, we shall find that every trace of the original cube will disappear, and that we shall obtain eight plane faces, instead of the eight corners of the cube, thus forming the primitive octohedron, in the middle of fig. 2. This operation may be very readily illustrated, with a piece of soft wood, or a potatoe, and a sharp knife

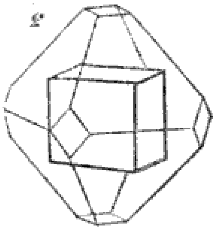
2. After having obtained the octohedron, by cleaving our crystal of fluor, if the same operation be continued, we shall lessen the size of the crystal, but in no wise alter its form, hence this is considered the primitive form of fluor.

§ 21. Having ascertained how the cube may be converted into the octohedron by cleavage, let us now suppose that the cube is the primitive form, and the octohedron one of its secondary modifications, as is the case with sulphuret of lead.

Obs. 1. The octohedron, has eight triangular faces, and six solid angles, or corners.

2. If each corner of this figure be truncated or cleaved off, we shall obtain a figure bounded by 14 faces, as in the former instance, but the new faces will be squares instead of triangles, thus making a figure which approaches the cube, as the triangular faces of the cleaved cube, approached the octohedron.





3. *Fig.* 1. The octohedron with its cleaved angles, as shown by the dotted lines.

4. By pursuing the cleavage, it is obvious by fig. 2, that we shall ultimately obtain the cube, which is enclosed in that figure, and that nothing is wanting for this purpose, but the further truncation of the projecting angles, by which the cube is surrounded.

5. This operation may be readily employed on an octohedral crystal of galena, and a brilliant cube obtained, whose form cannot be altered by further cleavage. This, therefore, is the primary form of galena.

6. These easy examples, are sufficient to give the young mineralogist an idea of what is understood, by primitive, and secondary forms, and also of mechanical division, or cleavage.

13. STRUCTURE.

§ 22. Structure is the consequence, of the particular arrangement of the particles, composing the mineral.

Obs. 1. The figures of all crystalline substances, must be determined by shapes of the integrant particles, of which they are composed, and the arrangement they take in respect to each other. In the secondary forms, we observe, that the shape of the crystal is constantly changing, as it is cleaved in different directions.

2. It is certain, therefore, that nature observes some definite, and invariable laws in their formation, for every crystal of the same substance, no matter where it is from, will be found to yield to cleavage in the same directions, and ultimately to produce exactly the same result. Now this result would be unaccountable, on any other supposition, except that the particles are of the same shape, and that during the process of crystallization, they should take the same arrangement in respect to each other.

§ 23. The slices, or layers, which are removed by the process of cleavage, are called by Hauy, the *laminæ of superposition.* These laminæ, it is supposed, are composed of an infinite number of integrant particles, so arranged, as to produce the particular forms, under which crystals appear.

Obs. It is not understood that the forms of the integrant particles, can be ascertained by any, or all of our senses. They may be considered as infinitely small, when compared with the most minute object of which we have cognizance. By the cleavage of primitive forms, together with certain geometrical calculations, it has, however, been reduced to some degree of certainty, that the forms of the integrant particles, are only five.

These are the *four-sided prism;* the *cube ;* the *tetrahedron ;* the *rhomb ;* and the *triangular prism.*

§ 24. If the forms of the integrant particles, are only five, then a great number of crystals must possess the same integrant forms, though externally, their shapes are widely different.

Obs. 1. To account for the immense variety of external forms, when the forms of the integrant particles are so few, let us remember what an immense number of different geometrical figures could be produced, by changing the position of only a thousand cubical, or triangular blocks of wood.

2. By this illustration, it is true, that the pyramidal terminations, the rhombs, &c. would not present smooth faces, because the angles of our wooden blocks might project ; but had we the power of seeing and feeling the integrant particles, of which crystals are composed, it is not probable that a single mineral with which we are acquanted, would appear smooth.

§ 25. The obvious structure of a mineral, as shown by its fracture, or cleavage, is a character of considerable importance, in descriptive mineralogy.

Obs. 1. It has been stated, (22) that the structure of a mineral depended on the shape, and arrangement of the particles, of which it is formed. What we mean by obvious structure, is such as result in the arrangement of these particles, as to produce characters which we can perceive by the sight or touch. For example, in some minerals, this arrangement is such as to produce *fibres,* in others *laminæ,* in others *grains,* &c. In each of these cases, where this arrangement is constant, it becomes a known characteristic of the mineral, and is employed in describing it.

§ 26. The natural joints of a crystal, and consequently the direction in which it can be mechanically divided, are dependent on its structure.

Obs. Some minerals possess natural joints, in only one direction, others in two, and others in three directions.

§ 27. The following kinds, or varieties of structure, are noticed in the descriptions of minerals.

Obs. 1. *Fibrous structure.* This structure evidently arises from the presence of small elongated crystals. The fracture presents a surface, composed of fibres, or threads, running in various directions. Sometimes, as in *bysolite* and *amianthus*, these threads are so fine, as scarcely to be individually distinguished ; in other cases, as in *actynolite*, they are a line or more broad, and gradually pass into the foliated structure. Sometimes the fibres are so closely arranged, as to make the mineral appear compact, as in *satin-spar* and *tremolite.*

§ 28. In descriptive language, several distinctions are made, in respect to the relative directions in which the fibres are arranged.

Parallel, when they run straight, as in *Tremolite.* *Diverging*, when they shoot off in different directions, as in fibrous *Hornblende.*

Stellated, or Radiated, when they diverge from a common point in all directions, as in *Wavellite, Brown Hæmatite.*

Promiscuous, when they cross each other in all directions, as in compact plumose Antimony. *Fasciculated*, when collected into bundles as in Arroganite.

2. *Foliated structure.* This structure exists in such minerals as present smooth shining faces when cleaved, or fractured. They are composed of layers or leaves closely incumbent on each other, as in *Mica, Talc, Orpiment.*

Laminated or Lamellar, when the layers are not so thin, and easily separable as in the foliated, but still present plane polished surfaces, as in *Felspar, Galena, Cyanite.*

Where the faces exposed by cleavage are extensive, it is called *broad* foliated. The state of the surface is also noticed, as whether the folia are *straight and smooth, curved, undulated, or indeterminate.*

The degrees of perfection in this structure, are perfectly foliated, when the broad shining folia are easily separable, as in *Selenite and Mica.*

Imperfectly foliated, when the surface is undulating, or rough, as in *Argentine, Native Antimony.*

3. *Bladed structure.* This may be considered intermediate between fibrous and foliated. It appears to be the result of imperfect, or compressed crystallization. The crystals are commonly long and narrow, resembling the blade of a knife, as in one variety of *Tremolite.*

4. *Slaty structure.* This is nearly allied to the laminated ; but the layers are thicker and more extensive, and want the shining lustre of the foliated structure. This structure exists in depositions, rather than in crystals. The surfaces may be *undulated, curved*, or *straight*, as in *clay-slate, roof slate*, and some varieties of *indurated clay.*

5. *Granular structure.* This arises from the aggregation of small

particles into grains, which are again united into masses. The fracture of this structure, presents a surface which is uneven and rough to the touch, as in *Coccolite*, *Sandstone*.

6 *Compact structure*. When the grains are so fine as not readily to be distinguished by the eye, it is *compact*, as in *Jasper*, *Carnelian*.

14. FRACTURE.

§ 28. By fracture is understood, the forcible separation of a mineral into parts, without attention to its structure, or natural joints.

Obs. Every mineral can be fractured, whether it is cleavable or not. *Cleavage* separates the specimen at the natural joints, *fracture* forces it asunder in any direction.

§ 29. The faces produced by breaking a mineral, are called *faces of fracture*, and it is found that their faces differ greatly in respect to direction, aspect and smoothness, in the different species, hence for descriptive purposes, fracture is divided into varieties, or kinds.

1. *Conchoidal fracture*. When it appears as though the face of the mineral was scooped out, resembling the inside of a shell. The outer edges of this fracture, and sometimes the whole concavity are waved, being surrounded with small risings and depressions, from the point where the specimen is struck to the diameter. The fracture is said to be *flat*, when the concavity is shallow; *deep* when the depression is great in comparison with its extent. It is also *perfect*, *imperfect*, *large* or *small*. *Flint*, *Carnelian*, and *Semi-Opal*, are good examples of conchoidal fracture.

2 *Splintery fracture*. When the pieces struck off are straight, thin, and nearly flat, in the form of scales, the fracture is called *splintery*. Sometimes the scales, or wedge-shaped pieces, adhere by the thicker ends, to the specimen, and allow light to pass through them, so that we can decide whether it is *coarse*, or *fine* splintery. None but compact minerals have this fracture, as *Quartz*. *Flint*. *Jade*. *Hornstone*.

3. *Even fracture*. This is the kind of fracture that shews the fewest inequalities, the faces being more or less plane and smooth. It passes into flat, conchoidal, and splintery. *Ex. Compact Galena*. *Flint*.

4. *Uneven fracture*. The faces of this kind, display angular elevations and depressions; their size depending on the coarseness or fineness, of the grain of the mineral. Hence the distinctions, *coarse* grained uneven, as in *Granite*, and *fine* grained uneven, as in *Sandstone*.

5. *Earthy fracture*. This is applied to such minerals as shew many small deviations, and depressions, without the angular form. It occurs in opake, dull minerals only, as *Indurated Clay*, *Chalk*, *&c.*

6. *Hackly fracture.* This consists of small inequalities which are sharp and rough to the touch. It is peculiar to the metals, as *Native Copper, Native Iron.*

15. FRANGIBILITY.

§ 30. By this term is meant the resistance which minerals offer to fracture, or the forcible separation of their particles. It has no relation to hardness, or cleavage.

Obs. The distinction will be understood by an example. *Quartz,* is much harder than *hornblende,* or *jade,* and yet a blow that would shiver quartz to atoms, would hardly effect either of the others.

The degrees of frangibility, or toughness, are, *very tough* as in *Native Copper, Jade; tough,* as in *Serpentine, Hornstone; moderately tough,* as in *Flint, Jasper; brittle,* as in *Opal, Fluor Spar; very brittle,*as in *Galena, Tremolite.*

16. SHAPE OF THE FRAGMENTS.

§ 31. If we take specimens of several species of minerals, and give each such a blow with a hammer, as to break, or separate it into parts, it will be found that the fragments differ greatly in respect to shape. Hence the *shape* of the fragments, is sometimes noticed in describing minerals.

Obs. In minerals which are easily separated at their natural joints, a blow with the hammer, has all the effects of cleavage, and the mineral breaks into regular forms. Thus, *Common Salt* separates into cubes. *Rhombic Spar,* into rhombs, and *Asbestus* and *Bituminous wood,* into splinters, &c. But where the mineral has no natural joints, or is not easily separable in any particular direction, the fragments are irregular in their shapes, and their edges only are noticed. Thus, some are *sharp edged,* as *Flint,* and *Obsidium; or blunt edged,* as in *Soap stone,* and *Gypsum.*

17. SURFACE.

§ 32. This character refers to the external surface of the mineral, or the surface of what are called *distinct concretions,* and not to the faces brought to view by fracture.

Of this character, several varieties are mentioned, viz. *smooth,* as in *Heamatite, Stalactite; streaked longitudinally,* as in *Schorl;* or *transversely,* as in *Quartz; drusy,* when the surface is covered with minute crystals, as in *Stalactical Quartz.*

18. TOUCH.

§ 33. There is much difference in respect to the *feeling* of minerals, even in their rough state, and in certain instances, this is an important character.

Obs. The varieties of this character, are as follow. *Unctuous* as *Talc*, *Soapstone;* *smooth*, as *Mica*, *Selinite*, *meagre*, or *dry*, as *Chalk;* *rough*, as *Coccolite;* *harsh*, as *Tremolite*.

19 COLDNESS.

34. Different minerals, with smooth faces, when exposed to the same temperature, convey different degrees of coldness to the touch.

Obs. This difference, obviously depends on the various powers which substances possess of conducting caloric. Thus a metal feels cold because it conducts caloric from the hand, while a piece of wood, having no such power, conveys no such sensation- Compactness, or specific gravity, seems to have more or lees, the same effect among minerals. Jasper, and agate, are evidently colder than limestone, and gypsum. The gems, as topaz, amethyst, ruby, &c. can be instantly distinguished from their imitations in colored glass, by their greater coldness, when touched to the lip, or tongue. Quartz, can be distinguished from paste, in the same way.

20. ODOR.

§ 35. This character applies only to a few species, as most minerals have no smell at all. When, however, it does exist, it is generally a decisive character.

Obs. When a mineral is heated, and emits the *alliaceoas*, or garlic odor, it is a decisive indication of *arsenic*. The odors observed in minerals, are, *fetid*, as in *Swinestone;* *bituminous* as in *Shale*, when it is struck; *argillaceous*, as in *Moistened Clay*, *Chlorite*, *Clay-Slate;* *sulphureous*, as in the *Sulphurets*, when under the blowpipe.

21. TASTE

§ 36. This character is very limited, as it applies only to such minerals as are soluble in water.

Obs. The taste may be *saline* as in *Nitre;* *astringent* as in *Alum*, *Green*, and *Blue Vitriol;* *urinous*, as in *Salamoniac*.

22. ADHESION TO THE TONGUE.

§ 37. This character exists in dry porous minerals, which have a disposition to imbibe moisture.

Obs. In most instances these are argillaceous substances, as *Lithomarge*, *Cimoline*, *Pipe Clay*, Sometimes, also, substances in a decomposing state, adhere, as *Cacholong*, *Hydrophane*,

23. SOIL OR STAIN.

§ 38. Some minerals, when handled, soil the fingers, and when rubbed on paper, leave a trace.

Obs. In a few instances, the trace differs in color, from the apparent color of the mineral, and in this way, may be a distinctive character, as in *Sulphuret of Molybdena.*

24. STREAK.

§ 39. By this character, is meant the streak or powder, which is left on the softer minerals after being scratched with a sharp point, or with a knife. It is applied cliefly to the softer minerals and ores.

Obs. In some minerals, the streak is *similar* in color to the mineral, as in *Chalk, white Marble.* In others it is *dissimilar*, as in dark *Specular Oxide of Iron*, the streak or powder is red; in brown *Roof slate*, it is white. In most instances, the streak is paler than the mineral.

25. HARDNESS.

§ 40. This is an important character, and therefore, is very generally used in descriptions. It is that property in the mineral, by which it resists impressions. It therefore, must be in proportion to the force with which the integrant particles cohere. It differs entirely from *frangibility*, which regards a separation of the grosser particles. Thus, a piece of quartz which is broken with a slight blow from the hammer, will scratch hornblende, which is broken with great difficulty. The hornblende, therefore, has the greatest tenacity, while the quartz has the greatest hardness.

Obs. 1. It is only by comparison, that the degrees of hardness can be ascertained. The common mode, therefore, is to take a few, well known substances, as standards of comparison, and *Quartz* and *Glass*, are most frequently employed for this purpose. Thus *Quartz, Agate, Flint, Chalcedony*, and the other minerals about the hardness quartz, scratch glass. Corundum, sapphire, ruby, hyacinth, and other minerals, scratch quartz; it being understood that such substances as scratch quartz, are not to be compared with glass.

2. Minerals which do not scratch glass generally *yield to the knife*, as *Marble, Fluor, Galena*, and others. It is, however, requisite to distinguish whether they are scratched with *ease*, or with *difficulty*. Thus *Felspar*, which is about as hard as glass, yields to the knife with *difficulty*, while *Marble* yields with *ease*.

3. A still lower degree of hardness, than those compared with the knife, are such as *yield to the nail.* For this purpose, the thumb nail is used. *Gypsum, Talc*, and most of the *Clays*, yield to the nail.

4. *Giving sparks with steel*, is another test of hardness. This, however, is perhaps a less certain mode than either of those mentioned above. The common flint, though less hard than many other bodies, is said to make by far the best gun flints, and to give more copious scintilations than even sapphire.

5. The *file* is also used as a test of hardness, and in polished specimens, where we wish to distinguish real stones from imitations, it is the best instrument. For this purpose, it should be of the finest kind. All imitations are easily marked with it, while stones no harder than quartz, require force to make the least impression.

26. TENACITY.

§ 41. This property belongs to the native, malleable, or ductile metals, and in consequence of it, we are enabled to hammer them into plates, and draw them into wire.

Obs. Native Gold, Silver and Copper, are examples.

27. SECTILITY.

§ 42. A substance is called *sectile*, when it can be cut without flying in pieces.

Gypsum, Talc, Clay, are examples.

28. ELECTRICITY.

§ 43. Several minerals produce electrical phenomena; some of them by friction, others by pressure, and others by heat. Some are electric of themselves; others are conductors of electricity. These phenomena, may be usefully applied as characters of minerals.

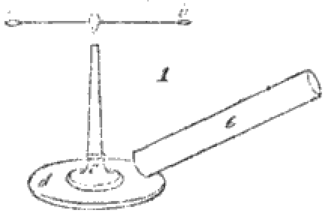
Obs. 1. There are two kinds of elictricity, viz. positive and negative, called also *vitreous* and *resinous*. When two substances possess the same kind of electricity, on being brought together, they repel each other. If one is positive, and the other negative, they attract each other.

2. A considerable number of minerals, become electric by rubbing them on the dry hand, or on a piece of silk, woollen cloth, or fur. A small number become electric by being heated. These are called *pyro-electric*. A curious property, observed in some pyro-electric crystals, is, that they acquire the positive electricity at one end, and the negative at the other, at the same time. In most cases, such crystals terminate in a different number of faces at each end, and it is also a remarkable fact, that the end having the greatest number of faces, is positive. If the terminations are alike, the crystal seldom acquires electricity at all. The substance which best displays these properties, is *Tourmaline*.

3. In most instances, stones and salts, with smooth surfaces, acquire positive electricity by friction. Examples are found in *Quartz*,

Mica, *Sapphire*, *Barytes*, *&c.* If they have rough surfaces, they acquire negative electricity, by the same process.

4. For observing the electricity of minerals, the simple electrometer represented by the figure, is recommended by the Abbe Hauy, and is thus described by Prof. Cleveland.



"In this figure, *a. b.* is a needle of copper, terminated at each extremity, by a small ball, and moving very easily on a pivot in the centre. At *c.* the instrument has a metallic base. If a mineral, which has been excited, either by friction or heat, be presented near to one of the balls, the needle turns, whether it be positive or negative; and the force of the electricity may be estimated by the distance at which the needle begins to move. To determine the kind of electricity a mineral possesses, the needle must previously be electrified, either positively or negatively; which may be done in the following manner. Let the instrument be insulated by placing it on *d.* a plate of glass or resin. Having excited a tube of glass, or a stick of sealing wax, place one finger on the metallic base *c.* of the electrometer, and then bring the excited glass or sealing wax *e.* within a small distance of one of the balls of the needle. When the needle is sufficiently electrified, first withdraw the finger, and then remove the glass, or sealing wax. If now an excited mineral be presented to the needle, they will repel, or attract each other according as they possess the same, or opposite kinds of electricity. But as the electricity of the needle is known, that of the mineral may be determined."—*Cleveland's Mineralogy.*

5. In respect to the production of electrical phenomena by *pressure*, M. Hauy states, that if a thin rhombic plate of carbonate of lime, be insulated, and pressed upon its two broader surfaces, it acquires positive electricity, which sometimes continues for several days. It appears that this property is possessed only by transparent crystallized substances, which can be cleaved into thin laminæ, as *Iceland Spar*, *Mica*, &c.

29. MAGNETISM.

§ 44. The magnetic property belongs to the metals, *iron*, and *nickel* only. As a descriptive character, it is confined here to iron only, and is of great use in distinguishing the ores of this metal, from others.

Obs. 1. The magnetic property is weakened, and in many instances entirely destroyed, by a natural combination of oxygen, sulphur, or arsenic with the iron. Thus several of the *Oxides*, the *Sulphuret*, and the *Arseniate of Iron*, are not magnetic, unless previously heated so strongly as to deprive them of a part of their oxygen, sulphur, or arsenic.

2 In examining the magnetism of minerals, the magnetic needle should turn with great delicacy, and its power be only just sufficient to give it polarity, otherwise it will not be effected by minerals of low attractive powers.

3. Minerals suspected to contain iron, which are not magnetic, must always be subjected to the blowpipe, before the fact can be ascertained. If they are oxides, a little oil, or tallow, on the charcoal with them, will assist to extract the oxygen.

4. Any person, by bending a common knitting needle, so that it may be suspended on the point of a sewing needle, and touching the end of the first with a magnet, can construct an apparatus sufficient for trying the magnetism of minerals.

30. SPECIFIC GRAVITY.

§ 45. Specific gravity, is the weight of one body, compared with that of another body, of equal bulk. The mode of ascertaining the specific gravity of a substance, depends on the form in which it occurs. If it is a solid, heavier than water, it is first weighed in that fluid, and then in the air, and the ratio of difference, is the specific gravity. If it is a fluid, a certain quantity of water is weighed; and then exactly the same quantity of the fluid, whose specific gravity we wish to ascertain, is weighed, and the ratio of difference, is its specific gravity.

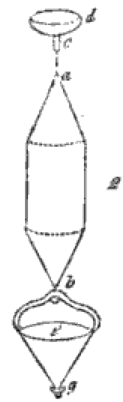
Obs. 1. In the first place, the student must understand that the specific gravity of a body is its weight, when compared with the weight of water, of an equal bulk. Thus, when we say that the diamond has a sp. gr. of 4, we mean that it is 4 times as heavy as a quanity of water, of the same bulk with the diamond.

2. Water, therefore, is the unit, or standard of comparison, and has in this respect, a sp. gr. of 1, 100, or 1000, the decimals being added as far as the case requires. A cubic foot of distilled water, weighs 1000 avoirdupois ounces, if then a cubic foot of silver weighs 9000 ounces, the sp. gr. of silver is 9, that of water being 1.

§ 46 If a body is suspended in water, and weighed, its weight will be diminished. by exactly the weight of a quantity of water equal to its bulk.

Obs. The reason of this is obvious, for if the body was not, bulk, for bulk, heavier than the water, it would not displace the fluid, so as to sink; but if it does sink, its decrease of weight must be just equal to the quantity of water it displaces. Archemides made use of this principle, to discover that Hiero's gold crown, was alloyed with silver.

§ 47. It is on the above principle, that *Nicholsons Portable Balance*, for taking specific gravities is constructed.



Obs. 1. The construction of this instrument, will be understood by reference to the figure. The body, is a hollow cylinder of tinned iron, or varnished copper, terminated at each extremity, *a b* by a cone. From the vertex of the upper cone, rises the small stem of brass or copper, *a*, *c*, bearing on its upper extremity, the small tin cup, *d*. This cup slips on, and may be removed, when the instrument is not in use, or for carriage. From the point of the lower cone, is suspended the tin cup *e*, at the bottom of which is attached the cone of lead *g*, which is so heavy, as to sink the whole instrument, nearly to the upper cone.

2. Before the balance is used, it must be placed in a vessel of water, and the upper cup loaded with weights, until it sinks so far as that a mark near *a*, on the stem, coincides exactly with the surface of the water. The weights so added, are called the *balance weights*, and their amount may be marked on the cup, as a given quantity for future use; suppose this is 900 grains.

3. Every thing being thus prepared, the specific gravity of a mineral is ascertained as follows. Place the mineral in the upper cup, and add weights until the mark on the stem coincides with the water's surface. Suppose this to be 400 grains. Subtract this from the whole balance weight, which will leave 500 grains for the weight of the mineral in the air. Then remove the mineral to the lower cup, and it will be found that the stem will rise above the mark, because it weighs less in water, than in air; weights must therefore be added in the upper cup, until the mark on the stem, is again brought to the surface of the water. Suppose this is 100 grains, which will be exactly the weight of water displaced by the mineral. We then have 500 grains, for the absolute weight of the mineral, and 100, for the absolute weight of the water; then say, as 100, the weight of the water displaced, is to 500, the weight of the mineral, so is 1000, the

standard weight of water, to the specific gravity of the mineral.—100 : 500 : : 1000=5 sp. gravity.

3. If the mineral is lighter than water, it must be tied in the lower cup, with a hair, or fine thread. The mineral solids of this kind, are however, very few. *Amber*, and *Asphaltum*, are both heavier than water.

§ 48. If the substance, whose specific gravity is to be taken, is a fluid, another method is used.

Obs. Take a small bottle, with a thin neck, and weigh it accurately; then put into the bottle, just 1000 grains of pure water, and mark with a file on the neck, the exact level of the water. The bottle thus prepared, will serve to take the specific gravity of any fluid; for having ascertained the exact quantity of water by the mark on the neck, which it takes to weigh 1000 grains, the weight of the same measure of any other fluid, is by comparison, its specific gravity. Thus, suppose, on filling the vial with sulphuric acid up to the mark, that its weight should be 1800 grains, instead of 1000, then, the sp. gr. of sulphuric acid, would be 1.8; water being one. If filled with alcohol, it might weigh 700 grains, then the sp. gr. of alcohol, would be 700, water being 1000.

31. PHOSPHORESCENCE.

§ 49. Phosphorescence, is the emission of light, without apparent heat, or, of an extraordinary quantity of light, by the aid of heat.

Obs. Four kinds of phosphorescence may be mentioned, viz.

1. When the emission of light, unattended by heat, is constant, as from *Putrifying Fish*, and *Decaying Wood.*

2. When it depends on percussion, or friction; as when two pieces of *Quartz* are struck together, or a piece of *Blende* or *Dolomite* is scratched with a sharp point.

3. Where the light is thrown off at a degree of heat, below that of redness, as in *Fluor*, *Spar*, *Chlorophane*, *Argentine*, and many others.

4. Where there is a glowing emission of light, when the substance is heated to redness, as in many varieties of the *Carbonate of Lime.*

Obs. 2. Phosphorescence, although a curious, and often a very interesting property, is of no great use as a descriptive character, because it is not constant, even in those minerals, where it is most freqnently found. Even some varieties of *Fluor*, are said not to phosphoresce.

3. The best way to shew this property, in *Fluor*, *Chlorophane*, *&c.* is to heat a shovel red hot, and carry it into the dark immediately. As the shovel looses its red heat, sprinkle on the mineral, in powder, or small grains.

32. DOUBLE REFRACTION.

§ 50. It is known to almost every one, that when the rays of light pass from one medium into another, of a different density, that they are *refracted*, or bent out of a straight line. In the instance under consideration, the rays of light are not only refracted in the ordinary manner, but are divided into two distinct parts, in their passage through the medium, so as to present double the usual number of images to the eye.

Obs. 1. This extraordinary phenomenon was first discovered by *Erasmus Bartholinus*,* who, having looked through a transparent piece of *Rhombic Carbonate of Lime*, from Iceland, was greatly surprised, to observe that it doubled every object.

2. The ready philosophy of Bartholinus, accounted for this phenomenon, by supposing that the cold of northern climates, so far from weakening, concentrated rays of light, and gave them such additional energy, as to produce two images, instead of one. Thus grounding his explanation, on the presumption, that minerals possessing this property, belonged to cold climates only.

3. Whether this explanation satisfied any one, except the author, is not known; it was however soon found, that climate had no effect on the refractive powers of rhombic spar, but that the images were doubled, from whatever country it came.

§ 51. The cause of double refraction, has excited the attention of philosophers and naturalists, ever since its discovery. Huygens, and Newton, each made a laborious series of experiments on it, without arriving to any satisfactory results, and Hauy, has more recently written twenty pages on the same subject. These facts shew the difficulty of explaining this phenomenon, and that its cause is not to be demonstrated by any simple process.

Obs. 1. To observe double refraction in Iceland spar, draw a line with ink, on paper, and look at it, through any two parallel faces of the crystal. If the crystal be turned, so that its longer diagonal, or acute angles correspond with the line, the greatest refraction will be produced, and the two images will be most distant from each other. If a second piece of spar be laid on the first, so that their positions shall correspond in every respect, the refraction will be increased, or doubled, if both crystals are of the same thickness. If now the upper crystal be made to revolve on the lower one, so as to bring the obtuse angles of the first, with the acute angles of the other, three lines will be observed, instead of two; and if the revolution be continued, so as to completely reverse the angles, and the oblique planes of the crystals, the effect will be, entirely to neutralize the doubly refractive powers of both, and only a single image will be seen.

2. If a crystal be placed so as to make its obtuse angles correspond

* Bartholinus published an account of his experiments on the Iceland crystals, and dedicated his book to Frederick of Prussia.

with the line, only one image will be observed. The axis of double refraction, therefore, is though the shorter diagonal of the crystal.

Many other curious phenomena may be observed with this substance, and particularly, by using a circle, instead of a line.

3. It will be remarked that in the rhomb spar, the double refraction is always through two parallel faces, for notwithstanding the obliquity of contiguous faces, the two opposite planes are always parallel with each other.

4. In making trials on this curious subject, the experimenter, must take care not to deceive himself, by viewing the object through contiguous, inclined faces; in which case, the images would be in proportion to the number of faces. For instance, if a crystal of quartz be placed over a dot, or line, at a certain distance from its pyramidal termination, and the object be viewed perpendicularly through two parallel sides, as is done with Iceland spar, only one image will be seen; but if the crystal be moved, so that the dot is brought within the refracting sphere of its lateral, and terminal planes, six images will be seen, viz. one through each of the three upper lateral planes, and as many through the terminal planes.

This is ordinary refraction, and is common to all transparent substances, when cut and polished with inclined contiguous planes.

§ 52. Besides Iceland spar, there is one other substance which has the property of double refraction, through opposite parallel planes. This is sulphur.

Obs. 1. If a small, perfect crystal of native sulphur, be shaped with a file, or by other means, into the form of a table, or cube, and polished,* it will be found to possess this property, in the same manner that the Iceland spar does, and nearly in as high a degree.

2. If one side of the crystal, be taken off, much more than another, that is, if it be divided through its axis, and an object viewed through the one half, it will be found doubly refractive, through certain parallel faces, but not through others.

3. If the side of a large crystal be employed for this purpose, no doubly refractive effect will be produced, at least the writer has not been able to observe any.

4. But if a crystal be shaped into the form of a cube, by reducing its several diameters equally, so as to approach an imaginary point at its centre, it will then present the phenomenon of double refraction, through any, or all of its parallel planes.

5. These different phenomena, probably depend on the presence, or absence of the primitive form, or a part of it, in the piece of sulphur artificially shaped. In the Iceland spar, no such difference is produced, because the actual form of the piece employed, and its primitive, are the same.

6. Carbonate of Lime and Sulphur, are perhaps the only two substances which are doubly refractive, through two parallel faces. A considerable number of other minerals possess this property, but in a less degree, and through faces, not parallel to each other. Quartz, Zircon,

* This may easily be done, with prepared chalk, or *whiting* on a cotton rag.

Topaz, and Sulphate of Strontian, are doubly refractive, when the object is viewed through certain inclined planes; but in the Topaz, and Strontian, it is necessary to form an artificial face, in addition to the natural ones, in order to observe this property.

§ 53. In quartz, double refraction may be observed by careful attention, through two natural faces.

Obs. 1. Take a transparent crystal between the thumb and finger, and holding it vertically between the eye and the window, place a thin object, as a pin, horizontally, across the lateral plane nearest the window, then view the pin through the plane of the pyramid, which corresponds with the lateral plane, opposite to the one across which the pin is placed Now by watching the pin carefully, and making the crystal revolve on it backwards and forwards, as on an axis, a second image will finally be seen, rising from the first, or approaching it from towards the apex of the crystal, attended with a kind of iridescence.

2. In making this experiment, we must avoid seeing the pin through the contiguous lateral plane, as well as through that of the pyramid, in which case, two perfect images would be observed, but the refraction would be ordinary, and common to all transparent bodies.

3. Quartz, has been selected as an example in this instance, because it is a common mineral, and does not require cutting in order to observe its doubly refractive property.

4. To observe it in Sulphate of Strontian, make an artificial plane, by cutting the crystal transversely through its axis, and perpendicular to its lateral planes. Having nicely polished this new face, hold the crystal in a horizontal position, between the eye and the light, and look at the pin, held across the new face, through one of the terminal planes of the crystal. By turning the crystal backwards and forwards slowly, and carefully, the double image can be discovered.

5. These examples are, perhaps, sufficient for the purposes of this work; but a great proportion of crystallized transparent minerals possess this property, when the object is viewed through certain faces, probably depending on the presence, shape, or position of the primitive form.

33. CRYSTALLIZATION.

§ 54. Every mineral, whose external surface is bounded, by a determinate number of planes, which meet and form determinate angles, is called a crystal.

Obs. 1. For the purpose of describing crystals, it is necessary that definite terms should be employed, and that their application should be accurately understood. In an other place (§ 14) we have seen, what is understood by *primitive forms*. In the present instance it is intended to give such an explanation of the terms employed in describing crystals, as that their meaning and application may be understood.

2. These terms are intended to apply to the actual, or external forms only.

34. FUNDAMENTAL FORMS.

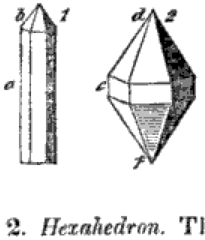
§ 55. By the *fundamental* or *predominant* forms of crystals, is meant the simplest forms under which they are found, or the geomotrical figures which they most appoximate.

Obs. 1. Take, for instance, and form a cube of wood with a knife. It is now a simple form, with six faces, eight solid angles, and twelve edges. Now cut off each of the corners, or solid angles, and we shall have a figure bounded by fourteen faces; but still the *fundamental* form would be the cube, because a part of all the original six sides of that figure remain, and it still approaches nearer the form of a cube, than any other geometrical figure, with which the mind is familiar. The cube therefore would be its fundamental form.

2. Now, it is by no means supposed, that nature works as we do—and first makes the cube, and then truncates its angles; but the same idea of the figure is conveyed to the mind, as though this were actually done, and an idea of it, can in this way be conveyed to others, which answers every object in view.

3. The advantage of this method, it will be seen, is, that by presupposing a figure, whose name conveys a definite shape to the mind, we have something with which to compare the general shape of the crystal. Thus, should an attempt be made to describe a figure, by saying it had fourteen sides, a part of which were triangular, a part square, with a certain number of edges, angles, &c. the description would not only be exceedingly prolix, but could never be well understood. But by describing it as a cube, in the first place, the mind of every one comprehends what figure is meant, and then by striking off the solid angles, we at once gain an idea of the form which we wish to describe, and which nature actually produces. It is to the celebrated *Werner*, that we are indebted for this method of describing crystals.

§ 56. The fundamental forms admitted by Werner, are seven, viz. the *Prism*, *Hexahedron*, *Pyramid*, *Dodecahedron*, *Icosahedron*, *Table*, and *Lens*.



1. *Prism.* This has any number of sides, or lateral faces, from three to twelve, or more. The prism is usually long, and terminated by a pyramid, as in *Quartz*, *fig.* 1. where *a* is the prism, and *b* the pyramid. Or it may be very short, as in *fig.* 2. where *c* is the prism, interposed between the two pymids, *d* and *f*. Crystals of *Quartz*, often occur of this figure.

2. *Hexahedron.* This is a six-sided figure, having six planes, and eight solid angles. It includes the cube, and rhomb, and also the double three-sided pyramid. It is not uncommon. *Carbonate of Lime*, often takes all these forms.

3. *Pyramid.* This, like the prism, has an indeterminate number

of sides, but they converge, and terminate in a point. The pyramid, is often set on a prism; but sometimes two pyramids are joined together, base to base. In fig. 2, a very short prism intervenes between the two pyramids.

4. *Dodecahedron.* This figure has twelve faces, either rhombic, or pentagonal; and twenty solid angles. Good examples are found in *Garnet*, and *Iron Pyrites.*

5. *Icasohedron.* This is a solid, contained under twenty triangular planes, and twelve solid angles; so that each solid angle is formed by the meeting of five planes.

6. *Table.* This is a very short prism. It has two very broad faces, when compared with the others. Thus, in fig. 2, if the two pyramids were deeply truncated, so as to leave the short intervening prism, the remaining figure would be a *six-sided table. Sulphate of Barytes*, and *Mica*, are examples.

7. *Lens.* This figure has two principal curved faces, as in *Lenticular Oxide of Iron.*

33. DESCRIPTION OF CRYSTALS.

§ 57. By the inspection of crystals as they are formed by nature, it will be found, that the above described fundamental forms, exist under a vast variety and number, of modifications. It therefore becomes necessary, that the terms employed to designate the different parts of these solids, with their modifications should be explained, and illustrated.

1. *Lateral Planes,* are the faces, sides, or planes, of prismatic crystals, as *a*, fig. 1.

2. *Terminal Planes,* are the faces, or planes, which form the extremities of prismatic crystals. They are sometimes called the *bases* of the prism, as *b*, fig. 1.

Lateral Edges, are formed by the junction of two lateral planes, or sides of the prism.

4. *Terminal Edges,* are formed by the meeting of lateral and terminaal planes.

5. A *Pyramid,* is formed, when the lateral faces, and edges meet at a point, as *d*, fig. 2.

Obs. 1. If now the pupil will for a moment leave his book, and obtain a piece of soft wood, and a penknife, he can get a better illustration of the above terms, than could be given by diagrams.

2. Form the wood into a square piece, say, two inches long, and half an inch in diameter; then, at one end, form a pyramid, the faces of which, shall correspond with each side of the square; also cut off the other end of the wood, at right angles with its sides.

3. We now have a four-sided prism terminated by a four-sided pyramid, the faces of which, are set on the lateral faces of the prism. The *laterals planes,* are the long and broad sides of the prism,—the *laterel edges,* are the four corners, formed by the meeting of these planes,—the *terminal plane,* is the square base at the end, opposite the pyramid,—the *terminal edges,* are the four edges, formed by the meet-

ing of the terminal, and lateral planes; and the *pyramid*, is formed, by the meeting of the four lateral edges, and planes, at a point.

§ 58. *Truncation.* By this term is meant, that certain edges, or angles of the fundamental form, are cut off; and though, as has been observed, this is not so, yet the appearance of the crystal, and the idea we wish to convey, is the same as though this had actually been the case.

Obs. 1. Truncation, is applied to the edges and solid angles of crystals. It may be so *deep*, as entirely to change their forms, or so *slight*, as only to be observed on close inspection.

2. If we take our four-sided prism, and shave off two of its lateral edges, so as to make two narrow lateral planes, opposite to each other, we shall then have an irregular six-sided prism, with four broad, and two narrow lateral planes. These two edges are now *truncated*, or *replaced* by planes, and we have six lateral edges, two of which are *right angled*, and four *obtuse*.

3. If we truncate the two remaining lateral edges, we shall have an eight-sided prism, with *equal* angles, and *equal* lateral planes.

§ 59. *Bevelment.* This, like truncation, is applied to the edges and angles of the crystal. It consists of a double truncation on the same edge, or angle; the effect of which is to produce two small planes, and three obtuse angles, in place of one edge, or angle.

Obs. Suppose we have a prism of three equal sides, and three equal acute angles, if we *bevel* one of the angles, we produce two new faces instead of the angle, and by continuing the bevelment on all the angles, we change the figure into a prism, of nine sides, because six new sides would be formed, and three would remain as a part of the fundamental prism. *Common Schorl,* is an example of this kind of bevelment.

§ 60. It has already been remarked, (§ 58) that the changes produced on crystalline forms, by truncation, differ according to its degree, or depth. It has also been noticed, (§21 and 22,) that by cleavage, one form may be converted into another, entirely different. Now the passage of one form into another, may be considerted in another light, viz. that it is the effect of truncation.

Obs. 1. Suppose we form of cork or wood, two figures, one a regular octohedron, and the other a cube, each of an inch in diameter. The cube has eight corners, or solid angles. Suppose with a knife, we take off each of these solid angles slightly, it is still a cube with truncated angles. But suppose this operation be continued, until every vestage of the original cube disappears, it will then be found that we have formed a regular octohedron.

2. The octohedron, has six solid angles. Suppose we begin with the octohedron, and take equal segments, in succession from each of these angles, the two opposite faces so formed being parallel, until its original faces disappear, the result will be a perfect cube. (See § 20 & 21.)

§ 61. The same operation, will produce modifications of the fundamental form, in exact imitation of natural forms, in a great variety of other cases.

Obs. 1. Thus if segments be taken from the twelve edges of the octohedron, so as to produce twelve new faces, the *dodecahedron* with twelve rhombic planes, will be the result. If a *cube* be deeply truncated on all its edges, a *pentagonal dodecahedron* will be produced. A four-sided prism truncated on all its lateral edges, becomes an *octohedral* prism, &c.

2. Some minerals, as *Fluor-spar*, and *Iron Pyrites*, occur in the form of the cube, octohedron, and dodecahedron; and crystals are sometimes found, truncated as above described, illustrating their passage from one fundamental form into another.

36. IMPERFECT CRYSTALLIZATION.

§ 62. The process of regular crystallization, obviously requires, that the substance to be crystallized, should be dissolved in some fluid, and that its particles should be permitted to move freely among themselves, so that each one should take its place, agreeably to the laws of attraction. In any other condition, the result of the process is imperfect and confused.

Obs. From the result of the crystalline process, in the great laboratory of nature, it is evident that some disturbing force was felt at the time of formation, nearly throughout the mineral kingdom. In many of the species, therefore, though evidently the result of crystallization, few perfect crystals are to be found. In many instances, one end of the crystal only is perfect; in others, where the perfect fundamental form is the *octohedron*, or *cube*, the actual form in most cases, is indistinct, the crystals interfering with each other, so as to form confused laminated masses.

§ 63. Under the head of imperfect crystallization, may also be considered such forms, as deviate from regular solids, in consequence of the want of angles, or in consequence of an undue extension in length, &c.

Obs. Some of these forms are best described by comparing them with well known objects, as

1. *Cylindrical*, when a long prism is without angles, and round in its form, as *Pinite*.

2. *Dentiform.* Tooth-like, when it is in the form of a cone, the base of which is attached, and the apex is like a canine tooth, as *Wood Tin. Native Silver. Hog's Tooth-spar.*

3. *Acicular*, like a needle, when the crystal is long, and narrow, straight, and minute, as in *Titanium. Hornblende.*

4. *Reticulated*, net-like, when acicular crystals cross each other, so as to resemble net-work, as *Native Silver.*

5. *Capillary*, hair-like, when the crystals are extremely minute, and entangled like a wisp of hair, as *Chromate of Iron. Brown Hæmatite.*

6. *Lenticular*, having two principal convex surfaces, as *Lenticular Iron Ore.*

§ 64. *Grouping of Crystals.* When several crystals are attached to each other, side by side, with distinct summits, they are said to be *grouped*, as *Quartz. Hog's Tooth-spar.*

Obs. A *geode*, is an assemblage of crystals, fixed to a common basis, the form being concave, or hollow. Cavities, studded with crystals, form geodes.

§ 65. *Twin*, or *Hemitrope Crystals.* These crystals appear, as though the two halves of each, had been so applied together, as to invert the one half; or that the one half had moved through half a circle, while the other half stood still. These crystals are also called, *macled.* Instances are seen in *Felspar, Oxide of Tin.*

Obs. In some minerals, the crystals appear to penetrate each other in different directions. In the regular crystals of *Gypsum*, it is not uncommon to see small crystals growing out of, or penetrating the lateral planes, and angles of the larger. Large crystals of *Arragonite*, frequently to appearance, send forth smaller ones in every direction.

§ 66. *Magnitude of Crystals.* The size of crystals vary from two feet in length, to mere points, the forms of which can only be ascertained by the microscope. Werner, therefore, in his descriptive language, defines a number of terms, significant of their magnitude, as *very large*, from six inches to two feet in length; *large*, from six inches to two inches; *small*, from half an inch to the eighth an inch, &c. But the scope allowed to these terms, is too great for any useful purpose, and the medium size in inches, will therefore, convey more definite ideas.

37. ANGLES OF CRYSTALLIZATION.

§ 67. It is a curious fact, that crystals of the same form, and of the same substance, give a constant admeasurement of their angles.

Obs. 1. It is very easy to conceive, that where the form of the crystal is an exact cube, for instance, that every crystal of this form should give the same angular quantity. If, therefore, an hundred crystals of cubical iron pyrites, or of common salt be measured, it would be found that wherever two planes met, it would be under an angle of 90 degrees. But the regularity with which nature works in the formation of crystals, will appear surprising, when it is known, that whatever the regular form may be, the corresponding angles in any number of crystals of the same variety, will always be found the same. As an instance, take a crystal of common quartz, and ascertain the angle, which one face of the pyramid gives with its corresponding lateral plane. It will be found to be 141° 40′. Now apply this angle to the other sides, and pyramidal faces of the same, or of any other crystal of quartz, from whatever part of the world it may come, and it will be found that these planes meet under the same angle.

2. Measure the mutual inclination of any two opposite pyramidal faces of a crystal of quartz. It will be found under an angle of 75° 52′, and this mutual inclination will be found the same, of whatever size the crystal may be, or from whatever part of the world it may come.

§ 68 The angles under which the planes of crystals, differing in composition, meet, has been considered as one of the surest means of distinguishing them, when their general form is the same.

Obs. Several minerals, of entirely different chemical characters, may so resemble each other, both in color and figure, as that the eye can distinguish no difference. This is said sometimes to be the case with specimens of *Carbonate of Iron*, *Bitter-spar*, and *Carbonate of Lime*. But the angles under which the planes of each meet, are said to be the means of distinguishing them at once. Thus if the planes of one of them meet at the angles of 105° 5′, and 74° 55′, it is *Carbonate of Lime*; if the second measures 106° 15′, and 73° 45′, it is *Bitter-spar*; the third measuring 107° and 73°, is *Carbonate of Iron*.

§ 69. Notwithstanding the exact symmetrical forms which nature has impressed on the crystals of the same variety, the difficulty of obtaining the same results, in taking their angles, will probably prevent this mode of distinction from being certain, or extensively adopted.

Obs. 1. This mode of distinction presupposes that we possess a perfect crystal of the substance, and that it is so situated that its angles can be taken. Now in some of the species, though clearly the result of crystallization, a perfect crystal is rarely to be found, and consequently can only be in possession of a few individuals. In such cases, other means must therefore, of necessity be generally adopted, to distinguish the species.

2. In such of the species as commonly occur in the form of perfect crystals, it is not an easy thing for an ordinary mineralogist to measure their angles with such accuracy, as to determine their composition, where this depends on minutes and seconds.

3. The best authorities differ so much in this respect, as to show that with the most skilful management, the Goniometer in different hands is not to be depended on, even to degrees, and much less to the hundreth parts of degrees.

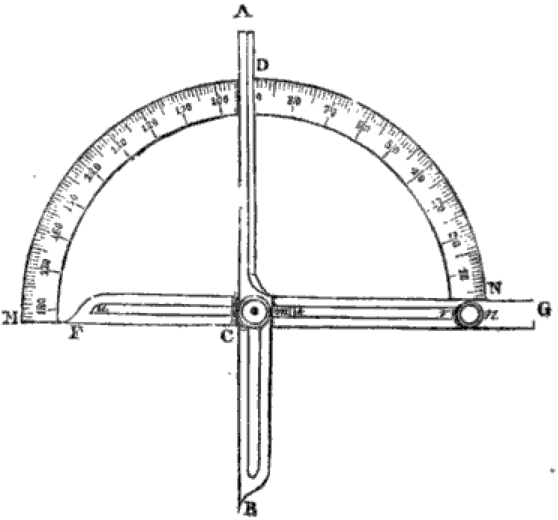
4. *Hauy*, for instance, makes the planes of *Rhombic Carbonate of Lime*, to meet alternately under angles of 104° 29′ and 75° 31′. *Phillips* makes the same planes meet at angles of 105° 5′ and 74° 55′. Hauy, the primitive rhomboid of *Quartz*, 94° 4′ and 85° 56′. *Phillips* 94° 15′ and 85° 45′. Hauy, the primitive rhomboid of *Specular Iron* 87° and 93°. *Phillips* 86° 10′ and 93° 50′. I might proceed to fill page after page, with such differences; indeed these authors very rarely agree exactly in the quantity of any angle, and Mohs often disagrees with both.

5. In the above example, (§ 68) where it is proposed to distinguish *Rhomb Spar*, *Bitter Spar*, and *Carbonate of Iron*, by means of the Goniometer, as well as in every other instance, where there is but little difference in the quantity of the angle, this must, it is thought be acknowledged, at best, but a very fallacious mode of distinction.

6. These considerations have induced the author of the following treatise to omit the *Geometrical Characters* in the descriptions, as being, at least to the learner, both uncertain and perplexing. These characters have therefore been thrown together in the tabular form.

38. GONIOMETER.

§ 70. The Goniometer, or angle measurer, is an instrument invented by M. Carangeau, for the purpose of taking the angles of crystals. It has lately been called the *Common Goniometer*, to distinguish it from a more recent invention of Dr. Wollaston's, which is called the *Reflective Goniometer*.



Obs. 1. The Common Goniometer, consists of a brass, or silver semicircle, N, D, M, graduated into 180 degrees, each degree being marked on the instrument, by a short line extending from the outer rim, to the circle, which is about the 20th of an inch within it: A, B, F, G, are two steel or brass arms, connected at *m*, with a thumb screw, so that they can be screwed tighter together when occasion requires. This screw goes into a small steel nut, on the under side of the arms, which enters the bar, connecting the two ends of the semicircle, and is the pivot on which the arms turn. In each arm there is a slit through which the pivot passes, so that they can be drawn back, the effect of which is to move the centre of motion near the ends of the arms. *r*, *n*, is a short pin passing through a slit, and on which it can be moved backwards and forwards.

2 The arm A, as it now stands cuts the semicircle at 90 degrees; if then an exact cube were presented to the portion of the arms below the bar, it would just fit them, as the planes of a cube always meet at an angle of 90 degrees. But if the angle should be greater, or less than 90°, it is obvious that its quantity can be ascertained by moving the bar backwards or forwards on the semicircle, where the degrees are marked.

3 The most convenient mode of using this Goniometer, is to take off the arms, and for a small crystal draw them back, so as to bring the centre of motion, near the points B and F, and for larger ones, let them remain as in the figure. Then tighten the screw, so that the arms need not move, and loose the true angle. After having applied them to the crystal, put the under one carefully in its place, as in the figure, and the right side of the other arm will give the angle required.

4. "It must be obvious that the use of this instrument depends on its precise adjustment to the planes of the crystal to be measured. In doing this, it will be found of advantage that the common pocket lens should be supported at a convenient height above the table, so that both elbows may rest upon it, while taking the angle; the glass being a little above the height of the wrist, when the hands are elevated. For this purpose, a card rolled up and stuck by one end into the nozle of a candlestick, and the handle of the glass placed in the hollow of the card will be found useful; for the glass will be nearly on a level with the eye. If then the crystal be placed behind it in the focus, the adaptation of the goniometer, will be observed with advantage; and *unless the light be excluded from between the instrument and the crystal*, the adaptation will not be complete. If this cannot be accomplished, it may be concluded that the crystal, how perfect soever its planes may appear, is not sufficiently regular to be relied on, if perfect accuracy is desirable."—*Phillips.*

5. The reflective Goniometer, is considered a more accurate instrument than the one above described. It determines the quantity of the angle by the rays of light, reflected from the polished faces of the crystal, and therefore will only answer for such minerals as possess reflecting surfaces. The machinery and its use, is much more complex than in the common Goniometer.

39. CHEMICAL CHARACTERS:

Remark. Having enumerated such of the characters of minerals, as can be ascertained by the senses, without destroying their structure, and which are properly called, *external*, or *physical;* we now come to another set of characters, which are called *chemical*, because heat and acids are the agents by which they are ascertained.

§ 71. By chemical characters, it is not understood that all such, as could be developed by chemical agents will be enumerated, or that the process of analysis will be described. On the contrary, a few simple experiments, chiefly with the *blowpipe* and *acids* are all that will be found necessary, to ascertain the most obvious chemical characters of minerals.

§ 72. *Blowpipe.* This is a simple instrument, consisting of a slightly conical tube of brass, 8, or 12 inches long, curved at the small end, and terminating in an orifice of the size of a pin. Sometimes they are made in several parts, so that they can be taken in pieces, for the convenience of carriage. This instrument is used by taking the large end in the mouth, placing the small end in the flame of a candle, and directing the flame by gently blowing on the mineral, which is placed on a charcoal support.

Obs. The following observations for the use of the blowpipe are from *Aikin*.

1. " Few persons are able at first to produce a continued stream of air through the blowpipe, and the attempt often occasions a great deal of fatigue ; I shall make no apology therefore, for treating this matter somewhat in detail. The first thing to be done is to acquire the habit of breathing easily and without fatigue, through the nostrils alone ; then to do the same while the mouth is filled and the cheeks inflated with air, the tongue being at the same time slightly raised to the roof of the mouth, in order to obstruct the communication between the mouth and throat. When this has been acquired, the blowpipe may be put into the mouth and the confined air expelled through the pipe by means of the muscles of the cheeks : as soon as the air is nearly exhausted, the respiration from the lungs instead of being made through the nostrils, is to be forced into the cavity of the mouth ; the communication is then instantly to be shut again by the tongue, and the remainder of the respiration is to be expelled through the nostrils. The second and all subsequent supplies of air to the blowpipe, are to be introduced in the same manner as the first : thus with a little practice, the power may be obtained of keeping up a continued blast, for a quarter of an hour, or longer, without inconvenience.

2. " Much depends on the size of the external aperture of the blowpipe. If so large that the mouth requires frequent replenishing, the flame will be wavering, and the operator will soon be out of breath : if on the other hand the aperture be too small, the muscles of the cheeks must be strongly contracted, in order to produce a sufficient current, and pain, and great fatigue of the part, will soon be the consequence. An aperture about the size of the smallest pin-hole, will generally be found the most convenient, though for particular purposes, one somewhat larger, or a little smaller may be required.

3. " The fuel for this little reverberatory furnace (as the blowpipe apparatus may without impropriety be denominated) is oil, tallow, or wax, kept in combustion by means of a wick : the oil is the worst, the tallow is better, and the wax is the best, not only as being the cleanest, and free from any offensive smell, but also as affording the greatest heat. The management of the wick, too, is a matter of some nicety : it should neither be too high, nor snuffed too low, and should be a little bent at its summit *from* the blast of the pipe. All casual currents and drafts of wind, ought to be carefully avoided, as rendering the flame unsteady, and very materially impairing its strength.

4. " The above conditions being complied with, the flame while acted on by the pipe, will evidently consist of two parts, an outer and inner : the latter will be of a light blue color, converging to a point at the distance of about an inch from the nozle, the outer will be of a yellowish white color, and will converge less perfectly. The most intense heat, is just at the point of the inner blue flame.

5. "The supports of the various substances while undergoing the action of the blowpipe, come next to be considered. Of supports, there are two kinds, *Combustible*, and *Incombustible*. The comb tible supports, (used chiefly for metallic ores,) is Charc "

closest grained, and soundest pieces are to be selected for this purpose, and even the best often split, and become rifty after being used for a short time. [If pieces of birch, or maple coal, burned in a coal pit, be selected, they will not be liable to this accident.]

6. "The incombustible supports, are ***Metal, Glass***, and ***Earth;*** in the use of all which, one general caution may be given: to make them as little bulky as possible. The support, [charcoal excepted,] always abstracts more or less, of the heat, and in many cases, especially where metallic spoons are employed, entirely prevents the flame from producing its due effect. The best metallic support is Platina, because it is infusible, and transmits heat to a less distance, and more slowly than other metals. A pair of slender forceps of brass, pointed with platina, is the best possible support for non-metallic minerals, that are not very fusible: for the fusible earthy minerals, and for the infusible ones when fluxes are used, leaf platina will be found the most convenient; it may be folded like paper, into any desirable form, and the result of the experiment may be obtained, simply by unfolding the leaf in which it was wrapped up. [Where a flux is used that does not spread, I have always found the solid birch, or maple charcoal, the very best support. When potash is used, which spreads on charcoal, the platina foil may be employed.] With regard to the magnitude of the specimens required for examination, no very precise directions can be given: the most fusible, such as some of the metallic ores, (galena), may be as large as a small pea, while the most refractory of the earthy minerals, should scarcely exceed the bulk of a pin's head."

7. On first application of the heat, the outer flame only should be thrown on the mineral, as some will *decrepitate*, or split in pieces, with a stronger heat. The changes also, which some minerals undergo by heat, are best observed when their temperature is raised slowly.

8. In the metallic ores, *fluxes* are used, and it is often the case, that the best test of the pressure of certain metals, is the color which they give the flux.

9. One of the most common as well as convenient fluxes, is glass of borax, or borax deprived of its water of crystallization, by previously heating it. This will neither spread on the charcoal, nor sink into it, but always takes the form of a round globule. For this purpose, the borax, as well as the mineral, ought to be in the state of powder, and made into a little ball with a drop of water. When it is desired to reduce the mineral to its metallic state, charcoal is the proper support: but where we wish to obtain a colored glass, platina leaf is the best; a good piece of charcoal will, however, answer for both. Sometimes *nitrous* borax, is employed as a flux. It is made by dissolving borax in hot water, and adding nitrous acid, to neutralize the excess of alkali.

40. ACTION OF ACIDS.

73. Although complete analysis. be not the object in subjecting minerals to the action of acids, yet we may

thereby obtain characteristic information in regard to many minerals, especially the acidiferous, and some of the alkalino-earthy minerals.

Obs. " In this process, it will often suffice, that a small fragment of the mineral, or portion of it reduced to powder, should be placed in a concave receiver, a watch glass, for instance, and that it should be covered with diluted acid ; for this purpose, the muriatic is commonly used, but the nitric, or sulphuric is sometimes employed. When the effervescence ensues, it is important to notice the rapidity of effervescence ; in some minerals, it is great and rapid, in others, slow, and not very apparent ; sometimes the solution is complete ; sometimes a residue is left, and occasionally, as in some of the alkalino-earthy substances, the solution becomes gelatinous. In most cases, the process is carried on at the common temperature, in others, by the application of a gentle heat.

Hence, it will be concluded that in more than a few instances, the consequences of the action of acids, form an important feature among the characters of minerals."—*Phillips.*

EXPLANATION OF TERMS, &c.

Commonly used in Mineralogical Descriptions.

Acicular. Long, slender, and straight prisms, or crystals, are termed acicular, from the latin, acicula, a little needle.

Acute rhomboid. See Rhomboid.

Acute octohedron. See Octohedron.

Aggregated. A mineral rock is said to be aggregated, when the several component parts only adhere together, and may be separated by mechanical means: the felspar, quartz, and mica, constituting granite, may be separated mechanically. Granite is an aggregated rock.

Alliaceous. The odour given out by arsenical minerals, when exposed to the blow-pipe or struck by the hammer, resembles that of garlic, in latin, allium; whence alliaceous.

Alloy. A natural combination of two or more metals in the metallic state.

Amalgam. A natural combination of two metals, of which mercury is one.

Amorphous. Without form; of undefinable shape; from the Greek, (amorphos) having that signification. Amorphous minerals are sometimes described as being of indeterminate, or indefinite forms.

Anhydrous, from the Greek, (anudros), signifying without water; anhydrous gypsum is without water.

Arborescent. From the Latin, arboresco, to grow like a tree; see Dendritic.

Arseniate. A term applied to a mineral consisting of the *arsenic acid* united with a base, as of copper in the arseniate of copper.

Base. A term denoting the substance to which an acid is united; in the arseniate of copper, the copper is the base.

Bevelled, see p. xlii.

Borate. A mineral in which the boracic acid is combined with a base, as of magnesia, in the borate of magnesia.

Botryoidal. From the Greek, (botruodes) signifying, hung with clusters of grapes or berries. So a mineral presenting an aggregation of large sections of numerous small globes, is termed botryoidal; but when the globes are larger, and the portions are less, and separate, the appearance is expressed by the term mamillated. These forms may be observed in certain ores of cobalt, copper, and manganese, and often in chalcedony.

Bladed. This term relates chiefly to the structure of such minerals as, on being broken, present long flat portions longitudinally aggregated, and somewhat resembling the blade of a knife; this appearance may in general be considered as the effect of interrupted crystillization.

Brittle. This character of mineral bodies does not depend upon their hardness; those of which the particles cohere in the highest degree, and are immoveable one among another, are the most brittle. The diamond, quartz, sulphate of barytes and sulphur, vary greatly as to hardness; they are all brittle, the first only in particular directions.

Canaliculated; presenting deep channels on the surface, resulting either from interrupted crystallization, or the aggregation of numerous crystals.

Capillary, is derived from the Latin, capillus, a hair, and is chiefly used to express the long, tortuous, hair-like appearances, to be observed in native gold, and silver, and some other minerals. Crystals are sometimes termed capillary, when long and slender; but when straight, they are more properly designated by the term acicular.

Carbon, see p. cclxxxi.

Carbonate. A mineral in which the carbonic acid is combined with a base, as of lime, in the carbonate of lime.

Cavernous. A mineral in which there are considerable hollows or cavities, is said to be cavernous.

Cellular. This term was used by Werner in the description of such minerals as exhibit cells formed by the crossing and intersecting of the laminæ or lamellæ of which they are constituted: commonly, any mineral presenting numerous small cells or cavities, is termed cellular: see vesicular.

Chatoyant, has been adopted from the French, who use it to express the changeable light resembling that to be observed in the eye of a cat, to be seen in certain minerals; as in the Cat's-eye.

Chromate; a mineral in which the chromic acid is united with a base, as of lead, in the chromate of lead.

Cleavage. This term is most commonly used in relation to the fracture of those minerals which, having natural joints, possess a regular structure, and may be cleaved into more or less geometrical fragments; as, into varieties of the parallelopiped, the rhomboid, &c.

Coherent. In minerals that are brittle, the particles are strongly coherent; in such as are friable, they are slightly coherent.

Columnar distinct concretions; a term used to express the great and small columns in which certain basalts and iron ores are found: but Werner included under this term all the columnar appearances in every mineral consisting of numerous aggregated crystals, which readily divide into long and narrow portions of irregular form, owing to interrupted crystillization—such as the amethyst, pyrites, fluor spar, quartz, &c.

Combustion. During the burning of a combustible, in common cases, oxygen unites with it, or with some of its ingredients: and the product of the combustion is either an oxide, an acid, or an alkali.

Compact. A mineral is compact when no particular or distinct parts are discernible; a compact mineral cannot be cleaved or divided into regular or parallel portions. The term compact is too often confounded with the term massive.

Concentric lamellar. This may be said to relate to structure, being used in the description of such minerals, as, being of a spherical form, or of any portion of a sphere, have received successive coatings of depositions. If an onion be cut in two, it exhibits the concentric lamellar in perfection.

Conchoidal, relates only to fracture; and is doubtless derived from the Latin, conchoides, signifying like the shell of a fish. Fragments of many of the brittle minerals exhibit this appearance, and occasionally in great perfection, as quartz and sulphur: the fracture of compact minerals is frequently more or less perfectly conchoidal.

Concretion, generally signifies a small and distinct mass.

Coralloidal, resembling branches of coral.

Cuneiform, wedge-shaped; cuneus, in Latin, signifies a wedge.

Cuneiform octohedron. See octohedron.

Decomposed. This term, when used strictly in a mineralogical sense, imports the consequence of the chemical action which takes place naturally in some minerals. Certain ores of iron, &c. in which sulphur predominates in an unusual degree, decompose by exposure to air.

Decrepitate. A mineral is said to decrepitate on exposure to heat, when it flies with a crackling noise similar to that made by salt when thrown into the fire.

Dentritic; derived from the Greek, (dentritis) signifying like the growth of a tree. The terms arborescent and dentritic are used synonimously: they are alike applied to the tree-like appearance in which native silver and native copper are sometimes found; to the delineations seen on the surfaces of certain minerals; and to the appearance in the mocha-stone, &c.

Dentiform or *Dentated;* in the shape of teeth; dens being the Latin for a tooth,

Disseminated. When a mineral, whether crystallized or otherwise, is found here and there imbedded in a mass of another substance, it is said to be disseminted in the mass. Crystals of quartz sometimes occur, disseminated in Carrara marble, &c.

Disintegrated. This term is generally used to express the falling to pieces of any mineral, without any perceptible chemical action.

Diverging or *divergent.* When the structure is fibrous, and the fibres are not parallel, they usually diverge in part, but not wholly, around a common centre; as in certain zeolites, and hæmatitic iron ores. The crystals of some substances assume a diverging position.

Drusy, has been adopted from the German term drusen, for which we have no English word. The surface of a mineral is said to be drusy when composed of very small prominent crystals nearly equal to each other; it is often seen in iron pyrites.

Efflorescence. An efflorescence is the consequence of chemical action; it is usually applied to such minerals as are found in extremely minute fibres on old walls, &c. &c.

Elastic. A mineral which, after being bent, springs back to its original form, is elastic. Mica is elastic; talc, which greatly resembles mica, is only flexible.

Earthy. This term relates to fracture, and to texture. Chalk and certain of the ores of iron and lead are notable instances of the earthy fracture or texture.

Fasciculated. When a number of minute fibres or acicular crystals occur in small aggregations or bundles, they are said to be fasciculated; a term doubtless derived from the Latin, fasciculus a little bundle. This appearance often occurs in green carbonate, and arseniate of copper.

Fibrous. This term relates both to form and structure. Certain minerals, as amianthus, amianthiform arseniate of copper, a variety of gypsum, &c. occur in distinct fibres. Asbestus, gypsum, red hæmatitic iron ore, &c are found massive, and of a parallel fibrous structure; some varieties of red hæmatite and other minerals are of a radiating fibrous structure, when the fibres diverge from a common centre.

Filament. A mineral is said to occur in filaments, when it is found in slender, thread-like or hair-like portions. It is therefore nearly synonimous with the term capillary.

Filliform, is used in the same sense as the preceding; but Werner confined its use to express the appearance of certain metals which occur in the form of wire, as native silver and native copper. Filum in Latin, signifies thread; filum metalli, wire.

Fistuliform. Minerals occurring in round hollow columns, are termed fistuliform; fistula, in Latin, signifies a pipe. Stalactites and iron pyrites occur fistuliform.

Flexible. Talc is flexible; it readily bends, but does not return to its original form. Mica is both flexible and elastic.

Fluate. This term designates a mineral in which the fluoric acid is combined with a base, as with lime, in the fluate of lime.

Foliated. This term, which doubtless is derived from the Latin foliatus, having, or consisting of leaves, is used by Werner to express the structure of all minerals that may be divided or cleaved regularly, and are therefore by him said to consist of folia or leaves. The structure of such minerals is more commonly and better expressed by the term lamellar; and they are said to consist of laminæ.

Fracture, is a term now chiefly employed in designating the appearance of minerals which have no regular structure, when they are broken; such minerals present an earthy, even, uneven, or a conchoidal fracture, &c.

Frangible. The term frangibility has relation to the susceptibility of minerals to separate into fragments by force : this quality in minerals is not dependent on their hardness ; the structure of some and the brittleness of others, renders them easily frangible; while others, which from their softness, and the ease with which their particles or molecules yield or slide over one another, are with much more difficulty frangible ; such minerals possess the character of toughness. Quartz is easily broken, asbestus is tough.

Friable. A mineral whose portions or particles slightly cohere, and which is therefore easily crumbled or broken down, is said to be friable, or in a friable state.

Fungiform. Certain substances, as for instance calcareous stalactites, are occasionally met with having a termination similar to the head of a fungus ; whence they are said to be fungiform.

Gangue, Gangart. We have these terms from the Germans ; the gangue of a mineral, is the substance, in, or upon which, a mineral is found : it is sometimes termed the matrix. Silver, occurring in, or upon carbonate of lime, is said to have carbonate of lime for its gangue matrix.

Geode. This also we derive from the Germans. A geode is a hollow ball ; at Oberstein, in Saxony, are found hollow balls of agate lined with crystals of quartz or amethyst, which are termed geodes.

Glance is also a German wood, meaning shining ; thus, the followers of that school use the terms glance-coal, copper-glance, &c.

Globular distinct concretion is used to designate the form of any mineral which occurs in little round or roundish masses ; the peastone and roe-stone are examples of it.

Granular. The structure of a mineral is said to be granular, when it appears to consist of small grains or concretions, which sometimes can, sometimes cannot, be discerned without the help of a glass ; we have therefore the fine granular, and the coarse granular structure.

Greasy is used in relation to lustre ; fat quartz has a greasy lustre.

Hackly. This term relates to a fracture which is peculiar to the malleable metals ; which, when fractured, present sharp protruding points.

Hæmatite is derived from a Greek word, signifying blood-red ; it was first applied by mineralogists to the variety of iron ore which now is called the Red Hæmatite ; but has since been extended to other iron ores of the same structure, but differing in color. We have also brown hæmatites, and black hæmatites.

Hepatic. A term derived from the Latin, hepar, the liver ; it is applied either to color or form. We have hepatic pyrites, hepatic quicksilver ; hepatite, &c.

Hydrate is derived from the Greek, (udor) water ; and is applied to certain of those minerals (as the hydrate of magnesia) of which water forms an ingredient in very large proportion.

Imbedded. A mineral found in a mass of another substance, is said to be imbedded in it. Crystallized quartz occurs imbedded in Carrara marble. It also occurs partly imbedded in other substances, as in fluor.

Indeterminate. Indefinite. These terms are used synonymously with Amorphous in describing minerals which have no particular, or definable form. Crystals of which the form cannot be accurately ascertained, are said to be of indeterminate forms.

Incrusting : any substance covered by a mineral, is sometimes said to be incrusted by it : thus the various articles which are placed for a certain length of time in certain springs or wells in Derbyshire, &c. and which are by some supposed to be converted into petrifactions, are only incrusted with calcareous, or argillaceous matter.

Interlacing. Interlaced. When fibres or crystals of a mineral are found intermingling with each other in various directions, they are said to be interlacing or interlaced.

Investing. A mineral coating, or covering another, is sometimes described as investing it.

Iridescent. This term relates only to the color with which the surfaces of some minerals are naturally tarnished : as yellow copper ore, iron pyrites, galena, sulphuret of antimony, &c.

Irised. A mineral is described as irised which exhibits the prismatic colors either externally, or internally : the latter is generally the consequence of some injury sustained by the mineral.

Lamellæ. If a mineral be found in very minute, thin plates, it is said to occur in lamellæ.

Lamellar ; this term relates to structure : when a mineral can be fractured or cleaved into regular and parallel plates its structure is said to be lamellar ; and the portions thus obtained are termed laminæ or lamellæ ; these terms have been adopted from the Latin, in which they were almost synonimously used to express thin plates of any substance.

Lamellar distinct concretions. This term is sometimes used to express the form of certain minerals (as the oxide of uranium) consisting of separate tabular crystals.

Lamelliform. A minearl consisting of lamellæ, is said to be lamelliform.

Laminæ. See *Lamellar.*

Lenticular is employed to express the form of certain crystals which are nearly flat, and convex above and beneath ; and which consequently resemble a common lens.

Malleability. Some of the metals suffer extension when beaten with a hammer ; and are therefore termed malleable metals. Native gold and native silver are very malleable metals.

Mamillated. See *Botryoidal.*

Massive. This term is sometimes used in describing a substance of indeterminate form, whatever may be its internal structure; but is more commonly applied to those minerals which possess regular internal structure, without any particular external form.

Matrix. See *Gangue.*

Meagre. This term relates to the touch or feel of a mineral. It belongs chiefly to some of those minerals which are of an earthy texture. Chalk is remarkably meagre to the touch.

Mechanical division, see p. 23.

Molybdate; a mineral in which the molybdic acid is combined with a base, as with oxide of lead in the molybdate of lead.

Muriate; a mineral in which the muriatic acid is combined with a base, as with soda, in the muriate of soda.

Natural joints. Such minerals as can be broken into regular forms, as the cube, rhomboid, &c. can be cleaved into those forms, only in the direction of, or along, their natural joints. In some minerals, however, the natural joints are perceptible by the assistance of a strong light.

Nacreous relates to lustre; and is employed to express the lustre of some minerals (as of pearl spar) which greatly resembles that of pearl. Nacre de Perle, in French, signifies Mother of Pearl.

Nitrate. A mineral in which the nitric acid is combined with a base, as with potash, in the nitrate of potash.

Nodular. A mineral which presents irregularly globular elevations, is termed Nodular. Flint is found in nodular masses.

Oblique prism, see Prism.

Obtuse octohedron, see Octohedron.

Obtuse rhomboid, see Rhomboid.

Octohedron. Octohedrons are of several kinds. An octohedron is sometimes described as two four-sided pyramids, *base to base.* In the *regular* octohedron, the three sides of each plane are of the same length. In the *obtuse* octohedron, the base is longer than the two sides. In the *acute* octohedron, the base is shorter than the two sides. In some obtuse and acute octohedrons, the base is square, in others, rectangular, but not square. In the *rhomboidal* octohedron, the common base is a rhomb or rhombic; and the three sides of each plane are of different lengths. In the *cuneiform* octohedron, the common base of the pyramids is not square, and the planes are not all equal, but resemble each other two and two, on opposite sides of the pyramid.

Opake. Those minerals are opake which do not transmit a perceptible ray of light even through the thinnest and smallest pieces.

Oxide. This term is used mineralogically to designate metallic minerals, in which the metal is combined with any proportion of oxygen, which is less than suffices to convert it into an acid. Iron is found in different states of oxidation. Every metal which is found united with an acid, is, when so combined, in the state of an oxide: but when united with sulphur, the metals are not in the state of oxides, but in the metallic state.

Parallelopiped, see p. 22.

Pass into. One mineral is said to pass into another, when both are found so blended in the same specimen, that it is impossible to decide where the one terminates, and the other begins. Flint is found passing into chalcedony.

Pectinated. If a mineral exhibit short filaments, crystals, or branches which are nearly parallel and equidistant, it is pectinated: pecten, in Latin, signifies a comb.

Peroxide, when a metal has the largest quantity of oxygen.

Porous. A mineral is said to be porous, when it is traversed in different directions with communicating holes which pass through the substance.

Primary crystal, see p. 22.

Protoxide, when a metal has the smallest quantity of oxygen.

Phosphate. A mineral in which the phosphoric acid is combined with a base, as with lime, in the phosphate of lime.

Prism. Prisms have four or more sides surrounding the *axis*: they are sometimes terminated by a *single plane*, and when this plane is at right angles to the axis, we have a *right prism*; but if the terminating plane be not at right angles to the axis, we have an *oblique prism*. If the sides of a quadrangular prism, are at right angles with each other, we have a *rectangular* prism, and if the sides be of equal width, a *square prism*, and its height is either greater or less than that of the cube.

Pseudomorphous. Minerals exhibiting impressions of the forms peculiar to the crystals of other substances are said to be pseudomorphous. Quartz exhibiting crystals in the form of the cube; calamine, such as are peculiar to carbonate of lime, &c. are termed pseudomorphous: From two Greek words, signifying false form, or figure.

Pulverulent. When the particles of a mineral are very minute and cohere very slightly, or not at all, it is said to be pulverulent; or in the pulverulent state.

Radiated; radiatus, in Latin, signifies beset with rays; when the crystals of a mineral are so disposed as to diverge from a centre, they are said to be radiated.

Ramose; ramus, in Latin, signifies the branch of a tree; a mineral having that appearance is described as being ramose.

Rectangular prism, see Prism.

Refractory. The term is used both chemically and mechanically in relation to minerals. It is sometimes applied to those which strongly resist the application of heat; and occasionally to some whose toughness enables them to resist repeated blows.

Reniform. Kidney-shaped; ren, in Latin, signifies kidney.

Replacement, see p. 33.

Retiform, Reticulated. Minerals occurring in parallel fibres, crossed at right angles by other fibres which also are parallel, exhibit squares, like the meshes of a net. Retis, in Latin, signifies a net. We have reticulated native silver, native copper, red oxide of copper, &c. And it may be remarked that such minerals as occur reticulated, generally assume the cube, as one of their crystalline forms.

Rhomboidal octohedron, see Octohedron.

Right Prism, see Prism.

Rhomboid. Rhomboids are of two kinds; obtuse and acute. In each there are two points that may be termed the apices. The planes of the obtuse rhomboid meet at each apex, under one obtuse and two acute angles: while three planes of the acute rhomboid, meet at the apex under acute angles.

Schistose structure. Minerals which split only in one direction, and present fragments which are parallel, but of unequal thickness, which also are not smooth and even, and are without lustre, are said to possess a schistose structure. Schist in the German signifies slate.

Scopiform. If a number of minute crystals or fibres be closely aggregated into a little bundle, with the appearance of diverging slightly from a common centre, they are said to be scopiform. Scopa in Latin, signifies a broom or besom.

Secondary Crystals, or forms. Such crystals as do not exhibit any portion of the *primary* planes are termed secondary crystals. Thus, in fluor, the cube is a secondary crystal.

Sectile. The term sectile is derived from the Latin, seco, to cut. Those minerals are termed sectile which are midway between the brittle and the malleable. A slice or portion cut from a sectile mineral, is fragile, and the new surface on the mass is smooth and shining. Plumbago and the soapstone are both sectile.

Semi-transparent. A mineral is said to be semi-transparent when an object is not distinctly seen through it.

Slaty structure. This term is synonymous with Schistose structure, which see.

Solid angle, see p.

Specific Gravity, see p. 35.

Specular Minerals are those which present a smooth and brilliant surface which reflects light; those which present only one such surface, which is not crystalline, are commonly termed specular: but among crystallized minerals we have specular iron, from the brilliancy of its planes. Speculum, in Latin, signifies a looking-glass.

Specular and Splintery Fracture belong to imperfectly crystalline minerals. The fractures do not greatly differ: they are both irregular; the spicular is shorter and more pointed than the splintery.

Square Prism, see *Prism.*

Stalactitiform. (Stalagma) in the Greek, signifies a drop, an icicle. Stalactitiform minerals greatly resemble icicles in shape.

Stalagmite. A stalagmite is the deposition afforded by the water dropping from a stalactite, as on the floor of a cavern.

Stellated. When the crystals or fibres of a mineral diverge all round a common centre, it is said to be stellated: stella, in Latin, signifies a star.

Striæ Striated. The slight channels occasionally observable on the planes of crystallized minerals are termed striæ, and the crystals on which they are seen are said to be striated. The striæ are commonly parallel, and generally indicate the direction in which crystals may be cleaved. Stria, in Latin, signifies a groove, or channel.

Structure. This term relates to the internal characters of minerals. Such as can be cleaved into regular forms, presenting smooth, brilliant, and parallel surfaces, are said to have a crystalline structure; but when the surfaces are neither smooth nor parallel, and when, on the contrary they are rough and curved, or undulating, the structure is said to be *imperfectly crystalline;* under which term also may be comprehended all fibrous minerals whether massive or not. All such as have no determinate structure, as those minerals which are granular, splintery, &c. may be included under the term indefinite or promiscuous structure. See page xxv.

Sulphate. A mineral in which the sulphuric acid is combined with a base, as with lime, in the sulphate of lime.

Sulphur. See p 280.

Sulphuret. A metallic mineral in which the metal is combined with sulphur. In these minerals the metal is not in the state of an oxide, but in the metallic state.

Supernatant. Such minerals as are lighter than water, and consequently swim upon it, are said to be supernatant. Supernato, in Latin, signifies to swim or float upon.

Tabular. When this term is used in relation to structure it is nearly allied to the schistose or slaty. Talc, mica, and roofing slate, are described by the German School, as possessing a tabular structure. This term is used more generally to express the external form of such crystals as are nearly flat: these are termed tabular crystals; from the Latin, tabula, a table board.

Terminal plane, see p. XLI.

Toughness relates to internal texture. Those minerals which are bruised, or suffer depression, by repeated blows in the attempt to fracture them, are esteemed to be tough.

Translucent. A mineral through which an object cannot be seen, but which transmits some light, is termed translucent. Rock salt, sometimes quartz, flint, and fluor, &c. are translucent: many minerals are translucent on the edges, as common marble, &c.

Transparent. Those minerals are transparent through which an object may be clearly seen.

Truncated, See p. XLII.

Tubercular. A mineral whose unevenness of surface arises from small and somewhat round elevations, is said to be tubercular. Flint is sometimes tubercular.

Tuberous : exhibiting somewhat circular knobs, or elevations.
Tubular, see Fistuliform.

Vesicular. A mineral is said to be vesicular, when it has small and somewhat round cavities, both internally and externally. Lava, pumice, limestone, basalt, &c. are sometimes vesicular : from the Latin, vesicula, a little bladder.

Vitreous; from the Latin vitreus, glassy ; minerals having the lustre of glass, are said to possess the vitreous lustre.

Unctuous. The term relates to the touch. Pipe-clay is somewhat unctuous : Fullers' earth is unctuous ; plumbago and soap-stone are very unctuous.—*Phillip's Mineralogy.*

A TABLE,

Exhibiting the angular admeasurements of crystals by the Reflecting Goniometer, according to Phillips.

Actynolite. Rhombic Prism, 124° 30′, and 55° 30′, alternately.

Adularia. In one direction, four of 90°; in another, four, alternately of 59° 25′, and 120° 35′; and in another, four, alternately of 67° 15′, and 112° 45′. These are obtained with great difficulty.

Albite. In one direction, alternately 93° 30′, and 86° 30′; in another 119° 30′, and 60° 30′: and in another direction, 115° and 65°.

Amblygonite. Rhombic Prism, 106° 10′, and 73° 50′ alternately. (See carbonate of Zinc.)

Amethyst. Primitive Rhomboid, 94° 15′, and 85° 45′ alternately. (See Quartz.)

Analcime. Primitive Cube, 90°, and 90°, in all directions.

Andalusite. Rhombic Prism, 88° 40′, and 91° 20′ alternately.

Anthophyllite. Rhombic Prism, 125°, and 55°, alternately.

Arfwedsonite. Rhombic prism, 123° 55′, on one of the lateral planes. (Hornblende, 124° 30′.)

Arragonite. Rhombic prism, 116° 5′, and 63° 55′, alternately.

Arseniate of Copper. Rhomboidal, 110° 30′, and 69° 30′ alternately.

Arseniate of Copper. Oblique prismatic, 124°, and 56°, alternately.

Arseniate of Copper. Right prismatic, 110° 5′, and 69° 10′.

Arseniate of Copper. Martial. Primitive rhomb 120° and 60°.

Arsenic, Sulphuret of. Rhombic prism, lateral planes, 74° 15′, and 105° 45′, alternately.

Arsenical Iron. Lateral planes, 111° 12′, and 68° 48′, alternately.

Augite. Primitive rhomb, 87° 5′, and 92° 55′, alternately. (See Specular Iron, and Bournonite.)

Barytes, Sulphate of. Primary prism, from fractured surfaces, 101° 42′, and 78° 18′, alternately.

Bismuth, Sulphuret of. After cleavage in one direction, 90°, with indications of cleavage, parallel to 130° and 50°.

Bitter-Spar. Primitive rhomb, 106° 15′, and 73° 45′. Also, in some specimens, 107° 20′, and 72° 40′, alternately. (See Calcareous Spar, and Cyanite.)

Borate of Lime. Primitive rhomb, 103° 40′ and 76° 20′, alternately.

Borate of Soda. Primitive rhomb, 86° 36′ and 93° 30′, alternately.

Bournonite. Primitive 90°, and 90°, or a rhomb of 93° 30′, and 86° 30′, alternately. (See Specular Iron, Augite, and Borate of Lime.)

Bronzite. Cleavage parallel to the planes of a rhomb of 100°, and 80°.

Calcareous Spar. Primary, Obtuse rhomboid of 105° 5′, and 74° 55′, alternately. It is readily obtained. (See Bitter-Spar.)
Carbonate of Zinc. Cleavage parallel to planes of 106° 30′, and 73° 30′, alternately.
Carbonate of Iron. Cleavage, parallel to the planes of 107°, and 73°.
Carbonate of Lead. Primary, right rhombic prism of 117°, and 63°.
Carbonate of Magnesia, and Iron Primitive 107° 30′, and 72° 30′. (See Bitter-Spar.)
Carbonate of Strontian. Primitive, right rhombic prism of 117° 32′, and 62° 28′, alternately. (See Carbonate of Lead.)
Celestine. Primitive, right rhombic prism, of 104°, and 76°. (See Calcareous Spar.)
Chabasie. Obtuse rhomboid, 94° 46′, and 86° 14′, alternately.
Chromate of Iron. Octohedron, two adjacent planes, give an angle, of 109° 28′. (See Arseniate of Iron.)
Chromate of Lead. Oblique prism, of 93° 30′, and 86° 30′. (See Chabasie.)
Chrysolite. Primitive, a cube.
C nnibar. Acute rhomboid, of 71° 48′, and 108° 12′.
Cobalt, Arsenical. Primary, a cube.
Copper, Sulphuret of. Double six-sided pyramid, the incidence of an upper, on the adjacent plane of the lower pyramid, being about 147° 30′.
Copper, Muriate of. Primitive, a right rhombic prism, of 100°, and 80°.
Copper, Phosphate of. Right rhombic prism 110°, and 70°.
Corundum. Primary, rhomboid, of 86° 4′, and 93° 56′.
Cyanite. Primary, a doubly oblique prism, of 106° 15′, and 73° 45′, of the terminal plane on the prism, in one direction, 100° 50′, and 79° 10′, and in another, 93° 15′, and 86° 45′, alternately. (See Chabasie, Sillimanite, Clevelandite, and Bitter-Spar.)

Diopside. Primary, oblique rhombic prism, of 87° 5′, and 92° 55′ alternately.

Egeran. Angles of cleavage, 90°.
Epidote. Primary, right oblique angled prism of 115° 30′, and 64° 30′. (See Arragonite.)
Eudyalite. Lateral planes, 120°. Summit, with the lateral planes, 90°.

Felspar. See Adularia.
Fibrolite. Right prism, with rhombic bases, of 100° and 80°.
Fettenstein. Cleaves parallel to all the planes, and diagonals of a right rhombic prism, of 112°, and 68°.
Fucite. Cleaves parallel to the lateral planes of a rhombic prism, of 87°, and 93°.
Galena. Primary, the cube.
Gehlenite. Primary, the cube.
Glauberite. Primary, rhombic prism, lateral planes, 83° 20′, and 96° 40′. Terminal, and lateral planes, 104° 15′, and 75° 45′, alternately.

Hedenbergite. Cleavage, parallel to the sides of a rhombic prism, of 124° 30′ and 55° 30′, alternately.

Hornblende. Cleavage, parallel to the sides, of 124° 30′, and 55° 30′, alternately. (See Actynolite, and Arfwedsonite.)
Humite. Right rhombic prism, of 120°, and 60° alternately.
Hypersthene. Rhombic prism, sides, 87°, and 93°, alternately.

Idocrase. Right prism with square bases, of 90° and 90°.
Indianite. Cleaves into prisms of 95° 15′ and 84° 45′ alternately, (see Glauberite, Quartz, and Tabular spar.)
Iron, Arsenical. Cleaves parallel to 111° 12′ and 68° 48′ alternately.
Iron Pyrites. Primary a cube, to all the parallel planes of which it cleaves.
Iron Pyrites, White. Primary, a right rhombic prism of 106° and 73°. Cleavage parallel to all its planes. (see Cyanite and Carbonate of Iron.)
Iron, Specular Oxide of. Primitive acute rhomboid of 86° 10′ and 93° 50′. (See Augite, Bournonite and Sillimanite.)
Iron, Carbonate of. Cleavage parallel to all the planes of an obtuse rhomboid of 107° and 73°. *(*see Iron pyrites, Sillimanite and Cyanite.*)*

Jenite. Primary, a rhomboid of 111° 30′ and 68° 30′. *(*see Arsenite of copper.*)*

Killinite. Cleavage parallel to the planes of a rhombic prism of 135° and 45°.

Latrobite. Cleavage in three directions parallel to all the planes of a doubly oblique prism, viz. in one direction 98° 30′ and 81° 30′, in another 91° and 89°, and in the third 93° 30′ and 86° 30′. *(*see Specular Iron, and Hypersthene.*)*
Laumonite. Oblique rhombic prism, inclination of lateral planes 113° 30′; inclination of terminal, with the lateral planes 86° 15′.
Lead, Sulphato-carbonate of. Primary, oblique prism of 120° 45′ and 59° 15′.
Lead, Sulphato-tri-carbonate of. Primary, an acute rhomboid of 72° 30′ and 107° 30′. *(*see Carbonate of Iron.*)*
Lead, Cupreous sulphato-carbonate of. Primary, a right rhombic prism of 95° and 85°.
Lead, Sulphate of. Primary, a right rhombic prism of 103° 42′ and 76° 18′.
Lead, Molybdate of. Cleavage parallel to an octohedron with a square base; angle of two opposite terminal planes 49° 45′; of the upper and lower terminal planes 130° 15′.
Ligurite. Oblique rhombic prism of 140° and 40′ alternately.

Manganese, Grey oxide of. Cleaves parallel to the planes of a rhombic prism of 100° and 80°
Mica. Primary, oblique rhombic prism of 120° and 60°.
Muriate of *Soda.* Primary a cube.

Orpiment. Primary, a right rhombic prism of 100° and 80°.

Pargasite. Cleavage parallel to the lateral planes of a rhombic prism of 124° 30′ and 55° 30′ being the same with Actinolite and Hornblende.
Polyhalite. Cleavage, parallel to all the planes of the cube, affording brilliant faces of 90° in every direction.
Prehnite. Primary 100° and 80°.
Pyroxene. see Augite.

Quartz. Primary rhomboid 94° 15′ and 85° 45′.

Realgar. Cleaves parallel to all the planes of an oblique rhombic prism, whose lateral planes are 74° 15′ and 105° 45′ alternately.
Rhomb Spar. See Bitter spar.
Ruby, Oriental, Primary, acute rhomboid of 93° 56′ and 86° 4′.

Sahlite. Primary rhomb 92° 55′ and 87° 5′; the same as Augite.
Sapphire. The same as Ruby.
Selenite. Primary, a right oblique angled prism, of which the bases are oblique angled parallelograms of 113° 8′ and 66° 52′.
Silver. Flexible Sulphuret of. Oblique angled prism of 125° and 55° alternately, on the lateral planes.
Silver, Red. Primary, obtuse rhomboid, of 108° 30′ and 71° 30′.
Sphene. Primary, an oblique rhombic prism, lateral angles 133° 30′ and 46° 30′, alternately.
Spinellane. Primary, the rhombic dodecahedron, of 90° and 120°.
Spodumene. Cleavage parallel to the planes and shorter diagonal of a rhombic prism of 100° and 80°; the same as Prehnite.
Staurotide. Primary, a right rhombic prism of 129° 20′ and 50° 40′.
Sulphate of Strontian, see Celestine.
Sulphuret of Antimony. Primary, right rhombic prism of 88° 30′ and 91° 30′ alternately.

Tabular Spar. Cleaves into prisms of 95° 20′ and 84° 40′ alternately. (See Cupreous sulphuret of Lead, Indianite, and Quartz.)
Thomsonite. Cleaves parallel to the lateral planes of 90°.
Tin, Oxide of. Primary, an obtuse octohedron with a square base, the angle over the apex being 112° 10′ and a plane of one pyramid, on the adjoining plane of the other 67° 50′.
Tungstate of Lime. The angle formed by the meeting of a plane of the upper, with the adjoining plane of the lower pyramid 128° 40′.
Topaz. Primary, a right rhombic prism of 124° 22′ and 55° 38′ alternately.
Tourmaline. Primary, an obtuse rhomboid of 133° 30′ and 46° 10′ alternately.

Wavellite. Cleavage parallel to both sides of a prism of 122° 15′ and 57° 45′.

Yenite, see Jenite.

Zinc, Red oxide of. Cleaves parallel to the planes of a six-sided prism, each lateral plane on the adjoining one being 120° and the terminal on the lateral plane 90°.

Zinc, Silicious oxide of. Primary, a right rhombic prism of 102 30′ and 77° 30 alternately.

Zinc, Carbonate of. Cleavage parallel to all the planes of a rhomboid of about 106° 30′ and 73° 30′. (See Amblygonite, Bitter spar and Carbonate of Iron.)

Zircon. Primary, an obtuse octohedron of 95° 40′ and 84° 20′. *(see* Glauberite, Indianite, Quartz, &c.*)*

Zoisite, Cleaves parallel to the sides of a rhombic prism of 120° and 60°.

TABULAR ARRANGEMENT.

The following Table shews, at one view, the order in which the Minerals are arranged for description. The numbers on the right, refer to the pages where the mineral is described.

The Species begin with Roman capitals; the Sub-species, are in *Italics*; and the varieties are in small type.

CLASS I.
EARTHY MINERALS.

This Class includes such minerals as are composed of one or more earths. Some of them, contain, also, small portions of one, or more, metallic oxides, which are mostly considered as accidental ingredients.

CLASS II.

ACIDIFEROUS EARTHY MINERALS.

This Class includes such minerals as consist of an earth combined with an acid; some of them contain small portions of metal, as iron, manganese, and perhaps chrome.

CLASS III.

ACIDIFEROUS ALKALINE MINERALS.

This Class includes such minerals as consist chiefly of an alkali, united with an acid. Some of the species contain foreign matter, rendering them very impure.

CLASS IV.

ACIDIFEROUS ALKALINO-EARTHY MINERALS.

The minerals arranged under this Class, contain an alkali, and an earth acidified by the sulphuric, or fluoric acids, forming salts of various characters.

CLASS V.

ALKALINO-EARTHY MINERALS.

The minerals belonging to this Class, consist of earths, in various proportions; including, generally, in their composition, one or more of the alkalies.

CLASS VI.

NATIVE METALS AND METALIFEROUS MINERALS.

This Class includes the native metals, together with the ores, or metals combined with other substances, as oxygen, sulphur, or acids.

CLASS VII.

COMBUSTIBLE MINERALS.

The substances belonging to this Class, combine with oxygen, under ordinary, circumstances not requiring with an exception or two, a high temperature, or the aid of pure oxygen, to effect their combustion.

CLASS I.

EARTHY MINERALS.

This Class includes such minerals as are composed of one or more earths. Some of them also contain small portions of one or more metallic oxides, which however are not considered as essential ingredients.

QUARTZ.

Pure quartz, as it exists in transparent rock-crystal, is composed of silex or silicious earth, with two or three per cent of water.

Silex is perfectly white, without either taste or smell. It feels harsh; is insoluble in any of the mineral acids; infusible alone, but melts and forms glass with potash. It is a compound body, and according to Berzelius, is composed of about 50 per cent of oxygen, united to an equal proportion of its base, called SILICIUM.

Species 1.—COMMON QUARTZ.

Quartz Hyalin, H. Common Quartz, C. Crystallized Quartz, P. Rhomboidal Quartz, J. Rhombohedral Quartz, M.

External Characters.—Colors, white, yellowish, red, bluish, brown, and greenish, or green, or transparent and colorless; occurs massive; in concretions, with a diverging and circular structure; in confused crystalline masses, of which the structure is not visible: also in crystals; form, the six-sided prism, terminated by six-sided pyramids: also the dodecahedron, or double six-sided pyramid. Both forms subject to a great variety of modifications; scratches glass; sp. gr. 2.63.

Chemical Characters.—Infusible. Two pieces rubbed together give a peculiar smell, like that of the electric fluid; insoluble in the acids, except the fluoric.

Composition.—Silex, nearly pure.—*Berzelius.*

Sub-species 1.—*CRYSTALLIZED QUARTZ.*

Quartz Hyalin, H. Crystallized Quartz, P. Rhomboidal Quartz, J. Common Quartz, C. Rhombohedral Quartz, M.

General characters, as in the species. Common form of the crystals, six-sided prisms, terminated by six-sided pyramids. Primitive form, the rhomboid.

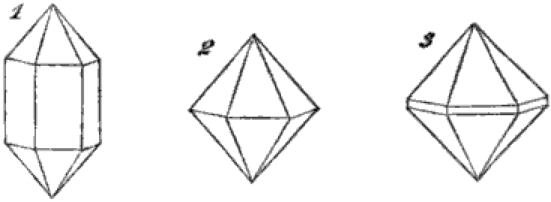


Fig. 1. The six-sided prism, terminated by six-sided pyramids.

Fig. 2. The dodecahedron, or two six-sided pyramids, joined base to base, without the intervention of the prism.

Fig. 3. The two pyramids separated from each other by the intervention of a very short six-sided prism.

Observation 1. In figure 1, the terminating pyramids may be considered as separated several inches from each other, by the intervening prism, or as a prism several inches long, terminated by pyramids. In figure 3. the pyramids are merely separated by the short prism interposed between their bases. This form however is still considered a prism, terminated by pyramids.

In figure 2, the prism entirely disappears, and the two terminal pyramids join base to base. It now assumes a figure of twelve sides, each end beginning and terminating a six-sided pyramid.

2. These crystals are subject to a variety of modifications, by truncation, or the replacement of their edges, or solid angles, by plane faces of various sizes and shapes.

3. Crystallized quartz, not only occurs in single distinct crystals, but is often found implanted in groups, the pyramids of which only appear distinct. It also occurs lining the cavities of other minerals, or incrusting their surfaces in small, but frequently in very perfect crystals, the pyramidal terminations having a high polish, and the specimen appearing as if it was studded with gems.

Quartz occurs in primitive, transitive, and secondary rocks.

Localities.—Madagascar, Dauphiny, the Alps, Cornwall, &c.

Observation 1.—The finest crystals come from Madagascar and the Alps.

2. Specimens sometimes contain water, air, or bitumen enclosed. These are rare.

3. Crystals often enclose clay, titanite, hornblende, asbestus, iron ore, native silver, &c.

4. According to Pinkerton, nature produces regular rock crystals in the vast caverns of the Alps, of such enormous size, that they weigh several tons each.

U. S. The localities of rock crystal are very numerous in this country. A few, only where fine specimens are found can be given

Lake George, *N. Y.* The crystals are perfectly transparent and sometimes 5 inches long.—*Silliman.* Frederic County, *Md.* The crystals are scattered on the surfaceof the ground, and are perfectly transparent.—*Hayden.* Grafton, *Ver.* Remarkably pure and translucent.—*Hall.* Newbury District, *S. C.*; Abington and Plainfield. *Mass.*

Uses.—It is much used, when cut and polished, as an inferior gem. The ancients made engravings upon it, but it is considered too soft for this purpose. The transparent variety is polished for spectacles, and has the advantage of not being easily scratched.

Obs. 1.—Crystals may be colored by plunging them while hot into a vegetable, or metallic solution which possesses color, but they are very apt to crack by the process.

2.—Quartz when set, may be distinguished from glass, or paste, by touching it with a fine file, which will cut the glass, but will not scratch the quartz.

The varieties of this species are numerous, and are distinguished chiefly by their colors.

Variety 1.—AVANTURINE.

Quartz hyalin avanturine, H. Avanturine, P. Avanturine Quartz, C.

External Characters.—Colors, brown, yellow, grey, bluish, greenish, or white; variegated by brilliant points or spangles, of a golden or silver color.

Observation.—These spangles are small plates of mica, of various colors, interspersed through the mass. It is employed in jewelry, and some specimens are exceedingly beautiful. It is sometimes imitated by art, apparently, by sprinkling recent brass filings into melted glass.

Localities.—Cape de Gatte, *Spain.* This is of the finest kind. Scotland, England, France, &c.

Uses.—It is much esteemed in jewelry.

Variety 2.—PRASE. GREEN QUARTZ.

Quartz hyalin vert-obscur, H. Prasem, A. Prase, P. C.

External Characters.—Color, dark green; occurs in crystals, and crystalline masses; lustre resinous, or vitreous; translucent.

Observation 1. It is seldom crystallized, but is commonly found in pebbles, or masses among other minerals.

2. It seems to be common quartz colored with actynolite, or perhaps epidote. Sometimes the fibres of the actynolite are distinct.

Localities. Saxony in a metallic bed. Scotland with actynolite. Moravia, England, &c.

U. S. On Lake Superior. Near Baltimore, and on the west side of Blue Ridge, *Md.* Milton, Brighton, and West Cambridge, *Mass.*

Use. It is much esteemed as an ornamental stone, and is cut and polished for jewelry.

Variety 3.—MILKY QUARTZ.

Quartz hyalin laiteux, H. Milky Quartz, P.

Ext. Char.—Color, milk-white; occurs massive and in crystals; hardness, that of quartz.

Obs. When crystalized, it is remarkable that the crystals are more regular in their forms than those of the transparent variety.—*Phillips.*

Variety 4.—ROSE QUARTZ.

Quartz hyalin rose, H. Rose Quartz, P. C.

Ext. Char.—Color, rose-red, which in small pieces appears pale. Occurs massive and in crystals; translucent, or nearly transparent.

Obs. It fades, when exposed for a long time to the light. Its color is probably owing to a small quantity of manganese.

Local. Bavaria, Bohemia, Finland, Siberia.

U. S. Southbury, *Con.* It is of a delicate color, and forms an insulated mass.—*Silliman.*; also at East-Haddam; Plainfield, and Williamsburg, *Mass.*; West-Chester, *N. Y.*; Keene and Acworth, *N. H.*

Use. It is cut and polished for jewelry.

Var. 5.—AMETHYST. VIOLET QUARTZ.

Quartz hyalin Violet, H. Violet Quartz. Amethyst, P. Amethyst, A. P. C.

Ext. Char.—Color, violet blue, often deep and pale in the same specimen; occurs most commonly in crystals; form the same as common quartz; crystals generally grouped, the pyramids only appearing distinct; translucent; hardness, that of quartz.

Composition. Silex 97.50; alumine 0.25; oxide of iron 0.50; oxide of manganese 0.25.—*Rose.*

Obs. 1. Crystals of amethyst are rarely of the same color throughout. The summits only, are commonly purple, the prism being colorless, or tinged greenish.

2. The Orientals were very partial to this stone. The color, they considered that of new wine, and the Persians believed that wine drank from a cup of amethyst, would not intoxicate. The *oriental* amethyst is a sapphire, but it is probable that the present species was the one so highly esteemed, as the sapphire is found only in small crystals.

3. Crystals of amethyst very rarely occur single, but are faciculated, or aggregated, and separate into irregular columnar pieces, when struck.

4. By long exposure to heat, the color is said to disappear.

It occurs in greenstone and porphyry, often forming geodes. It is also sometimes found in primitive rocks.

Uses. It is highly valued as an ornamental stone, and is cut and set for ear rings, necklaces, watch seals, &c. at the present day.

The name *Amethyst* occurs in Scripture. It was the ninth stone in order, on the Jewish high priest's breast-plate of judgment, with the name *Issachar* engraved thereon.

Some of the finest engravings are on this stone. Among these are the bust of Trajan in the Royal Library at Paris; and more recently done, are the Apollo Belvidere, the Farnese Hercules, and the group of Laocoon, by *Sirleti.*

Local. Cambay in *India*, Siberia, Spain, Sweden, Bohemia, France, England, &c.

The finest are brought from India, Spain, and Siberia.

U. S. Wallingford, Farmington, Berlin, and East-Haven, *Con.*—*Cleaveland.* Mount Tom, *Mass.* in beautiful crystals.—*Silliman.* Ludlow and Westminster, *Vt.* Pacquanack Mountain, and at Patterson, *N. J.* Chester County, *Penn.* in large transparent crystals.—*Gilmor.* Hampton Falls, and White Hills, *N. H.* Belchertown, *Mass.* in rounded masses sometimes 18 inches in diameter.—*Shepard.*

Var. 6.—YELLOW QUARTZ. CITRINE.

Quartz hyalin jaune, H. Yellow Quartz, P. C.

Ext. Char.—Color, wine, honey, or straw yellow; occurs massive and in crystals; translucent; semi-transparent.

When heated, its color entirely disappears in a few seconds.

Obs. It is called *false*, or *Bohemia* topaz.

Local. Carngorm, *Scot.*; Cornwall, *Eng.*

U. S. Southampton, *Mass.* Near St. Louis, on the banks of the *Mississippi.* Blue Ridge, *Penn.* Acworth, *N. H.*

Distinctive Characters.—The topaz, for which citrine is often mistaken, scratches quartz, which citrine does not.

Var. 7.—BROWN QUARTZ.

Ext. Char.—Color, various shades of brown; translucent.

Local. Jetland furnishes the finest crystals of this variety.

Var. 8.—FERRUGINOUS QUARTZ.

Quartz rubigineux, H. Ferruginous Quartz, A. P. C. Iron Flint, J.

Ext. Char.—Color, yellowish, or reddish, sometimes blood, or brownish red; occurs massive and crystallized in the usual form of quartz; translucent or opake; fracture small conchoidal.

Chem. Char.—Some specimens become magnetic when heated.

Composition. Silex 93.5; oxide of iron 5.0; water 1.0.—*Buchotz.*

Obs. 1. The massive variety is sometimes crystallized on the surface; and sometimes groups of common white crystals terminate in ferruginous quartz, the summits only being colored.

2. This variety of quartz is colored by the oxide of iron: hence when the yellowish kinds are exposed to heat, oxygen is absorbed, and the color is changed to red.

Ferruginous quartz is most commonly found in primitive mountains, associated with the ores of iron.

Local. Bohemia, Spain, England, Scotland, Siberia, and Saxony.

U. S. Litchfield, *Con.* At Mentzer's Gap, *Penn.* in loose masses terminated at each extremity by three faces.—*Hayden.*

Var. 9. IRISED QUARTZ.

Quartz hyalin irisé H. Irised quartz C. Irisated quartz P.

Obs. 1. This variety is peculiar only for reflecting a series of prismatic colors, either internally, or externally. When the reflection is external, it probably proceeds from the deposit of some metallic oxide on the quartz. The internal colors obviously proceed from cracks, or fissures, which are sometimes in the direction of the natural joints.

2. Sometimes the internal play of colors may be produced, by plunging a crystal moderately heated, into cold water.

Var. 10. RADIATED QUARTZ.

Quartz hyalin fibreux H. Radiated quartz P. C.

Obs. It occurs in crystals generally small, and closely aggregated, which radiate from a point.

Var. 11. STALACTICAL QUARTZ.

Obs. This variety according to Phillips, occurs in one of the Cornwall Copper mines. It has, in no respect, the appearance of chalcedony, since it consists of strait stalactites several inches long, composed of an aggregation of crystals diverging from the centre.

A beautiful specimen of this variety in my possession from South America, is studded at every point externally, with small brilliant crystals. Internally, and particularly near the surface, it is composed of aggregated, radiating crystals. Color, milk-white.

Var. 12.—PSEUDOMORPHOUS QUARTZ.

Quartz hyalin pseudomorphique, H. Pseudomorphous Quartz, P. C.

This variety either takes the forms of crystals, or of cavities once occupied by crystals.

Obs. These specimens sometimes present very curious appearances, viz: hollow vacant spaces, of the exact form of some crystal which the quartz had once invested, but which had been decomposed and washed away. Also, the solid form of some crystal, under which real crystals of quartz never appear, and which form it took from the deposition of quartz into the cavity once occupied by some real crystal.

Local. Bristol, Cornwall, and Durham, *Eng.*

U. S. Southampton and Deerfield, *Mass.* Simsbury, *Conn.*

Var. 13.—FETID QUARTZ.

Quartz hyalin gras, H. Fat, or Fetid Quartz, P. Fetid Quartz, C.

Ext. Char.—Color, grey, of several shades, sometimes marked with spots or stripes of a dark hue; occurs massive, and sometimes in crystals; translucent; lustre resinous; gives a fetid odor when struck.

Obs. 1. According to Professor Cleaveland this variety, never transparent, is always translucent or opake, and in some instances phosphoresces by friction.

2. The odour which it emits is like that of sulphuretted hydrogen, and probably arises from some bituminous matter, which at the same time gives it color.

Local. Near Nantes, in *France*.

U. S. Topsham, *Me.* On the banks of Connecticut river, from Bellows Falls to Middletown.—*Hitchcock*.

Var. 14.—SPONGIFORM QUARTZ.

Float-Stone, J. Spongiform Quartz, P.

Ext. Char.—Color, white, yellowish, or greyish white; occurs massive; texture loose and spongy; easily broken; very light; scratches glass; floats on water for a few minutes.

Comp. Silex, 98; carbonate of Lime, 2.—*Vanquelin.*

Obs. Professor Mohs says, that float-stone consists of a delicate tissure of minute crystals, visible under a powerful magnifier, and that it insensibly passes into hornstone and flint.

Var. 15.—GRANULAR QUARTZ.

Quartz hyalin granulaire, H. Granular Quartz, P. C.

Ext. Char.—Color, white, or greyish white; occurs massive; structure, fine granular; often friable; sometimes flexible; opake.

Obs. The appearance of this variety resembles a white sand-stone without cement. In thin plates it is sometimes slightly flexible.

It sometimes forms extensive beds.

Local. Brazil and near St. Gothard. Whitby, *Eng.* The flexible kind occurs at all these localities.

U. S. Vernon and Middlebury, *Ver.* Williamstown, *Mass.* where it forms a hill.

Var. 16.—SMOKY QUARTZ.

Quartz hyalin enfumé, H. Smoky Quartz, C.

Ext. Char.—Color, brownish yellow, of various shades; translucent, or nearly transparent.

Obs. Objects seen through it appear as they do through smoked glass.

Local. Cairngorm, *Scot.* and Brazil.

U. S. White Hills, *N. H* Shrewsbury and Wardsborough, *Ver.* Lancaster county, *Penn* Fine crystals.—*Seybert.* Cornwall, and Torrington, *Conn* Topsham, *Maine.* Acworth, *N. H.* Fine specimens.

Uses. It is employed in jewelry. Some very ancient engravings are said to be on this kind of stone.

Sub-species 2.—*HYALITE* * *MULLER'S GLASS.*

Quartz hyalin concretione, H. Hyalite. Muller's Glass, P. J. C.

Ext. Char.—Color, yellowish, sometimes grey; often bears a strong resemblance to gum arabic; occurs stalactical, massive, botryoidal, and in thin layers often curved; lustre vitreous; hardness equal to quartz; sp. gr. 2. 4.

Comp. Silex, 92; water, 6 3; alumine, a trace.—*Bucholz.*

It is found chiefly lining amgdaloid, the cavities of burr-stone, trap, &c.

Local. Frankfort on the Maine, Mexico, and at Chemneitz, in *Hungary.*

U. S. In the cavities of the burr-stone, of *Geo.*—*Hall.*

Spe. 2—CAT'S EYE.

Quartz-agathe chatoyant, H. Cat's Eye, J P. C.

Exter. Char.—Color, grey, with a greenish tinge; also brown, or reddish; gives out internal white chatoyant reflections of light, sometimes greenish and pearly, resembling the reflection from the eye of the cat; translucent in one direction, and nearly transparent in another; scratches quartz.

Chem. Char.—Infusible, but becomes opake and spotted, by heat.

Comp. Silex, 95; alumine, 1,75; lime, 1,50; oxide of iron, 0,25. —*Klaproth.*

Obs. This is a singular and beautiful little stone which comes from India, ready cut and polished. The size is about that of half a hazlenut, and it is generally cut in form of an ovate hemisphere. Its peculiar pearly reflections are said to be caused by minute fibres of amianthus, by which it is penetrated.

It is in great request as a gem, and bears a high price.

Its geological situation and localities are unknown.

Spe. 3.—OPAL †

Quartz rèsinite, H. Opal, P C. Indivisible Quartz, J. Uncleavable Quartz, M.

Remarks. This species contains one of the most beautiful and

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* Greek, from its glassy appearance.

† From the Greek, signifying eye. The ancients believed this stone had the power of strengthening the eye.

costly of precious stones. The composition of opal differs from that of quartz, chiefly in its containing a greater quantity of water. None of the varieties are hard enough to give fire with steel.

Var. 1.—PRECIOUS OPAL. NOBLE OPAL.

Quartz rèsinite opalin, H. Precious opal, J. P. C.

Ext. Char.—Colors, white, milk white, or yellowish white; occurs in small masses, or concretions; translucent, or transparent; presents, as it is turned in different directions towards the light, most of the prismatic colors; fracture conchoidal; scratches glass; easily broken; sp. gr. 2,1.

Chem. Char. Decrepitates and loses its colors when heated, but is infusible.

Comp. Silex 90; water 10.—*Klaproth.*

Obs. 1. The precious opal is readily known from its beautiful display of changeable colors; these are green, blue yellow, red, and purple of various shades, proceeding from the interior of the gem, and depending on the direction in which it is turned towards the light.

2. The phenomenon of this beautiful play of colors, has not been satisfactorily explained. Hauy attributes it to the fissures of the interior being filled with films of air, agreeably to the law of Newton's colored rings, when two pieces of glass are pressed together.

Mohs objects to this explanation, on the ground that, were this the fact, the opal would present nothing but a kind of irridescence.

Dr. Brewster, however, after a great number of observations, concludes that the play of light depends upon openings in the interior of the mass of opal, which are not accidental fissures, but of a uniform shape, and which reflect the tints of Newton's scale.

3. The opal was well known to the ancients, and is mentioned by Pliny, who states that the Roman Senator Nonius chose to suffer banishment, rather than part with a valuable one to Mark Anthony.

Local. Hungary; where it is found in small masses, in a vein of claystone porphyry. Also in the Faroe Islands; near Freyberg, and in South America.

Obs. The Hungarian opal mines are at Czerwiniza, where they are found of various qualities, from the white translucent common opal, to the utmost refulgence of the lively play of colors by which that noble gem is distinguished.

Uses. The opal is cut and polished for the finest and most costly kind of jewelry. In setting it, a black foil is said to have a powerful effect in heightening its play of colors Some opals of remarkable beauty, are equal in value to the diamond.

Obs. Jameson relates that in the cabinet at Vienna, there are two pieces of opal, one of which is 5 1-2 inches long, by 2 1-2 inches in diameter, and the other about the size of a hen's egg. Both of them exhibit a very rich and splendent play of colors. These are from Hungary, and probably the largest specimens ever found.

Var. 2.—FIRE OPAL.

Quartz rèsinite girasol, H. Fire opal, J. P. Girasol, C.

Ext. Char. This variety differs from the precious opal in possessing only a red reflection, when turned toward the sun, or a strong light.

Obs. The color of fire opal is bluish white or milk white. It is said to occur with the precious opal, but to be much more rare.

Jameson describes a fire opal of a hyacinth red, which gives carmine red and greenish reflections. It comes from Mexico.

Mr. Phillips possesses a specimen of fire opal from Cornwall.

Var. 3.—COMMON OPAL.

Quartz rèsinite commun, H. Common opal, J. A. C. P.

Ext. Char. Color, white, with shades of yellow, blue, or green; occurs massive, and in rolled pieces; fracture perfectly conchoidal; fragments sharp edged; lustre resino-vitreous; translucent; is scratched by quartz; brittle; scratches glass; sp. gr. 2. 1.

Chem. Char. Infusible; insoluble in acids.

Comp. Silex 92; water 7.75; oxid of iron 0.25. *Phillips.*

Obs. 1. This variety is entirely without the play of prismatic colors which makes the precious opal so valuable

2. When viewed by the transmitted light, the milk white variety often appears of a different color.

Dist. Char. Pitchstone which it may sometimes resemble, is fusible, and of a darker color. Its fracture is more perfectly conchoidal, and it is more translucent than semi-opal. It is not as hard as chalcedony, cacholong, or hornstone.

Local. Hungary, Saxony, Bohemia and Silesia. In Hungary it is found with the precious opal.

U. S. Near Easton, *Penn.* Litchfield, *Conn.*

Uses. It is cut and polished for Jewelry.

Some fine ancient engravings are on this stone, but it is considered too soft for this purpose. Of Modern engravings on it, a cameo is mentioned, bearing the likeness of Louis XIII, when a child.

Var. 4.—SEMI-OPAL.

Semi-opal, J. A. P. C

Ext. Char.—Colors, white, greyish, yellowish, or brownish; occurs in compact masses, also stalactical and reniform; fracture imperfectly conchoidal; translucent, or nearly opake; colors generally dull, and sometimes runs in spots, or veins; brittle; often covered with an opake crust from decomposition.

Chem. Char. Infusible.

Comp. Silex 85; carbon 1; ammonical water 8; oxide of Iron 1.75.—*Klaproth.*

Dist. Char. It is more opake than common opal; and is also harder. Pitchstone is generally of a darker color, and is fusible. It never possesses the peculiar milky whiteness of cacholong, nor the hardness of chalcedony.

It occurs in most countries of Europe, especially in silver veins, traversing granite and gneiss.

Local. Greenland, Iceland, Faroe Isles, and France.

U. S. Bare Hills, *Md.* Corlear's Hook, *N. Y.* At the Falls of the Delaware, *Penn.*

Var. 5. WOOD OPAL.

Quartz rèsinite xyloide, H. Wood opal, P. A. Opalized wood, C.

Ext. Char.—Color, several tints of white, grey, brown, and black; occurs massive, with a ligneous aspect; fracture conchoidal; harder than semi-opal; lustre resinous or waxy; translucent on the edges, or opake; sp. gr. 2.

Obs. 1. This variety resembles semi-opal, except in its woody appearance.

2. It is distinguished, according to Phillips, from petrified wood, by its greater lightness and translucency and its conchoidal fracture.

Local. Hungary, in alluvium. Transylvania, in trap.

Var. 6.—FERRUGINOUS OPAL.

Jasper Opal, J. Ferruginous Opal, J. P. C.

Ext. Char.—Color, some shade of red, yellow, grey, or brown, generally deep, sometimes spotted; occurs massive; opake or feebly translucent at the edges; fracture flat conchoidal; lustre shining: sp. gr. 2.

Comp. Silex 43.5; oxide of iron 47; water 7.5.

Dist. Char. Differs externally from common opal in the deepness of its colors. It probably passes into jasper, from which it is sometimes difficult to distinguish it.

Local. Hungary, Siberia, Saxony, and near Constantinople.

Var. 7.—HYDROPHANE.*

Quartz rèsinite hydrophane, H. Hydrophane, A. P. C.

Ext. Char.—Colors, white, or yellowish; occurs massive, and in small concretions; opake, when dry, but becomes translucent and opalescent after immersion in water; adheres to the tongue; fracture conchoidal.

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* From the Greek, in allusion to its becoming transparent in water.

Comp. Silex 93.13; water 5.25; alumine 1.62.—*Klaproth.*

Obs. 1. The curious property which this variety possesses of becoming transparent, on immersion, seems to depend on the porous nature of the stone. Other porous substances, containing air, as white paper and linen, become more or less transparent when their pores are filled with water instead of air.

2. Winklemann describes an ancient engraved stone, with three layers, one of which was white; and says that the white layer became black, when the ring in which it was set was worn, but that it became white again, when the ring was laid aside.

3. It is probable that the white layer, was an *hydrophane,* and that the moisture of the hand rendered it so transparent as to show the black one to which it was attached, through it, and thus to make itself appear black.—*Rees' Cyclop.*

Var. 8.—MENILITE.

Quartz rèsinite subluisant, H. Menilite, J. P. C.

Ext. Char.—Color, yellowish grey, brownish, or ash grey; occurs in small tuberous, or roundish masses; fracture conchoidal, sometimes with an apparent slaty structure; lustre dull; translucent or opake; aspect argillaceous; scratches glass; sp. gr. 2.25.

Chem. Char.—Infusible; insoluble in acids.

Comp. Silex 85.5; alumine 1; water 11; with a small portion of oxide of iron and bitumen.—*Klaproth.*

Local. Near Paris, imbedded in clay, at a place called *Menil*-Montant, and hence the name.

Species 4.—FLINT.

Quartz agathe pyromaque, H. Flint, J. A. P. C.

Ext. Char.—Colors, grey, yellow, and blackish, of various shades; occurs in nodular masses, covered externally with a white chalky coat; texture compact; fracture perfectly conchoidal; lustre glimmering, somewhat greasy; fragments sharp edged; translucent on the edges; gives lively and copious sparks with steel; scratches quartz; sp. gr. 2.58 to 2.63.

Chem. Char.—Infusible, but loses its color, and becomes opake and brittle.

Comp. Silex 98; lime 0.5; alumine 0.25; oxide of iron 0.25; water 1.—*Klaproth.*

It is found in the upper part of chalk formations, in marl, in limestone formations, and in alluvial deposits.

Local. Denmark, Poland, Sibéria, France, England. Immense beds are found in the north of France, and at Dover, in *England.*

Obs. Nodules of flint are sometimes found enclosing organic remains, and Kirwan quotes an author who says that 126 silver coins were found in different nodules of flint at Grinoc, in *Denmark*, and an iron nail, at Potsham.

Uses. Its most important use is that of making *gun flints*. It therefore assumes a very important rank among minerals, and particularly when it is considered that the defence, and even liberty of a nation may depend on its locality.

The manufacture of gun flints is chiefly confined to France and England. In the former country, in the vallies of the Seine and Marne, immense beds of flint are found, and the manufacture is carried on to a great extent.

Good stones for this purpose are however comparatively scarce, for Dolomieu states, that out of 20 beds, which the workmen go through, not more than one or two, contain good flints for working. Nor can the stones, though good when first raised, be worked after being exposed to the air for any considerable time.

The instruments used in fashioning gun flints are, a large hammer with square heads ; a small hammer with blunt points nearly in the form of a triangle ; a little steel instrument, in shape of a wheel, with a handle in the centre, called a roller ; and a chisel seven or eight inches long, bevelled on both sides.

Having selected a good specimen of silex, the workman seats himself on the ground and proceeds as follows.

1. Placing the mass on the left thigh, he divides it in the middle with a few gentle blows of the large hammer.

2. He next takes one half of the mass, and with the small hammer, breaks it into pieces about 2 1-2 inches long, 1 1-2 wide, and 1-4 of an inch thick. This requires peculiar dexterity and much experience.

3. To fashion the flint ; he places one of the small pieces on the edge of the chisel, which is supported by the fore-finger of the left hand, and with light blows of the roller, it breaks along the edge of the chisel, and is thus reduced to its proper shape and size.

The operation of fashioning a gun flint is done in less than a minute, and a good workman will produce a thousand per day.

About 800 people are employed in this species of manufacture, in a particular section of France, and they have excavated a great proportion of the plain they inhabit.

Species 5.—CHALCEDONY.*

This species presents several varieties which nearly agree in respect to fracture and hardness, but differ chiefly in respect to color. In several instances, however, they mutually pass into each other, so that it is sometimes difficult to determine where one variety terminates and the other begins. Chalcedony also passes insensibly into agate and carnelian, and perhaps into hornstone.

Var. 1.—COMMON CHALCEDONY.

Quartz agathe chalcedonia, H. Chalcedony, A. P. Common Chalcedony, C.

Ext. Char.—Colors, white, bluish white, pale yellow,

* From Chalcedon in Asia, where it was found by the ancients.

brownish, greenish, and grey ; occurs in small masses, in nodules, stalactical concretions, and in hollow crusts; surface rough ; fracture conchoidal, or uneven ; fragments sharp edged ; lustre vitreous ; harder than flint ; translucent ; with a cloudy, or milky appearance ; sp. gr. 2.60.

Chem. Char.—Infusible, but turns white and opake.

Comp. Silex 84 ; alumine 16.—*Bergman.*

Obs. 1. Chalcedony when viewed by transmitted light, appears milky, and sometimes clouded.

2. It almost always appears externally with a dark colored, corroded crust, and is often found hollow, with crystals of quartz lining its cavities.

Dist. Char. It is more transparent than flint ; is never reddish like carnelian ; nor milk white and opake, like cacholong, nor striped like onyx and agate. It also differs from all these in exhibiting marks of internal mammillary concretions, when held between the eye and the light.

Obs. Chalcedony is often called by jewellers, white carnelian.

It is found in the cavities of rocks, as amygdaloid, porphyry, greenstone, and basalt.

Local. Its foreign localities are very numerous, but the finest specimens are said to be found in Cornwall, *Eng.* and the Faroe Islands.

U. S. East-Haven, *Con.* ; specimens fine, and well characterized. —*Silliman.* Deerfield and Middlefield, *Mass.* ; Counties of Perry, Athens, Hocking, &c. *Ohio.—Atwater.* Little Britain, Lancaster County, *Penn.* ; very beautiful.—*Conrad.* Several places in *Missouri.* Near Pompton Plain, also on Pracknes Mountain, and in Sussex County, *N. J.* ; Lynn, on Nahant beach, *Mass.*

Uses. *Chalcedony* bears a fine polish and is considerably esteemed, under the name of *white carnelian* as an ornamental stone, for watch seals, snuff boxes, &c.

The ancients engraved upon it, and there are still extant, several master pieces of the art, on this stone. One of the best is the celebrated Dyonisiac bull, by *Hyllus.*

Var. 2. ONYX.

Quartz agathe Onyx, H. Onyx, P. Agate, Onyx, C.

Ext. Char.—Colors, milk white and opake, and bluish white and translucent, alternating with each other.

Obs. The onyx, so far as we have been able to ascertain, is a striped chalcedonic stone, consisting of alternate layers of opake milk white chalcedony, or cacholong, and of the common bluish, translucent chalcedony.

Remark. Good specimens of the onyx may often be found at the present time among the obsolete, and neglected articles which are thrown aside in every jeweller's shop.

Var. 3. CACHOLONG.

Quartz agathe cacholong, H. Cacholong, J. A. P. C.

Ext. Char.—Color. milk white; occurs in layers with chalcedony; or sometimes encrusting or penetrating it: opake, or as it runs into chalcedony, translucent; hardness equal to quartz; lustre pearly: subject to disintegration.

Obs. This is merely a white and opake variety of chalcedony, into which it passes by insensible shades. In polished specimens of chalcedony, specks of cacholong are often seen.

Local. On the Borders of the River *Cach.** in Bucharia, with chalcedony. In the Faroe Island, Elba, Spain, &c.

U. S. Deerfield, *Mass.* (with chalcedony.) Pittsfield, *Mass.*

Var. 4.—SARD.

Quartz agathe Sardoine, H. Sard P. Sardonyx, C.

This is chalcedony of a deep rich, reddish brown color; by transmitted light approaching to blood red.—*Phillips.*

Remark. This is most probably a variety of carnelian, but is permitted to remain here, that the varieties forming the Sardonyx may be near each other.

Species. 6.—SARDONYX. *Rees' Cyclop.*

Ext. Char.—Colors, alternately bluish, white, and red: consisting of stripes or layers of *onyx* and *sard.*

Remark. Systematic writers do not agree as to what constitutes *onyx* and *sardonyx.*

Jameson says, the onyx is formed of white and brown stripes of chalcedony.

Aikin, considers, that two or more plates of any of the varieties of chalcedony forms the onyx.

Hauy and *Cleveland*, call that variety of agate, on which the different colors are arranged in distinct parallel stripes or zones, *onyx-agate.*

Phillips, agrees with Jameson in respect to onyx, and says that *sardonyx* consists of *sard* and alternate layers of *onyx*, or milk white chalcedony.

Hauy and *Cleveland*, define sardonyx, to be a reddish yellow variety of chalcedony, &c.

Obs. 1. Amidst this confusion it appeared desirable that the ancient distinctions should be adopted, if they could be ascertained, and it appears from *Rees' Cyclop.* article Gems, that the stone anciently called *onyx*, was one which agreed with the above description of that variety, and that the *sardonyx* consisted of alternate stripes of *sard* and *onyx*, or sard and chalcedony, or both.

* Cach, whence the name.

This account agrees with that of Calmet, who says that sardonyx is sardius united to onyx.

2. Onyx and sardonyx have been employed by ancient, as well as modern artists, for executing those gems in relief, called *Cameos;* the different colors enabling the artist to display his taste and skill with most exquisite effect. Thus if a white translucent zone be next to one of sard, the red ground will impart a beautiful flesh red color to the face, and if a white opake zone comes next above the translucent one, as in the onyx, this may be converted into drapery, &c.

Many celebrated productions of this kind are still preserved, and among them, there are in the Royal Library at Paris, the following. The *Apotheosis of Augustus*, of two brown and two white layers, being an oval of eleven inches by nine. The celebrated *Brunswick Vase*, representing *Ceres* in search of *Proserpine*. *Agrippina* and her two children, the stone consisting of two layers, brown and white. The quarrel of *Minerva* with *Neptune*, three layers. *Venus* on a sea-horse surrounded by cupids, the layers being black and white; see *Rees' Cyclopedia.*

Species 7.—HELIOTROPE.* BLOODSTONE.

Quartz agathe vert obscur et ponctué, H. Heliotrope, A. P. C.

Ext. Char.—Color, deep green, peculiarly rich and pleasant to the eye, interspersed with blood red, or yellowish spots, or dots; fracture conchoidal; translucent on the edges; lustre glistening and resinous; sp. gr. 2.63.

Chem. Char.—Infusible, but loses its color.

Comp. Silex 84; alumine 7.5; oxide of iron 5.—*Thomsdorf.*

Dist. Char. It differs from jasper by its translucency, and from this and most other minerals by the richness and peculiarity of its colors.

Remark. It is called *bloodstone* from the appearance of the red spots, and sometimes *oriental jasper*, because the finest varieties come from the east. These spots appear to be fine red jasper.

Local. Siberia, Iceland, Bohemia, Faroe Islands, Scotland, and India.

U. S. Near Troy, *N. Y.*—*C. U. Shepard.*

Uses. Fine specimens are highly esteemed as an ornamental stone, for seals, snuff-boxes, rings, &c.

Artists who have engraved on this stone, have sometimes availed themselves of its peculiar arrangement of colors to produce striking effects. Thus there exists in the royal collection at Paris, a bust of Christ on a heliotrope, in which the drops of blood are represented by the natural red spots on the stone.

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* From two Greek words signifying, spotted with suns.

Var. 1.—PLASMA.*

Plasma, J. A. P. C.

Ext. Char.—Color, green, with yellow and white spots; fracture conchoidal; lustre feebly resinous; translucent: harder than quartz.

Chem. Char. Infusible, but becomes whitish and opake.

Comp. Silex 6. 75; alumine 0. 25; iron 0 5.—*Klaproth.*

Dist. Char. The green is not so rich, and pleasant, as that of heliotrope. It is darker than chysoprase, and its translucency will distinguish it from jasper.

Local. Italy and the Levant. Moravia, Mount Olympus, Prussia and South America.

It was worn as an ornamental stone by the Romans, and is still esteemed.

Var. 2.—CHRYSOPRASE.†

Quartz agathe prase, H. Chrysoprase, J. A. P. M.

Ext. Char.—Color. apple green; occurs in small masses; fracture conchoidal; translucent; lustre, glimmering; hardness, a little less than that of flint: sp. gr. 3

Chem. Char. Infusible, but becomes opake and white.

Comp. Silex 96.17; lime 0.83; alumine 0.08; oxide of iron 0.08; oxide of nickel 1.0.—*Klaproth.*

Dist. Char. Its color is a little lighter and more lively than those of heliotrope or plasma, and it is without spots. The lustre of prase is vitreous, and its fracture uneven and quartose.

Local. Lower Siberia, in veins with chalcedony.

U. S. New Fane, *N. H.*; color, apple green, amorphous.

Uses. It is highly prized as a gem; ringstones of the finest quality, being sometimes sold for 20 guineas. Its high price has produced excellent imitations in paste.

Species 8—CARNELIAN.‡

Quartz agathe cornaline, H. Carnelian, J. A. P. C.

Ext. Char.—Colors, red of different shades, from light flesh red, to dark blood red, passing into greenish brown, and bright yellow; fracture perfectly conchoidal; lustre, glimmering; translucent or semi-transparent; occurs in rounded masses, also reniform and in thin plates.

Chem. Char. Infusible, but turns opake and loses its color.

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* Plasma Greek; engraving; because the ancients engraved on it.

† From the Greek, a superior kind of *prase*.

‡ From its resemblance to the colour of flesh.

Comp. Silex 94; alumine 3.5; lime 1.5; oxide of iron 0.75.—*Bindheim.*

Dist. Char. Carnelian can only be distinguished by its colors, and in some specimens it is difficult to decide whether it belongs to chalcedony, agate, jasper, or carnelian. Indeed, in many specimens all these varieties are blended together, and insensibly pass into each other. Specimens properly called carnelian, are often spotted with opake jasper, striped, or clouded with cacholong, &c.

Obs. In making carnelian a species, convenience to the learner has been consulted, rather than the dictates of authority.

It is found with chalcedony, agate, and jasper.

Local. India, Arabia, Siberia, and almost every other country. The finest comes from India.

U. S. Near Lake Superior. At the Falls of St. Anthony, and at Herculaneum, *Missouri.* Deerfield, *Mass.*

Uses. Some of the finest specimens of antique engraving, are on carnelian, and the purest and most transparent stones of this kind, are still found among these remains of ancient art. Hence it has been supposed that the ancients possessed the art of improving the beauty of their carnelians, by some process now unknown.

The number of ancient engraved carnelians still preserved, is very numerous, and hence it is inferred that this stone was preferred to all others for this purpose.

Species 9.—AGATE.

Quartz agathe, H. Agate, J. P. C. M.

Ext. Char.—Agate is an aggregate of a variety of silicious substances, each of which maintains, more or less, its own character and color in the mass. The minerals of which agate is composed, are chalcedony, cacholong, quartz, amethyst, carnelian, heliotrope, jasper and common opal.

Obs. 1. In general, only two or three of these minerals are present in a single specimen, and occasionally specimens of agate occur mostly composed of chalcedony, which generally, indeed, is the principal ingredient.

2. The variety of colors which the agate presents, depends chiefly on the number and kind of simple minerals which compose it. Some specimens are dotted or clouded with red carnelian; or striped like the onyx, alternately with chalcedony and cacholong; or in some parts opake, with the presence of jasper, &c. The varieties depend on the arrangement of the colors.

Var. 1. *Ribbon Agate.*—It consists of parallel layers of several simple minerals, as chalcedony, cacholong, jasper, &c. alternating with each other.

Var. 2. *Brecciated Agate.*—This beautiful variety is composed of the angular fragments of the other varieties united into masses by a siliceous cement.

Local. Saxony, in a metallic vein.

Var. 3. *Fortification Agate.*—It consists of a centre of one color, for instance of red carnelian, surrounded by zigzag angular lines of other colors, as of white cacholong, chalcedony, &c ; the whole resembling with the help of the imagination, a fortification.

Var 4. *Mocha-Stone. Moss Agate.*—It is formed of a translucent exterior, with internal appearances like vegetable fibres, as roots, moss, or trees. These perhaps were once real vegetables, changed to stone by the infiltration of silicious particles.

Obs. Dr. Mac Cullock, as stated by Mr. Phillips, has instituted an inquiry into the nature of the vegetable appearances in the varieties of agate, and from which he concludes that they are owing to the existence of real plants in the stone.

Agates are found in porphyry, amygdaloid, greenstone, and serpentine, generally accompanied with chalcedony, carnelian, &c.

Local. Oberstein, in *Germany*. Saxony, Silesia, Italy, Scotland; also in many places in England, and most other countries.

The most beautiful are said to come from Oberstein, in *Germany*.

U. S Near Baltimore, *Md.* In most of the greenstone hills in *New Jersey*. East Haven, *Con.* Also at Woodbury, *Con.* Deerfield, *Mass.* composed of chalcedony, carnelian, sardonyx, and cacholong —*Hitchcock.* Also in Georgia, Missouri, and Indiana. Cumberland, *R. I.* beautiful.

Uses The hardness of agate, and the great variety and beauty of its colors, have brought it into extensive demand, both for useful and ornamental purposes. It is employed for mortars, snuff-boxes, seals, beads, &c.

The ancients employed it for engravings, and some fine cameos still exist on this stone.

Species 10.—JASPER.

Jasper, like carnelian, chalcedony, and agate, is chiefly composed of silex; but it always contains a greater proportion of iron, and hence instead of being translucent, like these minerals, it is always opake.

This species is subdivided into the following varieties.

Var. 1. COMMON JASPER.

Quartz Jaspè, H. Jasper, J. C. P.

Ext. Char.—Colors, red, yellow, and brown, of different shades, often variously intermixed ; also, greenish, bluish, or nearly black, and sometimes white; occurs in amorphous masses of various dimensions : lustre dull, or slightly resinous ; fracture conchoidal; entirely opake ; sp. gr. 2.70.

Chem. Char. Infusible, but turns whitish.

Comp. Silex 75; alumine 0. 5 ; lime 0. 02; iron 13.—*Kirwan.*

Dist. Char. Jasper is distinguished from carnelian heliotrope, hornstone and opal, by its opacity ; jaspery iron ore is heavier than jasper, and blackens under the blowpipe ; pitchstone is fusible ;

Var. 2. STRIPED JASPER. RIBBON JASPER.

Quartz jaspè onyx, H. Striped Jasper, J. A. P. C.

Ext. Char.—Colors, red, yellow, green, grey, or brown, arranged in stripes or bands; sometimes in spots or veins.

Local. Beautiful specimens are found in the Uralian mountains.

Var. 3.—EGYPTIAN JASPER.

Quartz agathe onyx opaque, H. Egyptian Jasper. J. A. P. C.

Ext. Char.—Colors, brown, red, and yellow of various shades, the yellow often light, approaching to cream color. These colors are arranged in irregular zones, or in spots. or dentritic delineations. It occurs in rounded or ovate masses, with a brownish or nearly black and rough external coat.

Obs. This variety is well characterized by the globular shapes of the masses, and their dark, rough, exteriors.

Local. It is found in vast abundance, in Egypt, between Grand Cairo and the Red Sea.

Var. 4.—PORCELAIN JASPER.

Jasper Porcellanite, H. Porcellanite, A C. Porcelain Jasper, P.

Ext. Char.—Colors, grey, or bluish grey, mixed with red, or yellowish, bluish. and brick red, variously intermixed in spots, clouds, or dots; occurs massive; structure sometimes slaty; fracture imperfectly conchoidal; lustre glistening, with the aspect of certain *porcelains;* scratches glass; opake; brittle; softer than the other varieties: sp. gr. 2.6.

Chem. Char. Fusible into a black scoria.

Comp. Silex 60. 75; alumine 27. 25; potash 3. 66; magnesia 3. 00; oxide of iron 2. 50 —*Rose.*

Obs. It is found in the vicinity of coal mines, which have once been in a state of combustion; and is considered as shale altered by heat. In some specimens, there are evident marks of vitrification.

Local. Mount Brassat in France; and at Madely, Dudley, and Staffordshire in England.

Var. 5.—RUIN JASPER.

Ext. Char.—Colors various, but generally the ground is some tint of brown, with different colored delineations resembling ruined buildings; nearly or quite opake.

When ground and polished, it is sometimes a very beautiful mineral.

Species 11.—HORNSTONE.

Quartz agathe grossier, H. Hornstone, J. A. P. C.

Ext. Char.—Color, greyish or yellowish white, also with shades of blue, green, or brown; occurs in masses, nodules, and amorphous concretions: transparent, passing into nearly opake; lustre glimmering and somewhat waxy; less hard than quartz; fracture conchoidal: sp. gr. 2.6.

Chem. Char. Infusible, but turns opake.

Comp. Silex 71. 3; alumine 15. 3; protoxide of iron 9. 3; and a trace of lime—*Faraday*.

Dist. Char. It resembles compact felspar, and petro silex, but they are both fusible. It is less hard than flint, and commonly of a higher color Jasper is opake.

Obs. Hornstone is sometimes *pseudomorpheus*.

Wood-Hornstone, is wood petrified by hornstone. It has the form and texture of wood.

Hornstone is found in veins, in primitive mountains, also in nodules in limestone.

Local. Bavaria, in limestone; Sweden, where it forms the basis of porphyry, and in most other countries.

U. S. Middlebury, Cornwall, Bridport, Orwell, and West Haven, *Ver.* Near Saratoga Springs *N. Y.* also in Albany County, at Bethlehem and at Bern *N. Y.* West side of the Blue Ridge, containing carbonate of copper, and near Baltimore *Md.* West Goshen and Newlin, *Penn.*

Spe. 12.—SILICIOUS SINTER.

Quartz hyalin concretioné, H. Silicious Sinter, J. P C.

Ext. Char.—Colors, white, greyish white, grey, and yellowish grey; occurs in deposites or concretions more or less porous; texture earthy or fibrous; fracture conchoidal or uneven; lustre glistening or pearly; translucent or opake: sp. gr. 1.8.

Chem. Char. Infusible.

Comp. Silex 98; alumine; 1.5; iron 0. 5.—*Klaproth.*

Dist. Char. This substance resembles common opal, but is less compact and has less lustre.

Local. Isle of France.

Var. 1.—OPALINE SINTER.

Ext. Char.—Colors, whitish, with brownish, blackish, or bluish spots; fracture imperfectly conchoidal;

lustre glistening; brittle; translucent on the edges; adheres to the tongue.

Var. 2.—PEARL SINTER.

Ext. Char.—Colors, white, yellowish white, or greyish; lustre, externally shining, internally, glistening and pearly; fracture fine grained, flat conchoidal; translucent on the edges; not so hard as quartz.

Chem. Char. Infusible, without addition.

Comp. Silex 95; alumine 2; lime 2.—*Somerville.*

Obs. It is considered a volcanic production.

Local. Mount Ammiatta in *Italy,* near Santa Fiora. It is sometimes called *Fiorite.*

Var. 3.—MICHAELITE. *Webster.*

Ext. Char.—It occurs in masses. composed both of delicate and coarse fibres, from one inch to four inches long, so crossing each other as to form a beautiful net work. The cross fracture of the fibres has a glistening pearly lustre. Its color, rarely snow-white, is usually greyish white, sometimes with a slight shade of brown, or red.

Its specific gravity is 1. 88.—*Cleveland.*

Comp. Silex 83 65; water; 16. 35.—*Webster.*

Obs. This variety, according to the analysis of Dr. Webster of Cambridge *Mass.* is a hydrate of silex. He found it at the Island of St. Michael, and hence its name.

Silicious Sinter, is a deposite from the water of hot springs, in volcanic countries. The waters of the celebrated Geysers of Iceland, deposit vast quantities of it, and even incrust wood, grass, leaves, &c. with a coat of silex.

U. S. East-Haddam, *Conn.*

Species. 13.—KARPHOLITE.

Karpholite. W. P. C.

Ext. Char.—Colors, yellow or yellowish white; occurs in minute crystals generally radiating, also amorphous, and in an earthy state probably from decomposition; translucent; lustre, glistening and pearly; brittle: sp. gr. about 3.

Chem. Char. Intumesces, whitens and fuses slowly into a brown opake glass.

Comp. Silex 37. 53; alumine 26. 47; oxide of iron 6. 27; oxide of manganese 18. 38. *Steinmann.*

Local. Schlachenwalde in *Bohemia.*

Species 14.—JEFFERSONITE.* *Keating.*

Jeffersonite, P. C. Augite-Spar, M.

Ext. Char.—Color, dark olive green, passing into brown; occurs in crystalline masses; translucent on the edges; cleavage in several directions which appear to be incompatible with each other; streak light green; lustre on the planes of cleavage semi-metallic. on the cross fracture resinous; hardness equal to fluor: sp. gr. 3.55.

Chem. Char. Fusible into a black globule.

Comp. Silex 56; lime 15. 1; alumine 02; prot-oxide of manganese 13. 5; peroxide of iron 10; oxide of zinc 10. *Keating.*

Local. Franklin Iron works *N. J.* in small masses, imbedded in Franklinite.

Species 15.—JENITE.† YENITE.

Ext. Char.—Colors. brown, or brownish black; occurs amorphous, and in prismatic crystals; form the four-sided prism, terminated by four-sided pyramids; sometimes the prism is rhombic; also in eight-sided prisms terminated by eight-sided pyramids, and in fibrous masses; structure foliated; lustre glistening and resinous, or somewhat metallic; opake; scratches glass, and gives sparks with steel: sp. gr. about 4.

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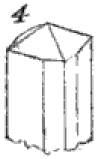

Fig. 4.—A four-sided prism, longitudinally striated, one of the common forms.

Chem. Char.—Fusible into an opate black globule, which is magnetic.

Comp.—Silex 30; oxide of iron 57. 5; lime 12. 5.—*Vanquelin.*

Dist. Char.—Blende, which it resembles in color, is infusible; hornblende, and epidote are of less specific gravity.

Local. Elba in two places, Siberia and Norway. It is found with iron ore, augite, and epidote. It is a very rare mineral.

*In honor of Pres. Jefferson.

† In commemoration of the battle of Jena.

Species 16.—GARNET.

Grenat, H. Dodecahedral Garnet, J. M. Garnet P. C.

The garnet family includes several species, which are composed of nearly the same elements, but in different proportions. All the varieties agree in occurring in dodecahedral crystals, when crystalized at all.

Var. 1.—PRECIOUS GARNET. ALMANDINE.

Ext. Char.—Color, red, mixed more or less with violet or blue, sometimes blood, or cherry red; occurs in crystals; form the dodecahedron, with its varieties; crystals sometimes flattened into tables; also granular; structure imperfectly lamellar; lustre shining vitreous; fracture conchoidal; brittle; translucent, or nearly transparent; scratches quartz: sp. gr. 4.

Chem. Char.—Fusible into a black globule which is often magnetic.

Comp. Silex 35. 75: oxide of iron 36; alumine 27. 25; oxide of manganese 0. 25.—*Klaproth.*

Dist. Char.—Spinelle ruby, which it resembles in color, is infusible: Titanite, which often closely resembles garnet, is by itself, infusible and its crystalline form is different. Hyacinth and leucite are both infusible, the latter is white.

Almandine is found in primitive rocks, as granite and mica slate

Local. Pegu, Bohemia, Hungary, Piedmont, Siberia, Alps, &c.

The most beautiful come from Sirian the capital of Pegu, and are called *Sirian* garnets.

U. S. Hanover, *N. H.* Bethel and Royalton, *Ver.* Goshen, *Conn.* Newlin, *Penn.*

Obs. 1. The precious garnet is cut and polished for jewelry, and is much worn at the present day for ringstones, breast-pins, &c.

2. When set, garnets are easily distinguished from spinelle, and red sapphire, by their more intense color, turpidness, and sombre aspect.

3. The garnet was highly esteemed by the ancients as an ornamental stone, under the name of *carbuncle.* Some beautiful specimens of ancient skill on this stone, are still preserved. The Dog Sirius engraved on the precious garnet, is said to be the greatest master-piece existing, in point of deep work and finish. It is in the collection of the Duke of Marlborough. Among the more modern works on this stone is a head of Louis XIII, preserved in the National Museum, at Paris.

Obs. In Bohemia, garnets are obtained by a regular system of mining, and when cut and polished, constitute an article of commerce, by which an extensive class of people are maintained.

After the garnets are collected, they are passed through vessels pierced with apertures of different diameters, by which means they are sorted into six different sizes. Of the largest size it takes 32 to weigh an ounce; of the next about 40, 75, 110, 165, 256 and 400, to an ounce.

The art of cutting and boring these stones occupies a great number of men.

The boring is done with a diamond fixed to the end of a small rod of metal. The garnet being properly placed and fixed, it is bored by turning the diamond with a bow and string. A workman can pierce 150 per day.

The large pyrope garnets are cut and polished on a disc of sandstone with emery. Of these a workman will finish 30 per day.

This art is carried to very great perfection in Bohemia. In the town of Waldkirck, alone, there are no less than 24 mills, and 140 master-workmen, occupied in manufacturing this article of commerce.—*Rees' Cyclop.*

Var. 2. COMMON GARNET.

Grenat Brun, &c. H. Common Garnet, J. A. P. C.

Ext. Char.—Colors, red, yellowish red, brownish red, or dark brown; occurs crystallized and massive; form the dodecahedron, with its modifications; opake, or feebly translucent; structure lamellar, or granular; fracture uneven; lustre glistening; brittle; less hard than the precious garnet: sp. gr. 3.69. to 3.76.

Fig 5. The dodecahedron with rhombic faces which is the primitive form, and is the most common form under which the garnet appears.

Fig. 6. The same, with the edges truncated.

Fig. 7. A solid with twenty-four trapezoidal faces, forming the trapezoidal garnet, a form under which it sometimes appears.

Obs. The garnet sometimes has 36, 48, or even 60 faces.

Chem. Char. Fusible with more ease than the precious garnet, into a black, or greenish glass.

Chem. Char. Silex 43; alumine 16; lime 20; oxide of iron 16;—*Vauquelin.*

Obs. It is a curious circumstance that the precious garnet should be nearly transparent, with almost 40 per cent of iron, while the present variety is opake, with only 16 per cent of the same metal.

Dist Char. It differs from the precious garnet in being opake, darker colored, more easily fusible, and not so hard.

It is mostly found in primitive rocks.

Local. The common garnet is found in almost every section of country where primitive rocks occur. Its foreign localities are too numerous to mention.

U. S. Haddam, Chatham, Bolton, and Washington, *Conn.* Newbury, Bedford, Plainfield, and Cummington, *Ver.* Interior of *North Carolina*, as large as a child's head.—*Maclure.* Barren-Hills, *Pa.* in dodecahedrons with truncated edges, sometimes five inches in diameter.—*Morton.* Brunswick and Topsham, *Maine.*

Var. 3.—PYROPE.

Grenat granuliforme, H. Pyrope, A. P. C.

Ext. Char.—Color red, often dark blood red, with a tinge of yellow, by the transmitted light; occurs in rounded, angular grains, but never in crystals; transparent, or translucent; lustre splendent, vitreous; fracture conchoidal; scratches quartz: sp. gr. 3.9.

Chem. Char. Fusible into a black glass; tinges borax green.

Comp. Silex 40; alumine 28 5; magnesia 10; oxide of iron and manganese 16. 75—*Klaproth*

Dist. Char. Differs from the other varieties, in never occuring in crystals. When polished, its yellowish tinge and greater transparency distinguishes it from almandine.

It is found in serpentine, and alluvial deposites.

Local. Saxony, and Bohemia; also at Ely in *Scotland.*

U. S. Chester county, *Pa.* Its color is fine dark red.—*Lea.*

Obs. Werner considered the present variety, as nearly allied to the pyrope of the ancients, mentioned by the same name by Pliny, and Ovid.

Var. 4. PYRENITE.*

Pyrenite, J. P. C.

Ext. Char.—Color, black or greyish black; occurs in minute rhombic dodecahedrons, and more rarely, massive; lustre glistening, vitreous; opake; hard: sp. gr. 2.5.

Chem. Char. Melts easily into a porous black slag.

Comp Differs little from common garnet.

Local. Pyrennees Mountains.

Var. 5 GROSSULAR.†

Ext. Char.—Color, green, of several shades; occurs in crystals of the same form as common garnet; translucent; faces of the crystals smooth and shining: sp. gr. 3.37.

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*From the Pyrennees, where it occurs.

†French, Goosbury, from its green color

Comp. Silex 44; alumine 8. 50; lime 33. 50; oxide of iron 12.—*Klaproth.*

Local. Siberia.

Var. 6. APLOME.

Aplome, H. Aplome, P.

Ext. Char.—Colors, deep brown, or orange brown; occurs in rhombic dodecahedrons, the faces of which are striated parallel to their shorter diagonals; fracture uneven; scratches quartz; nearly opake; sp. gr. 3.44.

Chem. Char. Fusible into a black glass.

Comp. Silex 40; alumine 20; lime 14. 5; oxide of iron 14. 5. oxide of manganese 2—*Laugier.*

Dist. Char. The direction of its striae differs from those of common garnet, and its specific gravity is less; in other respects they are much alike.

Local. Siberia, and probably in Saxony.

Var. 7. MANGANESIAN GARNET.

Garnet Manganésié, Bt. Manganesian Garnet, P.

Ext. Char.—Colors, deep hyacinth, or brownish red; occurs in dodecahedral crystals and massive; fracture imperfectly conchoidal; lustre vitreous.

Chem Char. Fusible alone; with borax and nitre, gives a violet globule.

Comp. Silex 35; alumine 14; oxide of manganese 35; oxide of iron 14.—*Klaproth.*

Remark. It is singular that a substance differing so much in composition, from common garnet, should take its form and color.

Local. Franconia.

U. S. Nine miles from Philadelphia, *Penn.* in masses from 1 pound to 100 pounds.—*Jessup.* Corlear's Hook, *N. Y.* Jones' Eddy, near Bath, *Maine.*

Var 8. MELANITE.

Grenat noir, H. Melanite, J. A. P. C.

Ext. Char.—Colors, black or greyish black; occurs in rhombic dodecahedrons; often with truncated edges; fracture imperfectly conchoidal; lustre shining and resinous; opake: sp. gr. 3.7.

Chem. Char. Fusible into a brilliant black globule.

Comp. Silex 35; alumine 6; lime 32; oxide of iron 25; oxide of manganese 0. 4.—*Klaproth.*

Local. Near Vesuvius in Italy. Bohemia, and in the iron mines of Lapmark.

U. S. Germantown, *Penn.* in gneiss; also at Morris' Hill, near the Philadelphia water works.

Var. 9. ALLOCHROITE.*

Allochroite. H. J. P. C.

Ext. Char.—Colors, yellowish brown, brownish grey, greenish, or reddish; occurs amorphous; structure slaty; fracture uneven; lustre feeble; translucent or opake; not so hard as quartz: sp gr. 3.5 to 3.7.

Chem. Char. Fusible into a brilliant black globule; with borax into a green glass, which goes through several changes of color as it cools.

Comp. Silex 35; alumine 8; lime 30.5; oxide of iron 17; oxide of manganese 3.5; carbonate of lime 6.—*Vauquelin.*

Local. Dandrada, in Norway, in an iron mine.

U. S. Near Baltimore, *Md.*

Var. 10. COLOPHONITE.†

Grenat Resinite, H. Colophonite, J. P. C.

Ext. Char.—Colors, blackish or yellowish brown; brownish black, or greenish; occurs in grains or in masses, composed of grains slightly adhering; also in rhombic dodecahedrons; opake or slightly translucent; aspect resinous, and often beautifully irridescent: sp. gr. 4.

Chem Char. Infusible, but turns black; with borax gives a green glass.

Comp. Silex 38; lime 29; alumine 6; protoxide of iron 25.20; water 0.33 —*Seybert.*

This specimen was from Willsborough *N. Y.*

Local Arundel in Norway, in a bed of magnetic iron; also in Ceylon and Italy.

U S Willsborough, *N Y.* It forms a vein 5 feet wide, in a hornblende rock, and is so plentiful that by blasting, hundreds of tons may be obtained. It is easily distinguishable from all other minerals, by the variety and brilliancy of its colors, and by its peculiar resinous aspect. It is composed of small distinct concretions, which may often be separated, even by shaking it in the hand.—*Hall.*

Var. 11. TOPAZOLITE.‡

Topazolite, *Bonvoisin*, P. C.

Ext. Char.—Colors, topaz yellow, or greenish; occurs in dodecahedrons; transparent or translucent.

Comp. Silex 37; alumine 2; lime 29; glucine 4; iron 25; manganese 2.—*Bonvoisin.*

Local. Mussa, in Piedmont.

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*From the Greek, in allusion to its change of color as it cools.

†From the Greek, signifying *resin colored.*

‡From its being similar in color to topaz.

Var. 12. SUCCINITE.*

Ext. Char.—Color, amber yellow; translucent; occurs in globular masses of the size of a *pea;* does not scratch glass; brittle.

Obs. It is probably a variety of *topazolite.*

Local. Piedmont, in serpentine.

Species 17. CINNAMON STONE.†

Prismatic Garnet, J. Cinnamon Stone, P. C. Essonite, H. M.

Ext. Char.—Colors, red, brownish red, yellowish brown, and orange; occurs in fissile masses, and in splintery fragments; transparent or translucent; fracture imperfectly conchoidal; lustre shining, resinous; sometimes occurs in dodecahedral crystals; scratches quartz slightly: sp. gr. 3.6.

Chem. Char. Fusible, with ebullition into dark green translucent glass.

Comp. Silex 38,8; alumine 21.2; lime 31. 25; oxide of iron 6.6.—*Klaproth.*

Dist. Char. The fusible varieties of garnet melt into dark opake globules, and are generally crystallized. The present species is translucent when melted and is rarely found in crystals.

Local. Ceylon, in the sands, and in Brazil.

U. S. Roxborough, *Mass.—Nuttall.*

Var. 1. ROMANZOVITE.

Ext. Char.—Colors, brown, brownish black, or black; occurs compact or in crystalline plates, which indicate the dodecahedron; fracture conchoidal; lustre oily; scratches glass; brittle; streak yellow: sp. gr. 3.60.

Chem. Char. Fusible into a dark globule.

Comp. Silex 41. 2; alumine 24. 1; lime 24. 8; oxide of iron 7. 02; magnesia and oxide of manganese 0. 92; loss 1. 98.—*Nordenskiold.*

Local.—Kimito in Finland, in limestone.

Species 18. IDOCRASE.‡ VESUVIAN.§

Idocrase, H. Pyramidal Garnet, J. Vesuvian, W. Idocrase, A. P. C.

Ext. Char.—Colors, yellowish or brownish green, reddish yellow or blackish brown; occurs massive, but more commonly in crystals; form the four-sided

*Succinum *Amber.* Lat. It is of an amber yellow.

†From its color being that of cinnamon.

‡*Idocrase,* a mixed figure, in allusion to its form.

§*Vesuvian,* because it was found at Vesuvius.

prism, terminated by four-sided pyramids, or it sometimes assumes an eight-sided prism, by truncation of the lateral edges of the four-sided prism; the angles of the summits being also truncated; cleavage parallel to all the planes of the prism; cross fracture small conchoidal; scratches felspar; transparent or translucent: sp. gr. 3.

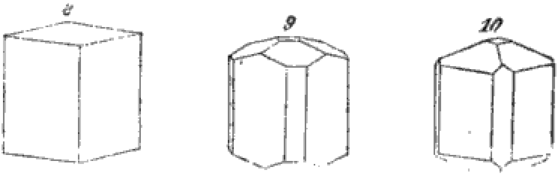

Fig. 8. A right four-sided prism, with a square base. This is the primitive form.

Fig. 9. The four-sided prism with the lateral edges truncated, forming an eight-sided prism, with unequal sides. The edges of the summits are also truncated.

Fig. 10. The same form differently modified by truncation.

Chem. Char. Fusible with ebullition into a translucent glass.

Comp. (That of Vesuvius) Silex 35.50; alumine 33; lime 22. 25; oxide of iron 7. 50.—*Klaproth.*

Dist. Char. Pargasite, which it resembles, has not its translucency, and fuses into a white enamel. Grossular, the variety of garnet which it most resembles in color, occurs in dodecahedrons. Olivine and chysolite are infusible. Epidote, which resembles it in crystalline form and color, wants its transparency, and is only fusible in part.

It is found both in volcanic, and in primitive rocks.

Local. Vesuvius and Etna, Siberia, Piedmont, St Gothard, Norway.

U. S. Worcester, *Mass* in four-sided prisms, of a brown color—*Meade.* Salisbury, *Conn.*—*Silliman.* Cumberland, *R. I.*—*Robinson.*

Uses. At Naples it is cut into ring stones, and sold under various names, as chrysolite, hyacinth, &c —*Jameson.*

Var. 1. EGERAN.

Ext. Char.—Color, deep brown; occurs in crystals in the form of right four-sided prisms, with the lateral edges sometimes truncated; crystals deeply striated; translucent; lustre shining vitreous. It also occurs massive, composed of primitive concretions; scratches felspar: sp. gr. 3.29.

Chem. Char. Fusible, into a blebby glass.

Comp. Silex 41; alumine 22; lime 22; iron 6; manganese 2; potash 1.—*Borkowski.*
Local. *Eger*, in Bohemia, hence the name.

Species. 19. GEHLENITE.*

Ext. Char.—Color, grey, with a greenish or yellowish tinge; occurs in rectangular crystals, nearly in form of a cube, also tabular; surfaces rough and dull; nearly opake; fracture uneven, splintery; scratches glass; structure imperfectly foliated; crystals commonly aggregated: sp. gr. 3.

Chem. Char. Suffers no change, without a flux. With borax, melts into a brownish glass.
Comp Silex 29. 5; alumine 14. 5; lime 27. 55; oxide of iron 12. 2; water 6.; magnesia 0. 25; potash and loss 10.—*Fuchs.*
Local. Fassa in the Tyrol.

Species 20. PREHNITE.†

Prenite, H. Prismatic Prehnite, J. Prehnite A. P. C. Prismatic Triphane-Spar, M.

Ext. Char.—Colors, pale green, or greenish white; occurs in crystalline masses of a fibrous radiating structure; also in distinct crystals, with four, six, or eight sides, and of a tabular form; translucent; in thin pieces transparent; fracture splintery; lustre shining; scratches glass: sp. gr. from 2.6. to 3.1.

Chem. Char. Fusible, with intumescence, into a pale porous glass. Electric by heat.
Comp. Silex 48. 8; alumine 30. 33: lime 18. 33; oxide of iron 5. 66; water 1. 88.—*Klaproth.*
Dist. Char. Beryl, which it resembles in color, is much harder and infusible; stilbite never has the green tinge of prehnite. Zeolite forms a jelly with acids, and from felspar it differs entirely, in structure.
Obs. Prehnite, though always the result of crystallization, often appears massive in consequence of the close and confused aggregation of its crystals. It generally consists, on one side, of tuberose, warty excrescences, composed of minute crystals, with shining faces, or of grannular concretions composed of radiating fibrous crystals, joined together. The other side of the mass or crust, is generally corroded and black.

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* After the chemist, Gehlen.

† In honour of Colonel Prehn, its discoverer.

Var. 1. KAUPHOLITE.*

Fibrous Prehnite, J. Koupholite, P. C.

Ext. Char.—Color, white or yellowish white; occurs crystallized in small rhombic tables; transparent; lustre glistening and pearly.

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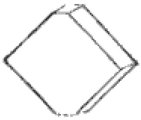

Fig. 11. A rhomboidal plate, the common form.

Comp. Silex 48; alumine 24; lime 23; oxide of iron 4.—*Vauquelin.*

Obs. Prehnite is found chiefly in secondary rock, as amygdaloid, greenstone, hornblende rock, &c.

Local. Cape of Good Hope, where it was first discovered by Col. *Prehn*; Tuscany, Tyrol, many places in Scotland, and in England.

U. S. Scotch Plains, Patterson, and near Newark, *N. J.* At the latter place, masses are found near a foot in diameter.—*Torrey.* Staten Island, *N. Y.* New Haven, Berlin, Woodbury, Simsbury, Granby, Farmington, Hartford and Windsor, *Conn.* Brookfield, Watertown, and Charlestown, *Mass.* At the latter place, in hexagonal tables.—*Waterhouse.* Bellows Falls, *Ver.*

Species 21.—STILBITE.†

Stilbite, H. Radiated Zeolite, J. Stilbite, P. C. Prismatoidal Kouphone Spar. M.

Ext. Char.—Colors, white, grey, yellowish, brownish, orange red, and brick red; occurs crystallized in the form of four-sided prisms, which is the primitive form; also variously modified by truncation. Sometimes it is compressed into the form of a table, and sometimes it assumes the form of a six-sided prism. It terminates in four-sided pyramids, often with truncated angles; translucent, or transparent; structure foliated in one direction; yields to the knife; lustre pearly; crystals sometimes slender and fasciculated: sp. gr. 2.5.

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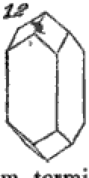

Fig 12. A four-sided prism, terminated by four-sided pyramids,

* From the Greek, signifying a light stone.

† A peculiar lustre.

the faces of which, are set on the angles of the prism. This is a common form.

Chem. Char. Fusible into a blebby, colorless glass.

Comp. Silex 50.24; alumine 29.3; lime 9.46; water 10.—*Vauquelin.*

Dist. Char. Zeolite, which it resembles, forms a jelly with acids, and becomes electric by heat. Prehnite is harder than stilbite, and has not its pearly lustre. Stilbite is foliated, which is not the case with prehnite.

Stilbite is found in the fissures of primitive rocks. It is also associated with zeolite, chabaise, and carbonate of lime, in secondary rocks.

Local. Dauphiny, of a pale straw color. Arendal in Norway. Iceland. Scotland. Giant's Causeway, and in the Faroe Islands.

U. S. Woodbury, *Conn.* Deerfield, *Mass.* associated with chabaise.—*Hitchcock.* Scotch Plains *N. J.* in four-sided prisms, and six-sided tables.—*Pierce. Torrey.* West Farms, *N. Y.* pale and deep red.

Species 22. HEULANDITE.

Heulandite.—*Brooke.* Foliated Zeolite, J. Hemi-Prismatic Kouphone-Spar, M.

Ext. Char.—Colors, white, yellowish white, brownish, red, and sometimes colorless; occurs crystallized in the form of a right oblique angled prism, (two of its opposed lateral planes being longer than the other two,) generally modified by truncation; faces bright and shining; lustre pearly; translucent or transparent; brittle.

Chem. Char. Fusible, with phosphorescence into a porous glass.

Comp. Silex 52.6; alumine 17.5; lime 9; water 18.5.—*Vauquelin.*

Dist. Char. It does not form a jelly with acids, like zeolite. Its crystalline form differs from that of stilbite.

Local. Faroe Isles, Giant's Causeway; Tyrol and Norway.

Remark. This mineral was considered as a variety of zeolite, by Werner and Jameson, and a variety of stilbite, by Hauy.

U. S. Chesterfield, *Mass.* associated with stilbite and chabaise. Distinguished by its superior pearly lustre. Chester, *Mass.*

Species 23. ZEOLITE. MEZOTYPE.

Mésotype, H. A. P. Prismatic Zeolite, J. Zeolite, C. Prismatic Kouphone-Spar, M.

Ext. Char.—Colors, white, sometimes shaded with yellow, grey, or red; occurs in masses and in crystals; form the four-sided prism terminated by four-sided pyramids; but more commonly it is found in masses composed of radiating fibres, or in fasciculated minute crystals of a stellular aspect. Sometimes the crystals are so broad as to give a foliated appearance; fracture splintery; lustre pearly or silky; translucent, sometimes nearly transparent; scratches carbonate of lime: sp. gr. 2.

Chem. Char. Fusible, with intumescence, and phosphorescence into a spongy enamel. Phillips says, fusible without intumescence. It forms a jelly with nitric acid. The proportion of acid should be small.

Comp. Silex 54.24; alumine 29.3; lime 9.46; water 10.—*Vauquelin.* Tennant found 17, and Gehlen 15 per cent, of soda. Possibly these gentlemen analysed different minerals.

Dist. Char. In its radiated structure, zeolite closely resembles prehnite, but differs from it in color, hardness, and lustre. Stilbite is foliated. Chabaise is crystallized in cubes, and from all these as well as from analcime, harmotome, and heulandite, it may be known by its forming a jelly with nitric acid.

Obs. Zeolite is often found in thin fibrous coats investing other minerals.

Var. 1. MESOLITE. NEEDLESTONE.

Mesolite, *Fuchs* and *Gehlen.* Mesolite, P. C.

Ext. Char.—Colors. white or greyish white, or colorless; occurs in long slender prisms, terminated by four-sided pyramids; crystals often radiate from a centre; lustre pearly; resembles zeolite, except in the distinctness and length of the crystals.

Chem. Char. Becomes opake, curls, and then melts into a porous bead.

Comp. Silex 45.8; alumine 26.50; lime 9.87; soda 5.40; water 12.30.—*Berzelius.*

Local. Pargas, in *Finland.* Iceland, Faroe Islands, and in the Tyrol.

Var. 2. NATROLITE.

Natrolithe, H. Natrolite, A. P. C.

Ext. Char.—Colors. white, yellowish white, or reddish brown, disposed in alternate zones around the centre; occurs in mammillary masses composed of diverging fibres; lustre pearly or dull: sp. gr. 2.2.

Chem. Char. Before the blow-pipe, behaves like Zeolite.

Comp. Silex 48; alumine 24.25; soda 16.5; water 9; oxide of iron 1.75.—*Klaproth.*

Local. Near the lake of Constance. In Scotland, and in Suabia.

Var. 3. MEALY ZEOLITE.

Ext. Char.—Colors, white, yellowish grey, or reddish;

occurs in dull friable masses, or in thin coats on other minerals; fracture earthy.

It is, probably zeolite in a decomposing state.

Var. 4.—THOMSONITE.*

Thomsonite,—*Brooke*, P. C.

Ext. Char.—Colors, white and translucent; in thin pieces transparent; occurs in radiating fibrous masses, in the cavities of which are sometimes formed crystals, in form of a right prism, with square bases.

Chem. Char. Infusible, but swells, curls, and becomes snow white, and opake, and loses 13 per cent, of its weight.

Comp. Silex 36.8; alumine 31.36; lime 15.4; magnesia 0.2; peroxide of iron 0.6; water 13.—*Thomson.*

Remark. Phillips has made a species of Thomsonite, but it is evidently a variety of zeolite.

Zeolite is found in secondary rocks, as basalt, greenstone, porphyry, and amygdaloid. It occurs in small masses, or investing these minerals in thin coats. Sometimes it runs in veins, but is seldom more than half an inch, or an inch thick. It is associated with prehnite, stilbite, analcime, calcareous spar, &c.

Local. Scotland, England, Faroe Islands, Brittanny, Tyrol, &c.

U. S. Near New Haven, *Con.* in secondary greenstone.—*Silliman.* Patterson and Scotch Plains, *N. J.* in four-sided prisms. Deerfield, *Mass.* in radiated masses.—*Hitchcock.* At Jones' Falls, *Md.* Near Philadelphia. Near Baltimore, *Md.* in quadrangular prisms.—*Gilmor.*

Species 24. WERNERITE.

Wernerite, H. P. Pyramidal Felspar or Scapolite, J. Scapolite, C. Pyramidal Feld-Spar, M.

Ext. Char.—Colors, greenish grey, olive green, bluish green, and greyish white; occurs massive and crystallized in eight-sided prisms, terminated by four-sided pyramids; lustre glistening or shining; structure foliated; translucent or transparent; crystals often long and deeply striated; the massive is composed of parallel or diverging crystals; fracture splintery; fragments angular; scratches glass: sp. gr. 2.5.

Chem. Char. Fusible, with intumescence, into a white shining enamel.

Comp. Silex 40; alumine 34; lime 16; oxide of iron 8; oxide of manganese 1.5.—*John.*

Local. Buoen, in Norway. Ulrica, in Sweden.

* In honor of Dr. Thomson.

Var. 1. SCAPOLITE.

Paranthine, H. Foliated Scapolite, J. Scapolite, P. C.

Ext. Char.—Colors, grey, white, greenish white, yellowish, and greenish grey; occurs massive and crystallized in four or eight-sided prisms, terminated by four-sided pyramids; primitive form, a right four-sided prism; cleavage parallel to the sides, terminal planes, and both diagonals of a square prism; crystals long and often striated; sometimes acicular and radiating, but more often broad, and collected into groups or masses; structure foliated; translucent; lustre pearly; scratches glass: sp. gr. 2.5.

Chem. Char. Fusible, with intumescence into a shining white enamel. Liable to decomposition, by which it becomes dull, and efflorescent.

Comp. Silex 45; alumine 33; lime 17.6; potash 0.5; soda 1.5; oxide of iron and manganese 1.—*Laugier.*

Dist. Char. It is harder, and less easily fusible than zeolite, or stilbite, nor is it like these soluble in acids. Its crystalline form and structure will distinguish it from prehnite and analcime. Apophyllite separates into flakes in acid, which scapolite does not.

Local. Arendal, in Norway, with oxide of iron. In various places in Sweden and Greenland.

U. S. Bolton, *Mass.* color white, crystals two inches long, form four-sided prisms.—*Meade.* Near Baltimore, *Md.* At Cold Spring, and at West Point, *N. Y.*

Remark. The external characters of Wernerite and scapolite are very nearly the same, and with the exception of a small portion of alkali in the Wernerite, there is nearly an identity of composition. Cleveland has blended the descriptions of both under scapolite. Jameson and Phillips make them separate species. The alkali has not been thought a sufficient reason for separating them, and scapolite has therefore been placed as a variety of Wernerite, until further analysis shall determine its place.

Species 25. ZOISITE.

Zoisite, J. P. A. C.

Ext. Char.—Colors, grey or greyish yellow, or brown; occurs in rhombic prisms, which are compressed and deeply striated longitudinally; terminations commonly incomplete. It also occurs massive; cleavage parallel to the sides of a right rhombic prism; translucent; lustre pearly; scratches glass.

Chem. Char. Fusible, at first into a yellowish transparent glass, but finally into a vitreous scoria; with borax swells, and melts into a vitreous scoria.

Comp. Silex 45; alumine 29; lime 21; oxide of iron 2.4.—*Klaproth.*

Dist. Char. It resembles epidote and tremolite; but the first gives a colored glass with borax, and the second melts into a white enamel.

Local. Carinthia, Franconia, Bavaria, and Tyrol.

U. S. East Marlborough, in regular tetrahedral prisms. Pittsfield, *Mass.* Near Philadelphia, *Penn.* Woodstock, *Vt.*

Species 26. EPIDOTE.

Epidote, H. P. C. Prismatoidal Augite, J. Prismatoidal Augite-Spar, M.

Ext. Char.—Colors, yellowish, bluish, or blackish green; occurs massive, granular, and crystallized in four, six, eight, or twelve-sided prisms; lustre of the massive, glimmering, of the crystals, shining; translucent or opake; fracture of the massive, uneven and splintery; crystals generally grouped, and the crystallization often confused; scratches glass: sp. gr. 3.45.

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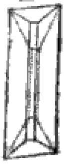

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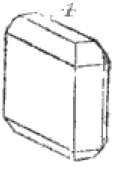

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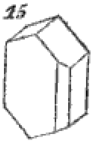

Fig. 13. A four-sided prism with truncated edges, and terminated by two faces standing on the truncated angles.

Fig. 14. A four-sided prism, also truncated and terminated by four planes standing obliquely on the lateral planes.

Fig. 15. A six-sided prism, with unequal lateral planes, and terminated by two unequal faces.

Chem. Char. Turns black, the sharp angles only being fusible into a shining glass. With borax slowly fusible into a greenish transparent glass.

Comp. Silex 37; alumine 21; lime 15; oxide of iron 24; oxide of manganese 15.—*Vauquelin.*

Dist. Char. It resembles actynolite, but the latter turns greyish white, under the blowpipe. This difference will always distinguish these two minerals, provided crystalline fragments of each be taken. Hornblende is easily fusible into a back shining globule. Idocrase is fusible into a translucent yellowish glass. Sahlite whitens and becomes glazed with a yellowish glass. These differences will distinguish the present species.

Var. 1. MANGANESIAN EPIDOTE.

Epidote manganesifere, H. Manganesian Epidote, P. C. Epidote Violet, Bt.

Ext. Char.—Colors, reddish brown, or violet; occurs in small prismatic crystals, closely aggregated into groups; opake; yields to the knife.

Chem. Char. Fusible, with ease into a black glass; with borax into a transparent glass.

Comp. It contains about 12 per cent, of oxide of manganese.

Local. Piedmont, in gneiss, with quartz and asbesters.

Var. 2. GRANULAR EPIDOTE. SKORZA.

Epidote Arenace, H. Arenaceous Epidote, C. Granular Epidote. Skorza, P.

Ext. Char.—Color. yellowish green; occurs in grains of various sizes, and appears to be common epidote disintegrated and reduced to grains by attrition.

Comp. Silex 43.0; alumine 21; lime 14; oxide 16.5; oxide of manganese 0.25.

Local. The borders of the river Arangas, in Transylvania.

Epidote is found chiefly in primitive rocks, both disseminated and in veins.

Local. Iseré, in *France*. Chamouni, in the Alps. Arendal, in *Norway*, crystals an inch in diameter. England, Scotland, Ireland, &c.

U. S. Middlebury and Chester, *Ver.* Near Lake George, *N. Y.* Cumberland, *R. I.* Near Baltimore, *Md.* Blue Ridge, *Va.* Milford, *Con.* Litchfield and Washington, *Con.*; also at Haddam, Saybrook, and Tolland, *Con.* Near Boston. Brighton,Dedham,&c. *Mass.* Also at Newbury, in large crystals.—*Webster.* Franconia, *N. H.* NearNew-York; also in West-Chester, and in the Highlands, *N. Y.*

Species 27. AXINITE.

Axinite, H. Prismatic Axinite, J. M. Axinite, P. C.

Ext. Char.—Colors, violet, brown, green, grey, yellow, and white; occurs in crystals, the form of which is an oblique rhomb, or four-sided prism, so compressed that the edges appear sharp like the edge of an axe; angles often truncated; lustre splendent; fracture uneven; fragments angular; translucent or transparent; occurs also massive; scratches glass: sp. gr. 3.2 to 3.30.

16  17 

Figs. 16 and 17. Present the common forms of these crystals.

Chem. Char. Fusible into a dark greenish glass.

Comp. Silex 44; alumine 18; lime 19; oxide of iron 14; oxide of manganese 4.—*Vauquelin.*

Obs. 1. The crystals are generally striated, except the greenish variety, which is the most perfect.

2. The same crystal is sometimes of various colors, and has various degrees of transparency.

3. Some crystals, and particularly the violet colored, become electric by heat.

It is found in primitive rocks and is rather a rare mineral.

Local. Thum* in Saxony. In the Pyrennees. Mount Atlas. Arendal, in Norway. France. Cornwall, *Eng.*

Species 28. INDIANITE.

Indianite, J. P. C. M.

Ext. Char.—Colors, whitish or greyish, sometimes tinged with brown; translucent; scratches glass; cleaves into prismatic fragments; lustre shining.

Chem. Char. Infusible; becomes gelatinous with acids.

Comp. Silex 42.5; alumine 37.5; lime 15; iron 3.—*Chenevix.*

Obs. 1. It is considered the matrix of corundum, and occasionally contains felspar, garnet, fibrolite, hornblende and mica.

2. It is not a well defined species.

Local. Carniatic.

Species 29. LAPIS LAZULI.

Lazulite, H. Azurestone, of Lapis Lazuli, J. Lapis Lazuli, A. P. C. Dodecahedral Azure-Spar, M.

Ext. Char.—Color, azure blue of various tints, but always intense and beautiful; occurs massive; structure fine grained and compact; lustre glimmering; fracture uneven; scratches glass; opake or translucent on the edges: sp. gr. 2.9.

Chem. Char. Fusible with difficulty into a glassy globule, at first bluish, but soon becomes white. With borax forms a clear glass.

Comp. Silex 49; magnesia 2; alumine 11; lime 16; potash and soda 8; oxide of iron 4; sulphuric acid 2.—*Gmelin.*

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* Jameson calls it *Thumerstone* on this account.

Klaproth found neither soda nor potash. Clement found soda 23. 2, and sulphur 3.1.

Dist. Char. Its peculiar and beautiful color, will distinguish it from most other minerals. The blue carbonate of copper which its color most resembles, becomes dark, and is reduced by the blow-pipe.

Obs. 1. The color of Lapis Lazuli is seldom uniform, and the stone is often interspersed with spots, or veins of iron pyrites.

Local. China, Persia and Bucharia.

According to Patrin, as quoted by Pinkerton, it chiefly comes from Great Bucharia, where it exists in rocks of granite. The amount of Patrin's information on this subject is as follows.

1. Lapis is seldom found pure, except in small pieces.

2. It is disseminated through a granite rock, in all sorts of proportion, but it is rare to find a piece as big as one's head, in which the blue predominates over the white and grey.

3. It is sometimes found in solid pieces, and particularly on the Lake Baikal.

Uses. Lapis Lazuli receives a high polish and is in great demand as an ornamental stone. Specimens in which the yellow pyrites is intermixed, are often exremely beautiful. In the palace which Catharine II. built for her favorite Orlof, at St. Petersburg, Patrin says, there are some apartments entirely lined with lapis, and that it would be scarcely possible to imagine a decoration more simple, and at the same time more magnificent.

But the most important use of this mineral, is that of furnishing the celebrated and beautiful pigment called *ultra-marine blue.*

Beckmann, in his history of Inventions, has devoted an entire chapter to this subject, and as usual, has quoted a great number of authors. From him we learn as follows.

1. Lapis Lazuli was well known to the ancients, under the name of *Sapphire.*

2. The process of preparing the ultra-marine, was known as early as the 15th century.

3. In the eleventh century, lapis, or some preparation of it was used in medicine.

4. It appears also that the process for making ultra-marine, was for a long time kept a secret, and the paint sold at a great price. In 1763 an ounce of it cost at Paris, £4 sterling. It was also sold at a ducat per ounce at Hamburg, and was warranted to "stand proof by fire."

The walls of the palace at St. Petersburg mentioned above, Beckmann says, are covered with amber, interspersed with plates of this costly stone.

The process of extracting the ultra-marine, is found in books on Chemistry. It is employed in oil, and not only gives the richest and most beautiful of all blue colors, but is said never to fade; hence its high price.

Some engravings have been executed on this stone, but it is much too soft for this purpose.

Species 30. DIPYRE.

Dipyre, H. A. P. C.

Ext. Char.—Colors, greyish or reddish white; occurs in slender prisms, fasciculated into masses; form six-sided prisms, but often so minute as to render it difficult to ascertain their modifications; scratches glass: sp. gr. 2.63.

Chem. Char. Turns milk white, phosphoresces, and melts into a blebby colorless glass.*

Comp. Silex 60; alumine 24; lime 10; water 2.—*Vauquelin.*

Local. Pyrennees, in steatite, mingled with sulphuret of iron. It is very rare.

Species 31. LAUMONITE.†

Laumonite, H. J. P. C.

Ext. Char.—Colors, white, sometimes with a tinge of yellow, or red; occurs in aggregated crystalline masses, and in regular crystals; form an octahedral prism, with dihedral summits, variously modified by truncation; primary form an oblique rhombic prism; fracture foliated; structure lamellar; cleavage perfect in two directions; translucent, or transparent; scratches glass: sp. gr. 2.2.

Chem. Char. Fusible with difficulty, into a porous colorless glass. Forms a jelly with acids.

Comp. Silex 49, alumine 22; lime 9; water 17.5; carbonic acid 2.5—*Vogel.*

Obs. The above description applies to the present species, only in its recent, or perfect state. On exposure to the air it *effloresces*, or loses its water of crystallization, and divides into angular fragments; becomes opake, of a milk white color, and pearly lustre, and finally falls into powder. Its appearance in this state, is much like that of selenite, after being exposed to heat.

Local. Brittany, in a lead mine Ireland and Faroe in trap. China, Transylvania, St. Gothard. England in several places.

U. S. Near New-Haven, *Conn.—Silliman.* Philipstown, *N. Y.* —*Barratt.*

Species 32. CLAY SLATE.

Clay Slate, P. Argillaceous Slate, C.

Ext. Char.—Colors, reddish, bluish, greenish, brown, also yellowish brown and black, always dull; occurs

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*Hence the name, which in Greek signifies the double effects of fire, in allusion to its turning white and phosphorescing.

†In honor of Gilbert Laumont.

massive; structure slaty; lustre glimmering; principal fracture slaty; cross fracture earthy, or uneven; opake; yields to the knife; does not adhere to the tongue: sp. gr. about 2.5.

Chem. Char. Fusible into a black slag.

Comp. Silex 48; alumine 25.5; magnesia 1.6; oxide of iron 11.3; oxide of manganese 0.5; potash 4.7; carbon 0.3; water 7.6—*Kirwan.*

It is very universally distributed, and forms vast strata in different countries.

Local. England. Scotland. Ireland, &c.

U. S. Hartford, Windsor, Suffield, *Conn.*

Var. 1.—ROOF SLATE.

Roof Slate, C.

Ext. Char.—Colors, brownish black or bluish black; occurs massive in beds; fracture splintery; cleavage perfect in one direction; easily fusible; surface smooth, or slightly undulating; divides into large thin plates; sonorous, when suspended and struck with a hard body.

It is found both in primitive and secondary rocks.

Local. It is found in most European countries.

U. S. Wayne, York and Lancaster counties, *Penn.* (quarried) Hoosack, *N. Y.* (quarried) Dummerston, Rockingham, Castleton, and Brattleborough, *Ver.* Charlestown, *Mass.* extensively quarried.

Uses. It is employed extensively, in cities, to cover the roofs of buildings.

Obs. In Pennsylvania, roof slate is quarried, to the amount of about 1600 tons annually. It sells at Baltimore, for $22, the ton.—*Hayden.* It is also extensively quarried at Dummerston, and Brattleborough, *Ver.*—*Hall.* And at Charlestown, *Mass.*—*Dana.*

Var. 2. SHINING ARGILLITE.

Shistè luisant, Bt. Shining Argillite, C.

Ext. Char.—Colors, blue, bluish black, grey, and reddish; occurs massive; fracture slaty; surface undulating or waved; lustre shining, sometimes pseudo-metallic.

Obs. This variety is primitive, and passes into mica slate. It abounds with ores; most of the tin and copper mines of Cornwall, traverse this rock.

Var. 3. SHALE.

Slate Clay, J. P. Shale. C.

Ext. Char.—Colors, grey, bluish black, brown, reddish, or greenish; occurs massive; fracture uneven; lustre dull; more or less fusible; yields to the knife; layers often uneven, protuberant, or knobby; adheres a little to the tongue.

Chem. Char. It is fusible by the blowpipe.

Obs. This variety often disintegrates, and falls in pieces.

Dist. Char. It is less solid, and not so hard as argillite; and does not, like roof slate, split into thin smooth layers.

Var. 4. BITUMINOUS SHALE.

Bituminous Shale, J. A. P. C.

Ext. Char.—Color, black or brown; structure slaty; fracture conchoidal; lustre a little shining or dull; yields easily to the knife: sp. gr. about 2.

Obs. This variety contains a considerable quantity of bitumen. When heated, or struck, it exhales a strong bituminous odor, and often burns with a flame. It is a strong indication of coal.

2. Shale frequently exhibits impressions of vegetables, as reeds, ferns, leaves, &c. It also exhibits impressions of fish.

Local. England, Scotland, &c.

U. S. Virginia, Rhode Island, Ohio, Connecticut, &c.

Obs. It is found with the R. Island anthracite, containing impressions of vegetables.

2. At Westfield, *Conn.* is a bed of highly bituminous shale, containing numerous impressions of fish. Sometimes the fish are a foot, or two feet long, the head, fins, and scales, being perfectly distinguishable. A single specimen sometimes presents parts of three or four fish, lying in different directions, and between different layers They are sometimes contorted and almost double. Their color, sometimes grey, is usually black, and the fins and scales, appear to be converted into coal.—*Silliman.*

Var. 5. NOVACULITE.

Argile schisteuse novaculaire, H. Novaculite, K. C. Whet Slate, J. A. P.

Ext. Char.—Colors, yellowish white, or blackish grey, often running in stripes; translucent on the edges; texture fine grained or compact; structure slaty, more or less fissile; fracture conchoidal; fragments sharp edged: sp. gr. 2.75.

Chem Char. Fusible, into a brownish, porous enamel.

Comp. Silex 71.3; alumine 15.3; oxide of iron 9.3; water 3.3.—*Faraday.*

Obs. The Turkish hone often presents the two colors, pale yellow, and bluish or greenish grey, in distinct layers, or stripes. It is from this circumstance, perhaps, that this substance is thought by many to be petrified wood. Sometimes the two layers are cemented together. The yellow, is generally more compact and hard, than the bluish.

Local. In the primitive mountains of Saxony, and in several parts of Germany. It was first brought from the Levant, hence it was called *Turkish* hone.

U. S. Berks County, *Penn.* It is explored, and sells at 25 cents the pound.—*Cooper.* Arkansas Territory, of a good quality.—*Schoolcraft.* Charlestown, Malden, and Dorchester, *Mass.*—*Dana.* Thetford, *Ver.*—*Hall.* Kennebec river, *Maine*—*Cleveland.*

Uses. It is employed to give a fine edge to cutting instruments.

Var. 6. ALUM SLATE.

Alum Slate, J. A. P. Aluminous Slate, C.

Ext. Char.—Colors, bluish, or greenish black, or iron black; sometimes irridescent; structure slaty; layers often curved or undulated; lustre glimmering or dull; fracture uneven or earthy: sp. gr. 2.33.

Chem. Char. Fusible. It turns red by the action of heat, and falls in pieces.

Comp. Silex 40; alumine 16; carbon 19.6; sulphur 2.8; sulphate of iron, lime, and potash 1.5 each; iron 6.4; water 10.7.—*Klaproth.*

Obs. On exposure to the air, it disintegrates, and throws out a saline efflorescence, which covers the surface with a white powder, and which is found to be alum. The production of this salt, is explained on the principle of chemical affinity. The sulphur on exposure, absorbs oxygen from the atmosphere, and is converted into sulphuric acid, which then unites to the alumine and potash, and forms a *sulphate of alumine and potash*, or alum. The alum is then obtained by lixiviation.

Local. Yorkshire, and near Whitby, *Eng.* At Whitby are extensive alum works. Also in Italy, near Rome.

U. S. Frederic, and Washington Counties, *Md.* Near Zanesville, *Ohio.* Near New Lebanon Springs, *N. Y* Pownal, *Ver.* Also in the western counties of *Pennsylvania.*

Var. 7. ADHESIVE SLATE.*

Ext. Char.—Colors, yellowish grey, or greenish brown; occurs massive; texture slaty, which becomes visible on exposure; but if the mass be moistened the slaty characters disappear; splits easily; yields to the knife; adheres to the tongue; sp. gr. about 2.

Comp. Silex 82.50; alumine 0.75; lime 0.25; magnesia 8.0; carbon 0.75; iron 4—*Klaproth.*

Local. Near Paris, in the gypsum formations.

* Because it adheres to the tongue.

Var 8. POLISHING SLATE.

Polishing Slate, J. P. C.

Ext. Char.—Colors, white, yellowish white, or yellow; occurs massive; structure slaty; opake; brittle; swims on water for a short time.

Comp. Silex 83.50; alumine 4; lime 8.50; oxide of iron 1.60; water 9.0.—*Bucholz.*

Local. Bohemia, Saxony, and Auvergne. It is supposed to be a volcanic production.

Use. It is used for polishing glass, marble, the metals, &c.

Var. 9. GRAPHIC SLATE.

Argile schisteuse graphique, H. Drawing Slate, J. Black Chalk, A. P. Graphic Slate, C.

Ext. Char.—Colors, black, greyish, or bluish black; structure slaty; fracture earthy; leaves a black dull trace on wood, or paper; opake; soils the fingers: sp. gr. 2.14.

Comp. Silex 64; alumine 11.25; carbon 11; oxide of iron 2.75; water 7.5.—*Weiglib.*

It is found with argilite, and in the vicinity of coal formations.

Local. Spain, France, Italy, Iceland, &c.

U. S. Rhode Island, with anthracite. On the Susquehannah, *Penn.*

Uses. It is employed for tracing lines on wood, and for making crayons, for drawings.

Species 33. SILICIOUS SLATE.

Silicious schistus, K. Flinty Slate, J. P. Silicious Slate C.

Ext. Char.—Colors, grey, bluish grey, reddish, brown or black; occurs massive; structure slaty; fracture imperfectly conchoidal; lustre glimmering; hardness about equal to that of quartz; translucent on the edges; colors sometimes arranged in spots or stripes: sp. gr. 2.59 to 2.64.

Chem. Char. Infusible, but turns reddish.

Comp. Silex 75; the remainder being lime, magnesia, and oxide of Iron.—*Weiglib.*

Local. Saxony, Bohemia, France, Scotland.

Var. 1. BASINITE. TOUCHSTONE.

Lidian stone, J. A. P. Basinite, K. C.

Ext. Char.—Colors, greyish black, or black; occurs massive, and in rolled pieces; opake; fracture conchoidal; streak black.

Obs. This variety, was formerly much employed as a test of the purity of gold. The metal being drawn across the stone, a judgment of its purity or quantity of alloy, is formed by the color of the streak; and if this is not satisfactory, the trace of metal is touched with nitric acid which dissolves the alloying substance without touching the gold Hence the name *touchstone.*

Local. U. S. Topsham, *Mass.* Northampton, *N. H.* Near Reading and Bethlehem, *Penn.* Topsham, *Me.*

Species 34. CLAY.

The varieties of this species, are composed of silex and alumine, with variable proportions of oxide of Iron, and sometimes a little carbon, manganese and water.

Var. 1. INDURATED CLAY.

Claystone. J. C. Indurated Clay, K. A. P.

Ext. Char.—Colors, grey, yellowish grey, brown, reddish, and sometimes greenish; occurs massive; fracture conchoidal and splintery; yields to the knife; texture compact, or porous; yields an argillaceous odor when moistened; crumbles and falls in pieces in water; opake; sp. gr. about 2.21.

Obs. It sometimes forms the basis of porphyry.

Chem. Char. Infusible, but becomes glazed by heat.

It often occurs in extensive beds.

Var. 2. IRON CLAY.

Iron Clay, J. A. P. C.

Ext. Char.—Color, reddish, or yellowish brown; occurs massive; fracture earthy; opake; easily broken; gives an argillaceous odor; often porous, or amygdaloidal.

Local. Ireland, Scotland, England, &c.

Var. 3. WACKE*

Wakke, Bt. Wacke, A. P. C.

Ext. Char.—Colors, yellowish grey, brownish, greenish, or reddish; occurs massive; fracture conchoidal, or earthy; opake; unctuous to the touch; gives the argillaceous odor when breathed on; may be cut by a knife; sp. gr. 2.53, to 2.89.

Chem. Char. Fusible into a porous slag.

Comp. Silex 28; alumine 23; lime 4.5; water 16.18; oxide of iron 26; carbonic acid 2.32.—*Webster.*

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*Pronounced *Wak-ke.*

It is associated with basalt, and seems to be intermediate between that substance and clay.

Local. Germany, Scotland, Saxony, Norway.

U. S. Near Boston, *Mass.* It there forms the basis of amygdaloid.—*Cleveland.*

Obs. It frequently contains embedded crystals, of mica, hornblende, calcareous spar, &c. In it are also found magnetic iron, chalcedony, agate, and zeolite. It also sometimes contains fossil bones, and petrified wood, but *Jameson* says, it never, like basalt, contains augite, or olivine.

Var. 4. ROTTEN STONE.

Rotten Stone, A. C.

Ext. Char.—Color, brownish grey, or reddish brown, passing into black; occurs massive; fracture earthy and dull; soft; soils the fingers; fetid when rubbed or scraped.

Comp. Alumine 86; silex 4; carbon 10.—*Phillips.*

Local. Derbyshire, where it is believed to arise from the decomposition of the shale, of that country.—*Phillips.*

U. S. Albany, *N. Y.*

Var. 5. PORCELAIN CLAY.

Feldspath decomposé, H. Porcelain Clay, P. Kaolin, Porcelain Clay, K. C.

Ext. Char.—Color, yellowish, or reddish white; occurs massive; composed of small particles slightly coherent; soft; friable between the fingers; unctuous to the touch; adheres slightly to the tongue; absorbs water, and falls to powder; but does not form a ductile paste: sp. gr. 2.20 to 2.40.

Chem. Char. Infusible.

Comp. (From Saxony,) Silex 55; alumine 27; lime 2; water 14; oxide of iron 5;—*Vauquelin.* (From Cornwall,) Silex 20; alumine 60; water 12.—*Wedgewood.* (From Vermont,) Silex 56; alumine 43.—*Smith.*

Obs. This is the clay of which China or porcelain ware, is manufactured. It is infusible even in a porcelain furnace, when pure, but hardens, and acquires a degree of firmness, though not sufficient for the purposes of the manufacturer, without the addition of some flux, as a little lime, by which it is softened in the fire, and as it cools assumes the proper degree of hardness and firmness.

2. Sometimes the best porcelain clay is of a yellowish color, probably from the intermixture of earthy matter, as it becomes white in the fire. When colored by oxide of iron, or other metallic oxides, it becomes reddish or brown in the fire, by which its value is greatly lessened The value of this clay, can therefore be ascertained, only by actual experiment.

3. Porcelain clay, is found in primitive rocks, where it occurs in beds, more or less extensive It is produced by the decomposition of felspar, one of the component parts of granite, and more particularly of graphic granite, which is almost entirely composed of felspar.

Local. Meissien in Saxony, and from which the Saxon porcelain is made. Limoges, in France. Cornwall, in England. Near Passau in Austria, &c.

U. S. Monkton, *Ver.* At this place, it appears to form a large bed, and to be of a good quality for the manufacture of porcelain.—*Silliman.* Near Wilmington, *Del.* Near Philadelphia, *Penn.* in several places.—*Wister.* Washington, *Conn.* in small quantities.

Var. 6. LITHOMARGE.*

Argile Lithomarge, H. Lithomarge. J. A. C.

Ext. Char.—Colors, reddish or yellowish white, also bluish, and greyish white, often spotted internally; occurs massive; opake; fracture conchoidal; texture fine grained; soft; adheres to the tongue: polishes with the nail; falls to powder in water, but does not form a paste: sp. gr. 2.20.

Chem. Char. Infusible; sometimes phosphoresces, when heated.

Comp. Silex 45.2; alumine 39.5; water 14; oxide of iron 2.7.—*Klaproth.*

It is found in veins in porphyry, gneiss, and serpentine, and in beds over coal.

Obs. Werner, divides it into two kinds, *indurated and friable.*

Local. Saxony, England.

U. S. Bare Hills, near Baltimore, *Md.* Montgomery County, *Penn.*

Var. 7. FULLER'S EARTH.

Fuller's Earth, J. A. P. C.

Ext. Char.—Colors, greenish brown, greenish grey, greenish white, yellowish, reddish, and bluish, sometimes striped or spotted; occurs massive; fracture somewhat conchoidal; texture earthy; polishes with the finger nail; unctuous to the touch; soft and tender; becomes translucent when thrown into the water, and falls into a pulpy impalpable powder, but does not become ductile: sp. gr. 1.7 to 2.

Chem. Char. Fusible into a porous slag. Turns white when heated.

Comp. Silex 53; alumine 10; water 24; magnesia 1.25; lime 0.5; muriate of soda 0.1; oxide of iron 9.75.—*Klaproth.*

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*Signifies Rock Marrow.

It is found in beds, sometimes enclosing fossil wood, sea shells, sulphate of barytes, and quartz.

Local. The best, is said to occur in England. It is also found in Austria, Saxony, &c.

U. S. Newfield, *Maine*, Kent, *Conn.*

Uses. This earth was formerly much employed, in the fulling of cloth, whence its name. At the present time, soap is generally substituted.

Var. 8. TRIPOLI.*

Tripoli, J. A. P. C.

Ext. Char.—Colors, various shades of grey, yellow, and red; occurs massive; fracture dull, coarse, and earthy; yields to the nail; rough to the touch; opake; aspect argillaceous; indurated or friable; does not form paste with water; sp. gr. 2.20.

Chem. Char. Infusible, sometimes effervesces with acids, from foreign ingredients.

Comp. Silex 90; the rest being alumine, oxide of iron, and lime.

It is found among secondary rocks, or in alluvial earths.

Local. France, Bohemia, Saxony, Brittany, &c.

Uses. It is used, like emery, for polishing metals, stones, marble, &c.

Var. 9. BOLE:

Bole, K. J. A. P. C.

Ext. Char.—Colors, reddish yellow, brownish black, yellowish white, or pitch black; occurs in solid amorphous masses; opake; fracture conchoidal; smooth to the touch; yields an argillaceous odor when moistened; soils the fingers: sp. gr. 2.

Chem. Char. Turns red, or black, and melts into a porous slag.

Comp. (From Lemnos) Silex 66; alumine 14.5; water 8.5; oxide of iron 6; soda 3.5; lime and magnesia 0.5.—*Klaproth.*

It is found with basalt and wacke.

Local. Armenia and Lemnos.

Obs. Bole appears to be a fine clay, colored by iron.

Uses. Formerly the Armenian bole was much employed in medicine as an astringent and absorbent. That of Lemnos was used when moistened, and made into a thick paste, to take the impressions of seals, and hence was called *terra sigillata.* Bole from Sienna, called *Terra de Sienna*, is a dark brown color, and is used as a paint. At the present time, the red bole is employed at Constantinople, to form the bowls of their tobacco pipes. It takes an exact and beautiful impression from the mould, and when gilded, appears like the finest workmanship.

* It was first brought from Tripoli

Var. 10. CIMOLITE.

Cimolite, H. J. A. P. C.

Ext. Char.—Color, internally greyish white, but acquires a reddish tint by exposure; occurs massive; fracture earthy; texture a little slaty; yields to the nail; adheres to the tongue; gives a shining streak; falls to pieces in water: sp. gr. 2.

Chem. Char. It whitens, but is infusible.

Comp. Silex 63; alumine 23; water 12; iron 1.25.—*Klaproth.*

Local. Argenteria, formerly *Cimolus*, an island in the Archipelago, situated near Milo.

Uses. It was employed by the ancients as a detergent, and is used by the inhabitants of the island as a substitute for fuller's earth, at the present day.

Var. 11.—MOUNTAIN MEAL.

Obs. This singular substance was found in the form of a bed, by Fibbroni, at Santa Fiori, between Tuscany and the Papal dominions. It is formed into bricks, so light as to swim on water.—*Phillips.*

Comp. Silex 79; alumine 5; oxide of iron 3; water 12.—*Klaproth.*

Var. 12. PIPE* CLAY.

Pipe Clay, K. J. P. C.

Ext. Char.—Color, yellowish white; fracture earthy; feels smooth and greasy; adheres to the tongue; when kneaded with water becomes plastic and tenacious.

Chem. Char. Becomes white in the fire, but is infusible.

Obs. This is merely a pure kind of potter's clay.

Local. Devonshire and Dorsetshire, *Eng.*

U. S. Martha's Vineyard, *Mass.*

Uses. Besides tobacco pipes, it forms the basis of queen's ware.

Var. 13. POTTER'S CLAY.

Argile glaise, H. Clay, A. Potter's Clay, P. C.

Ext. Char.—Colors, grey, greyish white, reddish, or bluish; occurs massive in beds; fracture earthy; texture more or less compact; sometimes friable; soft and unctuous to the touch; when dry, receives a polish from the nail; when moistened and worked, it makes a very tenacious and ductile paste: sp. gr. from 1.08 to 2.

Chem. Char. Infusible. Some varieties, however, soften in a porcelain heat.

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* Because tobacco pipes are made of it.

Comp. Silex 43.5; alumine 33.2; lime 3.5; iron 1.0; water 18. —*Klaproth.*

It is found in beds, or forming hills. It often contains organic remains of animals, fish, and plants.

Uses. This clay is employed in large quantities, in the manufacture of *stone ware*, consisting of pots, jugs, churns, jars, &c. which are of a yellowish, or greyish white color. When quite pure, it is necessary to mix with it a proportion of ground flints, to *temper* it for the potter's use. When it contains a sufficient quantity of fine silicious matter, this becomes unnecessary.

Stone ware is glazed in the furnace, by throwing in a quantity of common salt, at a certain stage of the burning. It may also be glazed by a mixture of alkali, ground silex, and oxide of lead, spread on each vessel.

Local. Devonshire, and Hampshire, in *England*, from whence large quantities are taken to supply the potteries at Staffordshire and Newcastle.

U. S. Near Philadelphia, *Penn.* Burlington and Bordentown, *N. J.* of a good quality for Pottery. Also in Maryland. Martha's Vineyard, *Mass.* It is white, and fit for pipe clay. *Missouri*, on the right bank of the Mississippi. This is an immense bed of 34 miles long, and from one to ten feet in thickness.—*Jessup.*

Var. 14. LOAM.

Loam, J. P. C.

Obs. Loam or brick earth, varies very much in appearance, texture and composition. It consists of potter's clay mixed with a portion of sand, carbonate of lime, oxide of iron, mica, chalk, &c.

It is the substance of which bricks are made, and is found in almost every country.

Var. 15. REDDLE. RED CHALK.

Reddle, K. A. C. Red Chalk, J. P.

Ext. Char.—Color, red, of different shades; occurs massive; fracture conchoidal; texture earthy; structure often slaty; soils the fingers, and leaves a bright red trace on paper; opake; adheres to the tongue, and gives an argillaceous odour when moistened; falls to powder in water, but does not form a paste: sp. gr. from 3.13 to 3.93.

Obs. It seems to pass into red oxide of iron. It occurs in small masses in clay-slate, and sandstone, of the more recent formations.

Local. France, Germany, Siberia, &c. That used in commerce, is brought from Germany and France.

Uses. It is principally used for drawing. The coarser varieties are used by the carpenter, the finer by the painter. It is either used in the natural state, or is pounded, washed, and mixed with gum, and cast into moulds. The crayons which are designed for small and delicate drawings, are mixed with a large portion of gum, in order to give them sufficient hardness.—*Jameson.*

Species 35. FAHLUNITE.*

Fahlunite, P. C. M.

Ext. Char.—Color, dark reddish brown, streak greyish white; occurs massive, and in thin layers; opake, or translucent on the edges; yields to the knife; scratches glass; lustre waxy; texture crystalline; sometimes shows a tendency to form six-sided prims.

Comp. Silex 46.74; alumine 26.73; magnesia 2.97; oxide of iron 5.11; water 12.5.—*Heisinger.*

Local. Fahlun, in *Sweden*, embedded in a slaty talcose rock, in a copper mine.

Species 36. HARMOTOME.

Harmotome, H. A. P. C. Pyramidal Zeolite, or Cross Stone, J. Partomatons Kouphone-Spar, M.

Ext. Char.—Colors, greyish white, milk white, sometimes with a tinge of yellow, or red; occurs in crystals which are rectangular four-sided prisms, terminated by rhombic planes, or four-sided pyramids; solid angles often truncated; crystals cross each other lengthwise, or so that the broad planes of one prism are perpendicular to the broad planes of the other. Crystals often compressed into a tabular form; translucent, or transparent; lustre pearly; scratches glass; structure foliated: sp. gr. 2.35.

Fig. 18. A compressed four-sided prism, terminated by a pyramid, consisting of four rhombic faces.

Fig. 19. A double, or twin crystal, consisting of two four-sided prisms joined together, and intersecting each other so as to make their axes coincide.

Chem. Char. Fusible into a diaphanous glass. On hot coals phosphoresces with a greenish light.

* From its locality.

Comp. Silex 49; alumine 16; barytes 18; water 15.—*Klaproth.*

Dist. Char. It does not, like zeolite, form a jelly with acids; arragonite is infusible; staurotide is of a deeper color and infusible. Stilbite exfoliates on hot coals.

Local. In the Hartz, it is found in metaliferous veins, with carbonate of lime, and sulphuret of lead. Also in Norway, Scotland, and Germany. It is a rare mineral.

Species 37. AMIANTHOIDE.*

Amianthoide, H. P. C.

Ext. Char.—Colors, olive green, or greenish white; occurs in long capillary filaments, very flexible and elastic; lustre shining and silky.

Chem. Char. Fusible, with difficulty into blackish enamel.

Comp. Silex 47; lime 11; magnesia 7; oxide of iron 20; oxide of manganese 10.—*Vauquelin.*

Dist. Char. It is more elastic than amianthus, and more flexible than asbestus. The result of its fusion, will also distinguish it from both.

Local. Oisans, in *France.*

U. S. Topsham, *Maine.*—*Cleveland.*

Var. 1. BYSSOLITE.†

Byssolete, P. C. Variety of Amianthoide, H.

Ext. Char.—Colors, green, or brownish yellow; occurs in delicate filaments implanted on other minerals, standing erect, and somewhat resembling a kind of moss. These filaments are flexible and elastic.

Comp. Silex 34; alumine 43; lime 9; oxide of iron 19.—*Saussure.*

Local. At the foot of Mont Blanc, and at Oisane, in France.

Species 38. AUGITE

Pyroxene, H. Oblique edged Augite J. Augite. Pyroxene, P. Augite, A. C.
Paratomous Augite-Spar, M.

Ext. Char.—Colors, green, brownish, or blackish green, yellowish green, grey, and sometimes white; occurs in crystals, in grains, and amorphous; form six or eight-sided prisms, terminated at each extremity by two principal faces; primary form, an oblique rhombic prism; cleavage parallel to the sides of this prism; lustre glimmering or splendent; opake, scratches

* From resemblance to amianthus.
†From its resemblance to lichen or moss.

glass; structure foliated; fracture conchoidal, or uneven: sp. gr. from 3.15 to 3.57.

Obs. 1. The lateral planes of the crystals are often unequal, some being broader than others. Augite is subject to a variety of modifications, by truncation. Sometimes it occurs in hemitrope crystals. It is subject to decomposition, by which it is reduced to a yellowish green, earthy mass.

2. Augite is found in primitive rocks, and in the productions of volcanoes. But whether in the latter case, it existed in the rock previously, and had passed the action of the volcanic fire unaltered, or whether its crystals are formed in the lava, after its ejection, is a matter of doubt and dispute, among geologists.

Chem. Char. Fusible, in small fragments, into a glassy globule, the color of which, depends on that of the specimen.

Comp. Silex 54 86; lime 23.57; Magnesia 16.49; protoxide of iron 4.44; manganese 0.42; alumine 0.21—*Rose.*

Dist. Char. It is commonly darker, and always harder, and heavier than olivine. Hornblende is more easily fusible than augite, sahlite is commonly more translucent, yenite fuses readily, and attracts the magnet. By these differences, this species may be distinguished.

Local. Vesuvius, Etna, Stromboli, Teneriffe, Bourbon, &c. in volcanic products. Bohemia, Hungary, Transylvania, and Hese, in basalt. Norway, in primitive trap. North Wales, Scotland, England, &c. in trap and basalt.

U. S. Kingsbridge, *N. Y.* in primitive limestone. It is white.—*Bruce.* Litchfield, *Conn.* in whitish crystals, sometimes four inches long.—*Brace.* Also at Washington and Brookfield, *Conn.* Deerfield, *Mass.* in black imperfect crystals. Eight miles from Baltimore, in white six-sided prisms. Also five miles from Baltimore, in six-sided prisms, of an olive green, or brownish red color, and sometimes five or six inches long.—*Hayden.* Pittsfield, *Mass.*

The following minerals, are considered varieties of augite.

Var. 1. DIOPSIDE.*

Diopside, J. P. C. Variety of Pyroxene, H.

Ext. Char.—Colors, green, greenish white, greyish, and yellowish white; occurs in crystals, of which the primitive form is an oblique rhombic prism; secondary forms six, eight, or twelve-sided prisms, terminated by four or six faces; crystals longitudinally striated; translucent, or transparent; often compressed into tables; sometimes the crystals are fibrous, and are aggregated into radiating masses; structure foliated; scratches glass; lustre vitreous and shining: sp. gr. between 3.23 and 3.30.

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* From the Greek, signifying transparency.

Chem. Char. Fusible, with difficulty, into a greyish limpid glass.

Comp. Silex 57; magnesia 18.25; lime 16.5; oxides of iron and manganese 6.—*Laugier.*

Dist. Char. It differs from augite and sahlite, in being more transparent, and of brighter green.

Local. Mussa, in Piedmont, and hence it has been called *Mussite.*

U. S. Philipstown, *N. Y.* Pennsborough, *Penn.*

Var. 2. PYRGOM. FASSAITE.*

Pyrgom. Fassaite, P. Fassaite, C.

Ext. Char.—Color, green, of various shades, often blackish green; occurs in crystals of six or eight sides; also in the form of an octohedron, or double four-sided pyramid, truncated on the edges; cleavage parallel to the sides of an oblique rhombic prism; crystals in confused groups; translucent or opake; scratches glass.

Local. In the valley of Fassa, in the Tyrol.

Var. 3. SAHLITE.†

Pyroxene, H. Sahlite, J. A P. C. Paratomous Augite-Spar, M.

Ext. Char.—Colors, greyish green, or pale green; occurs in four or eight-sided crystals, with dihedral summits; also massive, and in granular concretions; structure of the massive lamellar, with joints parallel to the planes of an oblique prism; lustre shining, or glimmering; a whitish foliated substance often interposes between the natural joints; slightly unctuous to the touch; translucent or opake; breaks easily into rhomboidal fragments: sp. gr. about 3.

Chem Char. Infusible, or melts with difficulty into a porous glass. In small fragments with borax it does not melt, but seems to impart its color to the glass.

Comp. Silex 53; alumine 3; lime 20; magnesia 19; oxide of iron and manganese 4.—*Vauquelin.*

Dist. Char. Sahlite is of a paler green than augite, and less transparent than diopside, into which it passes. Fassaite occurs most commonly in crystals, sahlite rarely.

Local. Sahla, in *Sweden*, in a silver mine Arendal, in *Norway*, with iron, lead, and hornblende. Siberia, with beryl and mica.

U. S. Near lake Champlain, *N. Y.* Near Ticonderoga, *N. Y.* in green octohedral crystals of an inch in diameter.—*McEwen.* Near New-Haven, *Con.* in serpentine. It is olive green and foliated.—*Silliman.*

Var. 4. *Baikalite.*—This substance receives its name from the

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* From the valley of *Fassa.*

† Because it was found at *Sahla.*

lake *Baikal*, in Siberia, and was considered by Werner as a distinct variety. But no difference can be observed between it and sahlite. They are therefore considered to be the same mineral.

Var. 5. COCCOLITE.*

Pyroxene granuliforme, H. Coccolite, J. A. P. C.

Ext Char.—Colors, greyish, or bluish green, greenish black, red, or reddish brown; occurs in grains adhering together, and forming masses of irregular shapes; lustre vitreous and shining; scratches glass; translucent; grains angular and easily separable by the fingers: sp. gr. from 3.30 to 3.37.

Chem. Char. Fusible with ease, into a vitreous opake globule.

Comp. Silex 50; alumine 1.5; lime 24; magnesia 10; oxide of iron 7; oxide of manganese 3.—*Vauquelin.*

Obs. The grains of this substance are of all sizes from that of the smallest sand, to that of a pea. Their form is angular, or rounded with irregular shining faces, often resembling crystals. In the same mass the different colors, red, green, &c. sometimes occur in distinct grains. Sometimes thin, white, and apparently silicious partitions run through the masses, and divide them into layers.

Local. Arendal, in *Norway*, with iron and carbonate of lime. Antrim, in *Ireland*, disseminated in limestone.

U. S. West Chester, Ticonderoga, and Philipstown, *N. Y.* Charlotte, *Ver.* At the last locality it is found in abundance, and of various colors.—*Hall.*

Var. 6. WHITE COCCOLITE.

White Coccolite.—*Dr. Barratt.*

Ext. Char.—Color, clear white, or yellowish white; occurs in masses composed of angular grains of the size of gun shot.

Local. Philipstown, Putnam County, *N. Y.* The masses are interspersed with crystals of white augite.

Obs. This is a new variety, and was discovered by Dr. Barratt in 1820.

Dr. Barratt also found at the same locality, *rose colored coccolite.*—*Silliman's Journal.*

Species 39. HORNBLENDE.

Amphibole, H. Hornblende, P. C.

Ext. Char.—Color, dark bottle green, passing into black; occurs massive, crystallized and slaty; form of the primitive, an oblique rhombic prism; secondary form, a six-sided prism, variously modified; crystals

* From the Greek, a granular stone.

striated and often flattened; sometimes distinct, but commonly aggregated, intersecting each other, or in confusedly radiating masses; opake; lustre shining, sometimes pseudo-metallic; indents under the edge of the hammer; breaks with difficulty; fracture, foliated or fibrous; streak and powder, greyish green; yields to the knife: sp. gr. 3.15 to 3.38.

Chem. Char. Fusible, with ease, into a greyish black glass.

Comp. (Deep green.) Silex 47.21; alumine 13.94; lime 12.73; magnesia 21.86; oxide of iron 2.28; oxide of manganese 0.57; fluoric acid 0.90; water 0.44.—*Bonsdorff.*

Obs. There is a considerable variety in the composition of this species.

Dist. Char. Schorl, which it resembles, is much harder, does not give a green streak and powder, and is generally found in distinct, nine sided crystals. It differs from augite in being more easily fusible, softer and tougher.

Obs. 1. Hornblende is a very abundant mineral. It is found chiefly in primitive rocks, but occurs more or less in secondary formations.

2. It frequently enters into the composition of granite, gneiss, and mica slate, and is an essential ingredient in syenite and greenstone.

Local. U. S. Jerico, *Ver.* in long capillary crystals.—*Hall.* Franconia, *Ver.* in superb polished crystals, some of which are nearly half an inch broad, also in long and slender crystals, in a hornblende and serpentine rock. On the Schuylkill, *Penn.* in large masses, and in bladed, or acicular crystals.—*Lea.* Brunswick, *Maine,* fibrous hornblende occurs with white granular limestone.—*Cleveland.*

Var 1. *Massive Hornblende, P.*—This variety presents a crystalline mass, consisting of long, straight, or curved fibrils, often intersecting each other, being closely compacted together. Sometimes the fibrils are twisted or curled, and appear like knots of wood, and sometimes like tufts of hair. It is very tough and difficult to break. Colors as in the species.

Var. 2. HORNBLENDE SLATE.

Hornblende Slate, P. C. J.

Ext. Char.—Color, greenish black; occurs in beds, more or less extensive; texture slaty, each layer being composed of fibres, interlacing, diverging, or curled into knots.

Obs. This variety agrees in all its characters with the massive, except in its slaty structure.

Var. 3. BASALTIC HORNBLENDE.

Basaltic Hornblende, J. A. P. C.

Ext. Char.—Colors, black, brownish black, or jet black; occurs in distinct crystals, in lava, volcanic scoria, and basalt; opake; often moves the magnet; crystals sometimes have a brilliant lustre; structure foliated; easily broken; scratches glass: sp. gr. 3.25.

Chem. Char. Melts with difficulty.

Comp. Silex 47; alumine 26; lime 8; magnesia 2; iron 15.—*Klaproth.*

Dist. Char. It is of a more intense black, and has a much stronger lustre than common hornblende. Schorl is harder, and more easily broken. Its matrix also will generally distinguish it from other black crystals.

Local. Saxony, Bohemia, Hungary, and other countries, where basalt and volcanic products exist.

Var. 4. PARGASITE.

Pargasite, P. C.

Ext. Char.—Color, light bottle green; occurs crystallized in six-sided prisms, with dihedral summits; also in rounded crystalline masses; cleavage parallel to the lateral planes of a rhombic prism; translucent; scratches glass: sp. gr. 3.11.

Chem Char. Fusible into a green glass.

Comp. Silex 42; alumine 14.1; lime 14.3; magnesia 18.3; oxide of iron 3.5; of manganese, 1.0; water and fluoric acid 3.

Dist. Char. This mineral resembles hornblende in every respect, except its lighter color and translucency.

Obs. The specimen before me from Pargas, resembles in color and translucencey, some varieties of prehnite.

Local. Pargas,* in *Finland*, in calcareous spar.

U. S. Chester, *Mass.*

Var. 5. HEDENBERGITE.

Hedenbergite.—*Berzelius.*

Ext. Char.—Colors, greenish black, or dark brown, powder pale brownish green; occurs in masses composed of shining plates; fracture uneven; fragments rhomboidal; scratches carbonate of lime; phosphoresces by heat and friction: sp. gr. 3.15.

Chem. Char. Fusible into a black shining glass, which is sometimes magnetic.

Comp. Silex 40.63; alumine 0.37; water 16.5; protoxide of iron 35.25; oxide of manganese 0.75; carbonic acid 4.93.—*Hedenberg.*

Local. Tunaberg, in *Sweden*, in calcareous spar, with iron pyrites, quartz, and mica.

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* Whence the name *Pargasite.*

Obs. 1. This variety seems to differ from common hornblende, chiefly in the form under which it occurs.

2. Pinkerton quotes several authors to prove that mountains of hornblende exist in several parts of the world. Patrin, he says, observed in Siberia, many mountains entirely composed of it, with occasional veins, or masses of granite.

Species 40. TREMOLITE.

Variety of Amphibole, H. Grammatite, Bt. Tremolite, J. A. P. C.

Tremolite occurs massive, crystallized, fibrous, and granular. Its colors are generally white, and greyish, or yellowish white; lustre shining, vitreous, or silky; it affords several varieties, depending chiefly on the different forms.

Var. 1. CRYSTALLIZED TREMOLITE.

Common Tremolite, J. C. Crystalized Tremolite, P.

Ext. Char.—Color, white, often with a tinge of grey, yellow, or red; occurs in crystals, which are either very flat four, six, or eight-sided prisms, deeply striated, or minute fibres, the forms of which, it is difficult to determine; crystals seldom well defined, but commonly compressed; translucent, sometimes nearly transparent; very brittle; harsh to the touch; lustre glistening or silky; scratches glass: sp. gr. about 3.

Chem. Char. Fusible, in small particles, into a porous white enamel.

Comp. (Fibrous.) Silex 65; lime 18; magnesia 10.33; water and carbonic acid 6.5; oxide of iron 0.16.—*Klaproth.*

Obs. The carbonic acid in the above analysis probably came from the gange, which is commonly limestone or dolomite.

Dist. Char. It may resemble asbestus, but tremolite is very brittle, while asbestus is flexible. It never has the green color of actynolite. The foliated structure of stilbite, and the electrical powers and chemical qualities of zeolite, will distinguish them from tremolite.

Var. 2. FIBROUS TREMOLITE.

Variety of Amphibole fibreux, H. Fibrous Tremolite, P. C.

Ext. Char.—Color, white, often very pure and beautiful; occurs in masses consisting of fine delicate fibres, sometimes long and straight, or gently curved, and sometimes radiating; lustre silky; fibres separable by the fingers; harsh to the touch; friable, sometimes between the fingers, in which case it is apt to penetrate the skin.

Dist. Char. This variety resembles fibrous gypsum, but gypsum instantly becomes opake, when heated, and falls in pieces.

Var. 3. BLADED TREMOLITE.

Ext. Char.—Colors, white, or yellowish, or bluish white; occurs in long flattened prismatic crystals, resembling in form the blade of a double-edged knife; translucent; traversed by cross fissures; easily broken; several inches long.

Obs. These are flattened, four or six-sided prisms.

Var. 4. PYRALLOLITE.*

Pyrallolite, P. C.

Ext. Char.—Color, greenish, becomes white by long exposure; occurs massive, and in crystals; form the flat rhombic prism, resembling the bladed variety of tremolite; crystals an inch or more long; fracture dull and earthy; cleaves into triangular prisms, but not with shining faces; opake, or in thin laminæ, translucent: sp gr. 2.57.

Chem. Char. Becomes black, then white, and the edges are reduced to a white enamel. In powder, phosphoresces on hot iron.

Comp. Silex 56.6; alumine 3.4; lime 5.6; magnesia 23.4; oxide of iron and manganese 1.1; bituminous matter and loss 6.4.—*Nordenskiold.*

Local. Pargas, in *Finland*, in foliated limestone.

U. S. Kingsbridge, *N. Y.* in limestone.—*Nuttall.*

Var. 5. CALAMITE.†

Calamite, P. M.

Ext. Char.—Color, light green; occurs in rhombic prisms, striated longitudinally; translucent; cleavage parallel to the sides of a rhombic prism; soft; resembles tremolite in the form of its crystals, which are traversed by fissures.

Local. Normark, in *Sweden*, with oxide of iron.

Obs. Tremolite is a common and abundant mineral. It is found in limestone, and particularly in that variety called *dolomite*. It was first found in the mountains of *Tremola*, in Switzerland, whence the name.

Local. Its foreign locations are very numerous. Beautiful specimens come from St. Gothard, in *Switzerland*.

* From the Greek, signifying change by fire, in allusion to its turning black or white under the blowpipe.

† From *Calamus*, Latin, a reed, from the appearance of the crystal.

U. S. Litchfield and Washington, *Con.* Beautiful specimens of the bladed and fibrous varieties are found at both places in dolomite. Also at Milford, Canaan, and Goshen, *Con.* Newbury and Bolton, *Mass.* Great Barrington and Sheffield, *do.* At Sheffield the fibres are two feet long.—*Dewey.* Wardsborough and Bellows Falls, *Ver.* Near Baltimore, *Md.* East Marlborough, *Penn.* fibres a foot long.—*Jessup.* Kingsbridge and Tarrytown, *N. Y.* Smithfield, *R. I.* very beautiful.—*Webb.* West Marlborough, *Penn.*

Species 41. ACTYNOLITE.

Variety of Amphibole, H. Amphibole Actinote, Bt. Actynolite, J. P. C.

Ext. Char.—Colors, green, sometimes deep and beautiful, also dark green and brownish ; occurs in single, long, straight, four-sided flattened prisms. crossing each other at various angles, and in fibrous masses, either radiated or curved ; lustre highly shining ; crystals often deeply striated ; translucent ; scratches glass ; brittle : sp. gr. from 3 to 3.30.

Chem. Char. On the first application of the heat, it turns deep brown, afterwards becomes ash grey, with the edges glazed with a black enamel ; tinges borax light green.

Comp. Silex 50 ; alumine 0.75 ; lime 9.75 ; magnesia 19.75 ; oxide of iron 11 ; oxide of chrome 3 ; of manganese 0.5 ; potash 0.5 ; water 5.0.—*Laugier.*

Dist. Char. Its color will distinguish it from hornblende and tremolite, both of which it very nearly resembles in form. Epidote is of a lighter, or yellowish green, and zeolite is greyish white.

Var. 1. BLADED ACTYNOLITE.

Amphibole hexaèdre, H. Common Actynolite, J. C. Crystallized Actynolite, P.

Ext. Char.—Color, deep green, often of various shades in the same crystal ; occurs in long slender. flat, four or six-sided crystals, with alternate sharp lateral edges, and often deeply striated ; summits commonly incomplete ; translucent ; lustre shining ; brittle ; commonly occurs in talc, crystals crossing each other at various angles.

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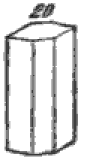

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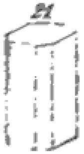

Fig. 20. A flat six-sided prism, the common form.
Fig. 21. The same with the lateral edges truncated.

Var. 2. ACICULAR ACTYNOLITE.

Asbestus Actynolite, J. Acicular Actynolite, C.

Ext. Char.—Color, lighter green than the bladed; occurs in capillary crystals, closely aggregated, and either parallel, intersecting, diverging, or radiating from a centre; lustre glistening; opake; harsh to the touch; brittle and inelastic.

Var 3. *Glassy Actynolite.* It differs from the above variety, in possessing a vitreous, or glassy lustre.

Var. 4. ASBESTIFORM ACTYNOLITE.

Amphibole fibreux. Fibrous Actynolite, C. Asbestiform Actynolite, P.

Ext. Char.—Color, greenish grey; occurs in slender, somewhat elastic, fibrous crystals, closely aggregated; lustre silky; fibres parallel or diverging, and easily separable by he fingers; very brittle.

Dist. Char. It resembles amianthus, but is easily known from it, by its brittleness.

Var 5. MASSIVE ACTYNOLITE.

Massive Actynolite, C.

Ext. Char.—Color, green; occurs in lamellar masses, composed of granular concretions; structure foliated; also disseminated in other minerals.

Obs. Actynolite is found in primitive rocks, as granite, mica slate, and in veins of talc.

Local. Tyrol, and St Gothard, in long six-sided prisms. Norway, Saxony, Piedmont, England, Scotland, and most other countries.

U. S. Bolton, Middlefield, Hawley, and Chelmsford, *Mass.* Windham, *Ver.* in compressed four-sided prisms, sometimes five inches long.—*Hall.* Brunswick, *Maine*, in all its varieties.—*Cleveland.* Near New Haven, and also at Litchfield and Canton, *Conn.* Near Baltimore, *Md.* in all its varieties. Concord, *Penn.* in large masses.—*Conrad.* On the Island of New York, *N. Y.* Near Philadelphia, *Pa.*

Species 42. HYPERSTHENE

Hypersthene H. J. A. P. C. Labrador Hornblende K.

Ext. Char.—Color, blackish green, or dark brown; occurs massive; structure lamellar; cleavage parallel to the sides, and shorter diagonals of a rhombic prism; lustre, when viewed in certain directions, greenish, in others, copper red, and strongly metallic; opake or translucent on the edges; powder, dark greenish grey; yields to the knife slightly; scratches glass.

Chem. Char. Fusible on the sharp edges; with borax, gives a dark green glass.

Comp. Silex, 54.25; magnesia, 14.0; alumine 2.25; lime 15; oxide of iron, 24 5; water, 1.—*Klaproth.*

Local. Hypersthene was first found on the coast of Labrador, and hence has been called *Labrador hornblende.* It occurs, forming a constituent of a rock, with Labrador felspar. It is also found in Greenland.

U. S. On Brandywine creek, *Penn.* color dark green; lustre metallic.—*Jessup.* Hingham, *Mass.* with hornblende. Essex, *N. Y.* crystals two or three inches long, color greyish brown.—*Hall.*

Uses. It is sometimes cut and polished for ringstones, and broaches.—*Cleveland.*

Species 43. METALLOIDAL DIALLAGE.

Diallage metalloide, H. Schiller-Spar, A. P. Metalloidal Diallage, C. Hemi-Prismatic Schiller-Spar, M.

Ext. Char.—Colors, bottle, emerald, or olive green, metallic grey, brownish, or nearly white; occurs massive; structure lamellar, sometimes curved; lustre metallic; opake; colors suddenly appear and disappear as the specimen is turned towards the light, in this respect resembling the Labrador felspar: sp. gr. about 3.

Chem. Char. Fusible with difficulty into a blackish enamel.

Comp. Silex 41; alumine 3; lime 1; magnesia 29; oxide of iron 14; water 10.—*Drappier.*

It is commonly found in serpentine.

Local. Tyrol, Saxony, Scotland, England.

U. S. Near Haverstraw Bay, *N. Y.*—*Schaeffer.* Middlefield, *Mass.*

Species 44. GREEN DIALLAGE.

Diallage Vert, H. Diallage, J. Smaragdite, A. P. Green Diallage, C. Paratomous Augite-Spar M.

Ext. Char.—Color, brilliant emerald green, or grass green; occurs massive and disseminated; structure foliated; cleavage parallel to the sides and diagonals of a slightly rhombic prism; opake or translucent; lustre of the laminæ, pearly or silky; scratches carbonate of lime: sp gr. about 3.

Chem. Char. Fusible with difficulty into a grey, or greenish enamel.

Comp. Silex 50; alumine 21; lime 13; magnesia 3; with a little oxide of iron and chrome.—*Vauquelin.*

Local. On the banks of the Lake of Geneva, in saussurite. Near Turin. Corsica, and Switzerland.

U. S. Crown Point, *N. Y.*—*Gibbs.* New Haven, *Conn.* in serpentine.—*Hall.*

Species 44. ASBESTUS.

Asbeste, H. Asbestus, J. A. P. C. Hemi-Prismatic Augite-Spar, M.

There are several varieties of this mineral, which differ considerably in their external characters but they generally agree in possessing a fibrous structure, more or less a vegitable appearance, and in being infusible in a common fire.

Var. 1. AMIANTHUS.

Asbeste flexible, H. Amianthus, J. A. P. C.

Ext. Char.—Colors, white, yellowish, silver grey, greenish, and reddish; occurs in long threads or plates, easily separable: lustre silky; somewhat unctuous to the touch; soft, flexible, and elastic; fibres usually straight, often resembling raw flax, and sometimes the finest silk.

Chem. Char. Becomes white, brittle, and opake, and then melts into a white enamel; gives a diaphanous glass with borax.

Comp. Silex 59; alumine 3; lime 6; magnesia 29.—*Chenevix.*

Dist. Char. It resembles amianthoide, byssolite and common asbestus. The two first are fusible in a black enamel and tinge borax green. Asbestus is inflexible; the others are flexible.

It is found in veins, in serpentine.

Local. Corsica, in great abundance. Savoy, fibres a foot long. Pyrennees, Cornwall, &c.

U. S. Hoboken, *N. J.* Staten Island, *N. Y.* it is uncommonly beautiful. The fibres are sometimes more than two feet long.—*Pierce and Torry.* New Haven, *Conn.* in serpentine; also at New Milford. Some specimens are exceedingly soft and fine. Kellyvale *Ver.* Mount Holly *Mass.* very abundant.—*Hall.*

Uses. It is said that the ancients preserved the ashes of their dead, by wrapping their bodies in cloth made of this substance, before they were committed to the funeral pile. It was also used for incombustible wicks; but is now considered chiefly as a curiosity.

In Siberia it is said to be manufactured into various articles, as gloves, purses, &c. Incombustible paper has also been made of it, and if it be a fact, that *ultra-marine blue,* will "stand proof by fire; as it was anciently advertised to do, we should have the materials for making incombustible records, an improvement of great consequence to the world.

Cloth is made, by mixing the amianthus with flax, and spinning and weaving the mixture in the usual way, after which the flax is burned out, and the incombustible cloth remains. When such cloth requires cleaning, it may be thrown into a fire, and moderately heated for a few minutes. A strong heat would render it brittle.

Var. 2. COMMON ASBESTUS.

Asbest dur, H. Common Asbestus, J P. C.

Ext. Char.—Colors, greenish grey, green, or yellowish grey; occurs massive, composed of fibres of various lengths, either straight, curved, or radiating from a centre; often appears nearly compact from the close aggregation of its fibres; fracture splintery or fibrous; fibres inflexible and inelastic; translucent on the edges; lustre shining; sp. gr. from 2.54. to 3.

Chem. Char. Easily fusible into a dark enamel.

Comp. Silex 63.5; magnesia 16.0; lime 12.8; alumine 1.1; oxide of iron 6.—*Bergman.*

Dist. Char. Its inelasticity will distinguish it from amianthus, and its softness, particularly in powder, from tremolite and actynolite.

It is usually found in serpentine.

Local. Sweden, Hungary, Uralian mountains, &c.

U. S. On the summit of the Green mountains, *Ver.*—*Hall.* New Castle county, *Del.* in abundance. On the Island of New York, *N. Y.* Also on the banks of the Hudson. Washington, and near New Haven, *Conn.*

Var. 3. MOUNTAIN CORK.

Asbeste tresseé, H. Mountain Cork, A. P. C.

Ext. Char.—Colors, grey, brown, yellowish brown, or pale yellow; occurs in amorphous, or flattish pieces; structure fibrous, with the fibres interlacing each other in every direction; it is somewhat elastic, and so light as to swim in water.

Var. 4. LIGNIFORM ASBESTUS.

Asbeste ligniforme, H. Ligniform Asbestus, K. A. P. C.

Ext. Char.—Colors, brownish, or yellowish; occurs massive, structure fibrous, often much resembling chips of wood; it is hard, the fibres rigid, sometimes straight, but often interwoven, curved or radiated; opake and dull: sp. gr. about 2.

Chem. Char. Fusible with difficulty, into a black slag.

Local. U. S. Mount Holly, *Ver.* Newlin township, *Penn.*

Var. 5. MOUNTAIN LEATHER.

Mountain Leather, P. Variety of Rock Cork, J. A.

Ext. Char.—Colors, brown, yellowish white, or reddish ; occurs in flat layers composed of fibres, straight, or curved ; opake ; layers sometimes separable ; has more or less the aspect of leather.

Local. Washington, *Conn.*

Var. 5. MOUNTAIN PAPER.

Ext. Char.—Color, white ; lustre silky, or pearly ; separable into thin layers, having the aspect of paper.

Local. Washington, *Conn.*

Species 46. SAPPHIRE.

Corundum hyalin, H Rhombohedral Corundum, J. Sapphire, C. Perfect Sapphire, P. Rhombohedral Corundum, M.

Ext Char.—Colors, blue, red, violet, yellow, green, and chatoyant ; also limpid ; occurs crystallized, and in rolled pebbles and angular fragments ; primary form the rhomb ; secondary forms the regular six-sided prism, often truncated, and the double six-sided pyramid, or dodecahedron ; also modified by truncation ; transparent or translucent ; hardness only inferior to that of the diamond ; fracture conchoidal ; cleavage indistinct : sp. gr. about 4.

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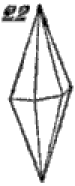

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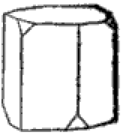

Fig. 22. A double six-sided pyramid.

Fig. 23. A short six-sided prism, with the solid angles alternately truncated. These are the common forms.

Chem. Char. Infusible alone, but loses its color. With borax slowly dissolves into a colorless glass.

Comp. Alumine 98.5 ; lime 0.5 ; oxide of iron 1 —*Klaproth.*

Remark. The varieties of sapphire depend on its different colors.

Var. 1. BLUE SAPPHIRE. *(Oriental Sapphire.)*

Ext. Char.—Color, azure, or indigo blue ; translucent or transparent.

Obs. The color of this variety often differs in the same specimen, some parts being deep blue, while others are nearly colorless.

Var. 2. RED SAPPHIRE. *(Oriental Ruby.)*

Ext. Char.—Color, blood red, passing into aurora, or rose red; cleavage more distinct than in the blue variety; sometimes chatoyant, translucent or transparent.

Var. 3. ASTERIATED SAPPHIRE.

Ext. Char.—Colors, reddish, or violet. When cut in a certain manner it shows a silvery star, of six rays.

Obs. The term *oriental*, merely signifies, that the stone comes from the east, and as most of the gems come from the eastern quarter of the globe, dealers in these articles, often attach this epithet to the name of the stone, in order to raise its value.

2. In addition to the above varieties, lapidaries make the following distinctions The violet sapphire, is called *Oriental Amethyst*. The yellow sapphire, *Oriental Topaz*. Green sapphire, *Oriental Emerald*.

Sapphires are found in alluvial earths, and in the sand of rivers, generally at the foot of primitive mountains. Their matrix is primitive rock, as granite and gneiss, though it has seldom been found in its native situation.

Local. The finest are found in Pegu, on the Island of Ceylon, and in the kingdom of Ava in the East Indies. It occurs also in Bohemia, France, Switzerland, and Portugal.

Obs. 1. The sapphire is often mentioned in scripture, and was the fifth stone in order, on the high priest's pectoral, or breast-plate of judgment, having the name of SIMEON inscribed upon it.

2. Pliny says, that the best sapphires come from Media; perhaps from Mount Sephar mentioned by Moses. Calmet says, that *Shaphir* in Hebrew, which he translates *sapphire*, signifies beauty, and that the orientals had an extraordinary esteem for this stone. Those who wore it about them thought it to be the occasion of their happiness and good fortune.

Uses The sapphire is ranked among the most valuable of gems. It yields in hardness only to the diamond, and is employed in the finest kind of jewelry. It is also employed for jewelling the pivot holes of chronometers, and other astronomical instruments.

Obs. 1. No ancient engravings exist on this stone, probably because its hardness is such, as to resist, like the diamond, the ancient means of engraving gems.

2. Since diamond dust has been used for cutting hard stones, the sapphire has been employed by a few artists. Caldore engraved a portrait of Henry IV, of France, on a sapphire, which was in the cabinet of the Duke of Orleans, and one or two German artists have tried their skill upon it.

3. The red variety is most esteemed under the name of *oriental ruby*.

4. The price of the oriental ruby is estimated by carats, after the manner of estimating the diamond.—*(See Diamond.)*

5. A perfect ruby, above three and a half carats or fourteen grains

is more valuable than a diamond of the same weight. If the weight be one carat, it is worth ten guineas, two carats forty guineas, three carats, one hundred and fifty guineas, six carats, above one thousand guineas. It is said, that in the throne of the Great Mogul, there are one hundred and eight oriental rubies, weighing from one hundred to two hundred carats each.

A blue sapphire of good quality, weighing ten carats, is worth fifty guineas, one of twenty carats, is worth two hundred guineas.

Among the crown jewels of France, is a ruby weighing one hundred and sixty-six carats. At ten guineas the carat, this would be worth two hundred seventy-five thousand, five hundred and sixty guineas. It is said that the lapidaries expose the light-blue varieties to a certain degree of heat, when they become white, and are worn instead of the diamond.

The sapphire is cut with diamond dust, and polished with emery.

Species 47. CORUNDUM.

Corindon harmophane opake, H. Common Corundum, P. A. Adamantine Spar, K. Corundum, C.

Ext. Char.—Colors, greenish, greyish green, reddish, yellowish, bluish, brown, or white; occurs in six-sided crystals, in rolled pieces, also granular and amorphous; structure foliated; cleaves into rhomboidal fragments; lustre shining; translucent or opake: sp. gr. nearly 4; hardness nearly equal to that of sapphire.

Chem. Char. Infusible. Fusible by the compound blowpipe.—*Silliman.*

Comp. Alumine 85.5; silex 7; oxide of iron 14.—*Chenevix.*

Dist. Char. The extreme hardness of this mineral, will distinguish it from all others which it resembles.

Local. India, in the kingdom of Ava, on the coast of Malabar. At Bengal, in China, Thibet, &c. It is accompanied with garnet, fibrolite, zircon and magnetic iron.

Obs. 1. That of China and Ava is brown, or greenish, and sometimes nearly black. That of the Carnatic is blue, or reddish purple. That of Thibet is reddish brown, often coated with steatite.

2. The variety which comes from China, was formerly called *adamantine spar.*

U. S. Laurens District, *S. C.* A six-sided prism has been found. Litchfield, *Conn.* in cyanite. It is greyish blue, and occurs massive and in six-sided prisms.—*Brace.*

Uses. It is employed like emery, for the polishing of hard stones and metals.

Var. 1. EMERY.

Corindon granulaire, H. Emeril, Bt. Emery, K. J. P. C.

Ext. Char.—Colors, blackish or bluish grey, powder brownish black; occurs massive; structure finely granular; fracture uneven, or splintery; opake; lustre a little glistening, or somewhat metallic; hardness equal to corundum; conducts electricity: sp. gr. 4.

Comp. Its constituents are the same as those of corundum.

Local. Saxony, in steatite. Naxos, in the Archipelago, where it is found in abundance, in fragments, or rolled pieces at the foot of a primitive mountain. Italy, Spain, East Indies, and Ireland.

Obs. The emery of commerce, is chiefly from Naxos.

Uses. It is employed almost universally in cutting and polishing stones, steel, &c. For this purpose it is reduced to powder in a steel ll.

Even the sapphire and oriental ruby, the hardest substances, next to the diamond, yields to emery when placed on the lapidary's wheel.

Species 48. DIASPORE.*

Diaspore, H. P. C. M.

Ext. Char.—Color, greenish grey; occurs massive, consisting of laminæ slightly curved, and easily separated; occurs also in cellular masses, consisting of slender crystals; lustre pearly; translucent in thin laminæ; also, though rarely, in separate crystals, in form of a doubly oblique prism: sp. gr. 3.43.

Chem. Char. In the flame of a candle, it crackles, and is *dispersed* in minute fragments, or spangles. It is infusible alone; with borax melts into a colorless glass.

Comp. Alumine 80; water 17; iron 3.—*Vauquelin.*

Nothing is known of its geological situation.

Obs. When heated in a retort, it decrepitates violently, and splits into small white brilliant scales.—*Phillips.*

Species 49. TURQUOISE.

Calaite. Oriental Turquoise, P. Turquoise, C. Mineral Turquoise, J. Calaite, M.

Ext. Char.—Color, bluish green, passing into sky blue, and apple green; occurs in reniform masses, from the size of a nut to that of a goose's egg; opake; powder white; lustre waxy, or dull; fracture conchoidal; not so hard as quartz; decomposes on the outside, when it resembles porcelain clay; sp. gr. about 3.

Chem. Char. Infusible alone; with borax melts into a limpid glass. Suffers no change with acids.

Comp. Alumine 73; water 18; oxide of copper 4.5; oxide of iron 4.—*Johns.*

Local. Persia and Turkey, in alluvial soils.

Obs. A kind of turquoise, which for distinction is called *occidental*

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* From the Greek, in allusion to its being dispersed by heat.

turquoise, is found near the town of Simore, in Lower Languedoc. This is suppos. d to consist of horns, or teeth of animals, penetrated and colored by oxide, or carbonate of copper. This variety consists chiefly of phosphate of lime.

Uses. The oriental turquoise receives a fine polish, and is much esteemed for ring stones, bracelets, watch ornaments, &c. It is greatly esteemed by the Persians, who work it into handles for sabres, &c.

Obs. 1. The ancients, especially the Egyptians, held this stone in great estimation. Some fine engravings were executed on it, but it was considered much too soft for this purpose.

2. This stone is so nearly imitated by the French lapidaries as to make it difficult to discover the difference.

Species 50. GIBBSITE *—*Torrey.*

Gibbsite, C. P. M.

Ext. Char.—Colors, greenish, yellowish, or greyish white; occurs in irregular stalactical masses, with a knobby surface, from one to three inches in length, and an inch in diameter; presenting an aggregation of elongated tuberose masses, somewhat resembling those of prehnite; structure fibrous, radiating from the centre; translucent on the edges; easily reduced to powder; harder than calcareous spar: sp. gr. 2.40.

Chem. Char. Infusible, but whitens. Does not effervesce with acids.

Comp. Alumine 64.8; water 34.7.—*Torrey.*

Obs. This is a new mineral.

Local. U. S. Richmond, *Mass.* in a neglected mine of brown haematite, where it was discovered by Dr. Emmons. Also at Pittsfield, *Mass.*

Species 51. FIBROLITE.†

Fibrolite, H. Bt. P. C. J. M.

Ext. Char.—Colors, white, or greyish white; occurs in minute fibres, closely united, and crossing each other in various directions; harder than quartz; form indeterminate; electric by friction: sp. gr. 3.2.

Chem. Char. Infusible. Emits a phosphoric light, when two pieces are rubbed together

Comp. Alumine 58.25; silex 38; iron 0.75.—*Chenevix.*

Local. It is found with corundum in the Carnatic and China. It is a rare mineral.

U. S. Cummington, *Mass.*—*Nuttall.* Saybrook, *Con.*—*Nuttall.*

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* In honor of Col. Gibbs.

† Because it occurs in fibres.

Species 52. PINITE.

Pinite, H. J. Bt. A. P. C.

Ext. Char.—Colors, brown, blackish brown, or grey; occurs in crystals only; form the regular six-sided prism, variously modified by truncation; sometimes four of its sides are extended, while the others are diminished, giving it the aspect of a four-sided prism with bevelled edges; sometimes it is truncated so as to appear as a twelve-sided prism; structure foliated; lustre glistening, sometimes slightly metallic; fracture splintery; powder unctuous; odor argillaceous; opake or translucent on the edges: sp. gr. 2.98; yields to the knife.

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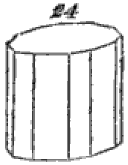

Fig. 24. A twelve-sided prism; or a six-sided prism so truncated as to give twelve faces.

Chem. Char. Infusible, but becomes glazed on the edges.

Comp. Alumine 63.75; silex 25.9; oxide of iron 6.75.—*Klaproth.*

Dist. Char. The form of its crystals, which often appear round, will distinguish it from most other minerals. Some specimens have the aspect of mica. It is softer than scapolite or cyanite.

Local. Saxony, in a mine called *Pini,* whence its name. France, Savoy, Cornwall, &c.

U. S. Haddam, *Con.* in a micaceous rock, crystals several inches long.—*Silliman.* Bellows Falls, *N. H.* in cylindrical crystals.—*Hall.* Lancaster, *Mass.* in six-sided prisms.

Species 53. KYANITE. CYANITE.*

Disthene, H. Bt. Prismatic Kyanite, J. Cyanite, A. P. C. Prismatic Disthene-Spar, M. Sappare.

Ext. Char.—Colors, azure blue, passing into light blue, or bluish white; also bluish green, greyish white, and reddish; colors often vary in the same crystal, from deep blue, running in veins, to bluish white; occurs in masses, composed of a confused aggregation of crystals; also in distinct crystals; form, four, or eight-sided prims, greatly compressed, and having two broad

* From the Greek, signifying blue.

shining faces; translucent or opake; lustre pearly; scratches glass; yields a little to the knife: sp. gr. 3.50.

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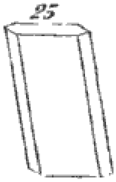

Fig. 25. A four-sided lamellar prism, with two broad and two narrow faces.

Chem. Char. Infusible, but turns white.

Comp. Alumine 55.5; silex 43; oxide of iron 0.5.—*Laugier.*

Obs. Cyanite or *Sappare*, generally occurs in long imperfect crystals closely aggregated, and crossing, or standing on each other, so as to present a singular and curious aspect. Some of the crystals are curved, others are corrugated, or wrinkled, as though they had been pressed endwise, or had not room to stretch themselves full length, others are pressed into triangular shapes, &c.

It is found in primitive rocks, especially in granite.

Local. Switzerland, Tyrol, Spain, and Hungary.

U. S. Several places in Maryland. Chester County, Delaware County, and several other places in *Penn.* Litchfield, Harwinton, Middle Haddam, and near New-Haven, *Con.* That of Litchfield is of a fine azure blue. That of Haddam, is brown. Chesterfield, *Mass.* imperfect crystals sometimes two feet long.—*Webster.* Conway, Granville, Deerfield, and Plainfield, *Mass.* Grafton, Norwich, and Bellows Falls, *Ver.* Orford, *N. H.* East Marlborough, and East Bradford, *Penn.*

Var. 1. RHETIZITE.

Rhetizite, J. C.

Ext. Char.—Colors, bluish grey, yellow, greenish and greyish white; occurs in masses composed of aggregated fibres or in laminæ; fracture splintery or fibrous; lustre shining or pearly; structure foliated presenting broad shining faces, or fibrous; opake, or translucent on the edges: sp. gr. 3.10.

Local. In the Tyrol, at *Rhaetia.*

U. S. Kingsbridge, *N. Y.*—*Schaeffer.* West Chester, *N. Y.*

Species 54. STAUROTIDE.

Staurotide, H. C. Grenatite, J. Staurolite, A. P.

Ext Char.—Color, reddish brown; occurs crystallized, in six-sided prisms, terminated by dihedral summits, often variously modified by truncation; crystals often cross, or intersect each other: lustre, sometimes shining, with a smooth surface, and sometimes rough and dull; scratches quartz; opake or translucent.

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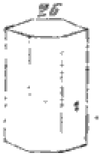

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Fig. 26. A single six-sided prism, the common form.

Fig. 27. Two six-sided prisms united in the form of a cross. This is not an uncommon form.

Chem. Char. Infusible alone; dissolves slowly with borax, giving it a greenish tinge.

Comp. Alumine 52.25; silex 27; oxide of iron 18.50; oxide of manganese 0.25 — *Vauquelin*.

Dist. Char. Its color resembles the garnet, but its form and infusibility will distinguish them. Titanite has a metallic lustre and a different form, and pinite differs from it in form and color.

Staurotide is found most frequently in mica-slate, sometimes in granite, and gneiss.

Local. U. S. Bolton, Litchfield, Harwinton, and Haddam, *Con.* Near Baltimore, *Md.* Sheffield, Northfield, Cummington, and Middlefield, *Mass.* Chester and Putney, *Ver.* Near the city of New-York, *N. Y.* Winthrop, Sidney, Paris, and Hallowell, *Maine.*

Species 55.—AUTOMOLITE.

Spinelle zincifère, H. Automolite, J. A. P. Gahnite, C.

Ext. Char.—Colors, dark bluish green, or blackish green; occurs in octohedrons, or hexahedrons, variously modified by truncation; faces of the crystals often unequal, sometimes mackled; cleavage parallel to all its planes; scratches glass; lustre shining and resinous; opake, or translucent on the edges: sp. gr. 4.26 to 4.69.

Chem. Char. Infusible alone; with borax in powder, gives a greenish glass.

Comp. Alumine 42; silex 4; oxide of zinc 28; oxide of iron 5; sulphur 17.—*Vauquelin.*

Dist. Char. It is heavier, and not so hard as spinelle ruby, and pleonaste; garnet is fusible.

Local. Fahlun, in *Sweden*, in a talcose rock.

U. S. Franklin Iron Works, *N. J.*—*Phillips.*

Species 56. TOPAZ.

Silice fluatée alumineuse, H. Prismatic Topaz, J. M. Topaz, W. A. P. C.

Ext. Char.—Prevailing color, wine yellow, of various tints, also bluish, greenish, lilac, and white; occurs crystallized, in rolled pieces, and massive; form, a six, eight, or ten-sided prism, with various and dissimular terminations; structure lamellar; cleavage parallel to the sides of a right rhombic prism; often electric by heat; fracture small conchoidal; lustre vitreous; scratches quartz; translucent, or nearly limpid: sp. gr. 3.5.

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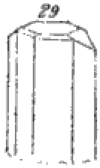

Fig. 28. An eight-sided prism, terminated by four unequal planes.

Fig. 29. The same with the solid angles replaced by truncation.

Chem. Char. Infusible, but after long heating becomes opake; with borax melts into a limpid glass.

Comp. (Yellow Brazilian.) Alumine 47.5; silex 44.5; fluoric acid 7; oxide of iron 0.5.—*Klaproth.*

Remark. In the composition of this species, there is a considerable variety.

Dist. Char It is harder than citrine, which is infusible with borax. The greenish Siberian topaz becomes electric by heat, and not by rubbing. The emerald and beryl are not electric at all. From colored glass, which is often sold for real topaz, it may be distinguished by a fine file, which will scratch the paste, but not the topaz.

Topaz belongs to primitive rocks.

Local. Siberia, Saxony, Bohemia, Brazil, Savoy. Cornwall, *Eng.* and Aberdeenshire, *Scotland.*

U. S. Huntington, *Con.* Color, honey yellow; structure foliated. One crystal from this locality weighed 1 3-4lb, and a fragment of another 2lb. 1oz.—*Hitchcock.* Goshen, *Mass.* This locality was discovered by the Rev. Mr. Hitchcock. It exactly resembles the limpid topaz of Rio Janeiro.

Remark. The largest crystal of topaz, probably ever in Europe weighs 7 ounces, and was found in Aberdeenshire.—*Jameson.*

Obs. 1. The topaz was known to Moses. But whether it was the same which we call by that name may admit of doubts. The ancient topaz was of a green color. Pliny says it was first found by king Juba, but whether he means the same stone with that mentioned by Moses, is also uncertain.

2. The topaz was the second of the first row in the Jewish pontifical breastplate, with the name of *Simeon* inscribed on it.

Uses. The yellow variety is chiefly employed in jewelry, and when of an equal color, and without flaws, it is considerably esteemed, though much too common to be highly valued by the lapidaries.

Obs. 1. The ancients engraved on the topaz. of which a few examples still remain. In the imperial library at Paris, there is a beautiful intaglio on this gem, representing an Indian Bacchus. The cabinet of the emperor of Russia also contains several portraits of emperors, and empresses on the same stone.

2. The topaz is polished on a copper wheel with tripoli and spirits of wine.

Var. 1. PYROPHYSALITE.

Pyrophysalite, J. A. P. C.

Ext. Char.—Colors, greenish white, or pale bluish green; occurs in small roundish masses, and in crystals; translucent or opake; structure lamellar in one direction; fracture, uneven or conchoidal; lustre glimmering; not so hard as quartz: sp. gr. 3.4.

Chem. Char. It intumesces, and gives out a greenish phosphoric light.—*Phillips*.

Comp. It is composed of nearly the same ingredients as topaz.

Local. Fahlun and Finbo, in *Sweden.*

U. S. Goshen, *Mass.*

Species 57. PYCNITE.

Pycnite, H. A. P. C. Schorlous Topaz, J.

Ext. Char.—Color, dull yellowish, or reddish white; occurs in long six-sided prisms, longitudinally striated; crystals, closely aggregated laterally; possesses no regular structure; full of transverse rents; lustre shining; scratches quartz; translucent; brittle; electric by heat: sp. gr. 3.5.

Chem. Char. Infusible alone; with borax slowly dissolves into a limpid glass.

Comp. Alumine 60; silex 30; lime 2; fluoric acid 6; water 1.—*Vauquelin*.

Local. Altenberg, in *Saxony*. Bavaria, Bohemia, Norway, Siberia, &c.

U. S. Chester, *Mass.*

Species 58. CHRYSOBERYL.*

Cymophane, H. A. Chrysoberyl, K. J. P. C. Prismatic Corundum, M.

Ext. Char.—Color, green, with a yellowish or brown-

* A superior kind of beryl.

ish tinge, sometimes reflects a whitish light, which appears to come from the interior of the crystal; occurs massive, crystallized, and in rolled pieces; form, a short broad four or six-sided prism, or table, terminated by four or six-sided summits; translucent, or nearly transparent; structure foliated; lustre shining; electric by friction; scratches topaz: sp. gr. 3.8.

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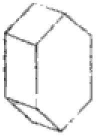

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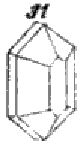

Fig. 30. A broad, short, four-sided prism, or table.

Fig. 31. A flat six-sided prism, so truncated as to appear as an eight-sided prism terminated by six-sided pyramids.

Chem. Char. Infusible alone; with borax, in small particles melts into a yellowish green transparent glass, which becomes colorless on cooling.

Comp. Alumine 71.5; silex 18; lime 6; oxide of iron 1.5.—*Klaproth.*

Dist. Char. The beryl is infusible with borax; the emerald with borax melts into a colorless glass. Its great hardness being next to that of sapphire, will distinguish it from most minerals.

Local. Ceylon and Brazil, where it is found in alluvial soils with the topaz, ruby, and sapphire.

U. S. Haddam, *Conn.* where it occurs chiefly in tabular crystals, of a yellowish green color, embedded in granite with garnet, beryl, and talc.

Use It is sometimes cut and polished for jewelry. It takes a high polish, but its color is seldom of that rich and pleasant green exhibited by the emerald.

Species 58. SPINELLE.

Spinelle, H. J. A. Ruby, C. Spinelle Ruby, P. Dodecahedral Corundum, M.

Ext. Char.—Color, red, often with tints of violet, yellow, or crimson, also dark brown, or black; occurs in round and angular grains, and crystallized in octohedrons, variously modified; translucent, transparent, or nearly opake; structure lamellar; fracture conchoidal; lustre vitreous; scratches quartz: sp. gr. 3.7.

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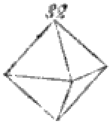

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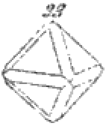

Fig. 32. The regular octohedron.

Fig. 33. The same with the edges truncated.

Chem. Char. Infusible, and retains its color, even when melted by the compound blowpipe.

Comp Alumine 84.47; magnesia 8.78; chromic acid 6.18.—*Vauquelin.*

Remark. The color is probably owing to the chromic acid.

Dist. Char. It resembles the precious garnet, but the garnet is fusible; it also resembles some varieties of the zircon, but these lose their color by heat The red sapphire is harder and of a more lively red than spinelle. It may resemble octohedral iron, but this is magnetic.

It is found with sapphire and zircon, in the sand of rivers. Its geological situation is little known.

Remark. The scarlet colored is termed *spinelle ruby:* the rose red, the *balas ruby;* the orange red, *rubicelle,* and the violet colored, *almandine ruby.—Phillips.*

Local Ceylon, Mysore, and Pegu.

U. S. Roxborough, *Mass.* colors, bluish grey, and dark green.—*Robinson.* Warwick, *N. Y.* At this locality, Dr. Fowler of Franklin, has discovered red and black spinelles of enormous and unprecedented sizes. The *red* is of various shades inclining to brown, and the largest crystals, (octohedrons,) are nearly 4 inches in circumference. The *black* crystals are still larger; the largest measures 16 inches around the base, and many others give a base of 4 and 8 inches.

Both kinds are embedded in pink carbonate of lime, associated with crystals of serpentine.—*Silliman's Journal.*

Var. 1. PLEONASTE.

Pleonaste, H. A. P. Ceylanite, C.

Ext. Char.—Color, dark blue, or greenish black; occurs in octohedral crystals, and in rounded grains; structure indistinctly foliated; cross fracture conchoidal; scratches quartz; feebly translucent; transmits, in thin pieces, a dark, bluish, or greenish light: sp. gr. 3.8.

Chem. Char. Suffers no change alone; with borax melts into a dark green glass.

Comp. Alumine 72.25; silex 5.48; magnesia 14.63; oxide of iron 4.26—*Berzelius.*

Dist Char. It is not so hard as spinelle.

Local. Ceylon, in alluvial soils. Vesuvius and Somma, in the cavities of volcanic rocks.

Species 59. IOLITE.*

Iolithe, H. Iolite, A. P. C. Prismato-Rhomboidal Iolite, J. Prismatic Quartz, M.

Ext. Char.—Color, violet blue, or purple, sometimes with a tinge of black; by transmitted light, in one direction, brownish yellow, in another, indigo blue: occurs massive, and in regular six and twelve-sided prisms; cleavage parallel to the sides of a six-sided prism; lustre, shining vitreous; fracture imperfectly conchoidal, or uneven; translucent or opake; structure foliated; scratches glass, and sometimes quartz: sp. gr. 2.56.

Chem. Char. Fusible on the edges; with borax dissolves slowly into a diaphanous glass.

Comp. Silex 42.6; alumine 34.4; lime 1.7; magnesia 5.8; oxide of iron 1.5; oxide of manganese 1.7.—*Gmelin.*

Local. Cape de Gatte and Grenada, in Spain, in a blue clay. Tunaberg, in Sweden, with pyritous copper. Greenland, embedded in quartz, or felspar. Siberia and Ceylon, in rolled masses.

Var. 1. PELIOM.†

Peliom, W. P. C.

Ext. Char.—Color, blue; occurs in six-sided crystals, truncated on the angles; fracture conchoidal; resembles the iolite in every respect except in color.

Local. Bodemnais, in Bavaria, in grey granite.

Var. 2. STEINHEILITE ‡

Steinheilite, J. P. C.

Ext. Char.—Color, light blue, sometimes with a tinge of red; rarely colorless; translucent; occurs amorphous; lustre shining; fracture conchoidal: sp. gr. 2.69.

Comp. Silex 49.95; alumine 32.28; magnesia 10.45; oxide of iron 5.—*Von Bonsdorff.*

Local. Finbo, in Finland, mixed with pyrites.

Species 60. LAZULITE.

Lazulet de Verner, H. Azurite, J. Lazulite, A. P. C.

Ext. Char.—Color, fine azure blue; occurs in crystals; form, the oblique four-sided prism, and the six-

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* From the Greek, a violet, or purple stone.

† Signifying blue color.

‡ After Count Steinheil.

sided prism ; also, and more commonly, in grains and small masses of the size of a hazlenut ; structure foliated ; translucent ; scratches glass ; lustre vitreous and shining ; brittle.

Chem. Char. Infusible alone ; with borax forms a yellowish glass.

Comp. Alumine 66 ; silex 10 ; lime 2 ; magnesia 18 ; oxide of iron 2.5 —*Tromsdorf.*

Dist. Char. It resembles lapis lazuli and the azure carbonate of copper. But the lazulite is never impregnated with iron pyrites, and the lapis rarely occurs in crystals. The carbonate of copper is heavier, blackens under the blowpipe, and tinges borax green.

The lazulite does not afford the *ultra marine.*

Local. Stiria, in quartz, and Saltzburg, in clay-slate.

Species 61. CHRYSOLITE.

Peridot, H. Prismatic Chrysolite, J M. Chrysolite, A. P. C.

Ext. Char.—Colors, green, yellowish green, and brownish green ; occurs in angular rounded crystalline grains ; primary form, a right prism, with rectangular bases ; secondary form, eight, ten, or twelve-sided prisms, with truncated pyramidal terminations ; the number of terminal faces varies from six to ten ; sometimes the termination is wedge-shaped, with truncated edges ; fracture conchoidal ; lustre, splendent and vitreous ; translucent or transparent ; crystals often compressed, with the broad lateral planes striated ; scratches glass : sp. gr. 3.4.

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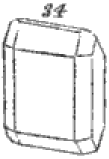

Fig. 34. A ten-sided prism, with two broad faces, terminated by two principal planes corresponding with the lateral planes.

Chem. Char Infusible alone, but turns brown ; fusible with borax into a greenish transparent glass.

Comp. Magnesia 50.5 ; silex 38 ; oxide of iron 9.5.—*Vauquelin.*

Local. Hungary, in serpentine. In the isle of Bourbon, among volcanic products.

The chrysolite of commerce comes from the Levant.

Obs. 1. The chrysolite was the tenth stone in the Jewish high priests pectoral, bearing the name of *Zebulon.*

2. The Hebrew word commonly translated *chrysolite,* has also been rendered *carbuncle* and *beryl.*—*Calmet.*

Uses. Chrysolite is sometimes employed in jewelry, but is little esteemed on account of its softness.

Var. 1. OLIVINE.*

Peridot Olivine, Bt. Olivine, J. P. C.

Ext. Char.—Color, olive green; occurs in masses of various sizes, from grains to many pounds in weight; translucent; lustre shining, often metallic and irridescent from decomposition; fracture small conchoidal; structure somewhat foliated; brittle; sp. gr. about 3.24.

Chem. Char. Becomes brown, but does not melt; with borax fuses slowly into a yellowish green translucent glass. Loses its color in nitric acid.

Comp. Silex 50; magnesia 38.5; lime 0.25; oxide of iron 12.—*Klaproth.*

Dist. Char. Its metallic lustre, foliated structure, and deeper colored glass when melted with borax will distinguish it from chrysolite, and its localities from the other minerals which it resembles.

Local. Bohemia, in basalt. Isle of Bourbon, in lava, and in most volcanic products. It is also occasionally found in trap and greenstone porphyry.

Olivine is said also to have been found by Professor Pallas, in the meteoric iron of Siberia.

Species 62. BRUCITE.†—*Gibbs.*

Maclurite.—*Seybert.* Condorcite.—*Berzelieus.* Brucite, C. P. Chondorcite, M.

Ext. Char.—Color, wine or amber yellow, or yellowish brown; occurs in grains and crystalline masses; also in four-sided prisms, with rhombic bases; lustre a little pearly; structure not apparent, or indistinctly foliated in one direction; crystals generally imperfect, sometimes terminated with dihedral summits; fracture uneven; hardness equal to that of felspar; translucent: sp. gr. 3.2.

Chem. Char. Infusible alone, but becomes white; with borax fuses slowly into a transparent globule, tinged with iron.

Comp. (From Pargas.) Magnesia 54; silex 38; oxide of iron 5.1; alumine 1.5; potash 0.86; manganese a trace.—*D'Ohsson.*

(That of Sparta.) Magnesia 54.000; silex 32.666; fluoric acid 4.086; potash 2.108; peroxide of iron 2.333; water 1.000.—*Seybert.*

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* From its color.

† In honor of Prof. *Bruce*, of New York.

Local. Sudermannland, in Sweden.

U. S. Sparta, *N. J.* in foliated limestone, where it was discovered by *Dr. Langstaff.* Warwick, Orange County, *N. Y.*

Species 63. HYDRATE OF MAGNESIA.

Hydrate of Magnesia, A. J. P. C. Native Magnesia.—*Bruce.*

Ext. Char.—Color, white, often tinged with green; occurs in plates, or thin pieces; structure foliated; the folia often radiating from a centre; lustre shining and pearly; somewhat elastic: translucent, in thin plates transparent; soft; yields to the nail; adheres slightly to the tongue; dissolves entirely, without effervescence in acids: sp. gr. 2.13.

Comp. Magnesia 70; water 30.—$\boxed{Bruce}$ Langstaff

Local. U. S. Hoboken, *N. Y.* in veins, from a few lines, to two inches in thickness, in serpentine. Also in Unst, one of Shetland Islands, traversing serpentine in all directions.

Species 64. SERPENTINE.*

Serpentine, Br. Bt. Serpentine, K. J. A. P. C. M.

Ext. Char.—Colors, green, yellowish, brownish, or blackish green; also, reddish and greyish: colors often run into spots, stripes, or veins; occurs massive, and very rarely in rhombic crystals; fracture splintery, uneven, or conchoidal; translucent or opake; receives a high polish; unctuous to the touch; yields to the knife: sp. gr. 2.5.

Obs. Serpentine, in rhomboidal crystals has been discovered by Samuel Fowler, M. D. in Warwick, Orange County. *N. Y.* This appears to have been the first discovery of crystallized serpentine, in any country. It occurs in crystalline carbonate of lime, with *spinelle, scapolite,* and *Brucite.*—*Silliman's Journal.*

Warwick is probably one of the richest mineral localities in this, or any other country.

Chem. Char. Infusible alone, but turns white; with borax slowly dissolves with bubbling into a transparent greenish glass.

Var. 1. PRECIOUS SERPENTINE.

Precious perpentine, J. C. Noble Serpentine, P. Serpentine noble, Bt.

Ext. Char.—Colors, green, yellowish, or blackish green, or brown, often clouded; occurs massive; fracture conchoidal; translucent; fragments sharp edged;

* From its resemblance to the skin of a *serpent.*

lustre glimmering; unctuous to the touch; yields to the knife; texture compact: sp. gr. 2.2.

Comp. Silex 32; magnesia 37.24; alumine 0.5; lime 10.2; oxide of iron 6; water 14.—*Hisinger.*

Dist. Char. It is softer and more easily broken than nephrite, or jade, which it most resembles.

It is found in masses and beds in primitive limestone, gneiss, and mica-slate.

Local. Sweden, Bohemia, Saxony, Cornwall. In Italy it is intermixed with limestone forming the *verd antique.*

U. S. Milford, *Conn.* It is embedded in primitive limestone, in irregular masses commonly enveloped in amianthus, and containing chromate of iron. Its color is a rich green, and it receives a high polish. Near Newburyport, *Mass.* The precious serpentine of this place is often extremely beautiful, and perfectly resembles that of Kevens, in Cornwall.—*Dewey.* Philipstown, *N. Y.* associated with white augite.—*Barry.*

Var. 2. COMMON SERPENTINE.

Common Serpentine, J. A. P. C.

Ext. Char.—Colors, green, yellowish green, blackish green, brown, bluish grey, or reddish; colors variously intermixed, or running in stripes or veins; opake or feebly translucent on the edges; occurs massive; fracture uneven, or splintery; harder than precious serpentine: scarcely yielding to the knife; often gives out the odor of clay, when breathed on: sp. gr. 2.5.

Comp. Magnesia 44; silex 44; alumine 2; oxide of iron 7.3; oxide of manganese 1.5; oxide of chrome 2.—*Vauquelin.*

Obs. 1. It is found in primitive mountains, and according to Werner, in more recent formations overlaying the older primitive rocks.

2. It occurs with, and commonly embraces the precious serpentine.

Local. Portsoy, in Scotland. Shetland Isles, Hebrides, Cornwall, &c.

U. S. Bare Hills, near Baltimore, *Md.* West-Chester and Montgomery County, *Penn.* Hoboken and Compton Plains, *N. J.* Rye, *N. Y.* Newport, *R. I.* Grafton, *Ver.*

Obs. 1. At Mount Rosa, serpentine is found at an elevation of from 7 to 9,000 feet.

2. The whole front of the Alps, which looks towards Italy, every where affords serpentine.

3. France, has some mountains of this mineral, particularly in Limousin.

4. The finest serpentine is said to occur near Grenada, in Spain, superb columns of which, decorate the churches, and palaces of Madrid.

5. The mountain, called *Red Horn*, near Mount Rosa, is elevated upwards of 7,000 feet, and is composed of compact serpentine, divided into irregular masses of immense size.

6. The serpentine of Bareith, is spotted with garnets of the size of a pea, the base being green. Ornaments are made of this, presenting fine red spots, contrasted with a deep rich green ground.

7. Saussure, found on the shores of the lake of Geneva, a variety of serpentine of remarkable specific gravity, it being 3.00.—*See Pinkerton.*

Uses. Jameson says, that at Zoblitz, in Upper Saxony, several hundred persons are employed in quarrying, cutting, turning, and polishing the serpentine, which occurs in the neighbourhood, and that the various articles into which it is manufactured, are carried all over Germany.

Species 65. ZIRCON.

Zircon, H. Bt. Pyramidal Zircon, J. M. Zircon, A. P. C.

Ext Char.—Colors, grey, green, yellowish, red, bluish, brown, and reddish; occurs in rounded grains or fragments; also crystallized, in the form of four-sided prisms, terminated by four-sided pyramids, and in dodecahedrons, composed of four hexagonal lateral faces, and of four rhomboidal terminal ones at each extremity; cleavage in two directions parallel to the axis of the crystal; structure indistinctly foliated: harder than quartz; translucent or transparent; lustre resinous, or adamantine: sp. gr. 4.4.

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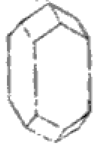

Fig. 35. A four-sided prism, terminatd by four-sided pyramids. This is the common form.

Chem. Char. It is infusible, but loses its color; with borax it forms a transparent glass.

Comp. Zirconia 69; silex 26.5; oxide of iron 0.5.—*Klaproth.*

Dist. Char. It is not so hard as chrysoberyl. It is more transparent than staurotide. Idocrase, which it resembles, is fusible alone, and from these and all other stones which it resembles, it may be known from its greater specific gravity, hardness, and peculiar oily lustre when cut and polished

It occurs in the beds of rivers and alluvial soils, with spinelle, tourmaline, &c. also embedded.

Local. Ceylon, in the sand of rivers, and embedded in crystalline slate. Norway, in sienite. Galloway, in Scotland, and Auvergne in France.

U. S. Buncombe County, *N. C.* in four-sided prisms, terminated by four-sided pyramids. On the Schuylkill, 14 miles from Philadelphia, *Penn.* in small light brownish crystals.—*Jessup.* Near Trenton, *N. J.* Also at Franklin Furnace. At Schooley's Mountain, *N. Y.* Sharon, *Conn.* Color, dark brown, crystals seldom exceed half an inch in length.—*Silliman.* Two miles from Baltimore, *Md.* Philipstown, *N. Y.* East Marlborough, *Penn.* in beautiful tetrahedral prisms, color, brownish red.—*Carpenter and Spackman.*

Uses. It is cut and set as a precious stone. Jameson says it exhibits in a faint degree the play of colors belonging to the diamond, and that it is frequently sold as an inferior kind of diamond. The pale variety is used in the jewelling of watches instead of the diamond.

Var. 1. HYACINTH.

Zircon Hyacinth, Bt. Hyacinth, K. J. A. C. P.

Ext. Char.—Color, various shades of red, as yellowish or brownish red; occurs in small angular, or rolled grains, and in crystals; form, the four-sided prism, terminated by four planes, which are set on the lateral edges; crystals short, small, and often variously terminated; lustre vitreous, inclining to resinous; structure foliated; transparent or translucent; fracture conchoidal; cleavage parallel to the sides of the primitive octohedron: sp. gr. 4 to 4.6.

Chem. Char. Infusible, loses its color but retains its transparency. With borax fuses into a colorless glass.

Comp. Zirconia 70; silex 25; oxide of iron 0.5.—*Klaproth*

It occurs in primitive rocks, and is found in the beds of rivers.

Local. Ceylon. Near Pisa, in Italy. Auvergne, in France, in volcanic sand. Lisbon, Saxony, and in Fifeshire, in Scotland.

Obs. 1. The *oriental hyacinth* is an orange colored sapphire. The *occidental hyacinth* is a topaz. The *volcanic hyacinth* is the idocrase, or vesuvian.

2. The hyacinth is frequently mentioned by the sacred writers. St. John says that the eleventh foundation of the heavenly city is a hyacinth, and in Canticles, gold rings, set with hyacinths, are spoken of. Moses often speaks of the hyacinth color, which learned interpreters say meant, violet color, or azure blue tinged with red. Hyacinth color now means yellowish red, so that it is at present uncertain what stone the ancients meant by the hyacinth, most probably however it was the amethyst.

Uses. When of a good color, and without flaws, it is much valued in jewelry. It is said, that after destroying the color by heat, it is sometimes sold for the diamond.

Var. 2. JARGOON.

Zircon Jargon, Bt. Jargon, K. Jargoon, A. P. Common Zircon, C.

Ext. Char.—Colors, greenish, bluish grey, and brownish red, always faint and passing into colorless ; occurs in small four-sided prisms, and in grains ; lustre splendent and adamantine ; transparent or translucent : sp. gr. 4.4.

Chem. Char. Becomes limpid by heat, but is infusible.

Comp. Zircon 66 ; silex 31 ; oxide of iron 2.—*Vauquelin.*

Local. Ceylon, in the sands of rivers. Italy, Spain, and several parts of India.

Uses. It is employed in jewelry, particularly in ornamenting watch cases, and is said to be frequently sold in Paris for the real diamond. Indeed after the colorless variety is cut and set, it is difficult to distinguish it from diamond. It is considered the most valuable of the varieties of zircon.

Species 66. EUCLASE.*

Euclase, H. Bt. A. P. C. Prismatic Emerald, or Euclase, J. Prismatic Emerald, M.

Ext. Char.—Color, light green of various shades ; greenish white, bluish green, or sky blue : occurs in crystals, in the form of oblique angled, four-sided prisms, variously modified and terminated ; structure laminated ; cleavage parallel to the sides of the prism : lustre strongly vitreous ; cross fracture conchoidal ; scratches quartz ; very brittle ; translucent or transparent ; sp. gr. 2.91 to 3.32. Crystals longitudinally striated.

Chem. Char. Fusible into a white enamel.

Comp. Glucine 21.78 ; silex 43.32 ; alumine 30.54 ; iron 2.22 ; oxide of tin 0.70.—*Berzelius.*

Dist. Char. Its fusibility and brittleness will distinguish it from the greenish varieties of zircon ; idocrase melts into a yellowish glass. The different forms of its crystals will distinguish it from emerald and beryl.

Local. Peru and Brazil. Its localities and associations are unknown.

Jameson observes, that it is a beautiful fossil, but cannot be employed in jewelry on account of its brittleness.

Obs. Phillips has given the figure of a crystal of euclase, which exhibits 78 longitudinal faces. The faces are so narrow as to make it appear striated.

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* From the Greek, signifying easily broken, in allusion to its brittleness.

Species 67. BERYL.

Berryl, K. Beryl, J. A. P. C. Rhomboidal Emerald, J. M. Aqua-Marine.

Ext. Char.—Colors, green, yellowish green, bluish green, or greenish white, always pale; occurs in six-sided crystals, terminated by six-sided pyramids; crystals often taper gradually, from one end to the other, and are of all sizes, from a line to a foot in diameter; lateral faces striated, often so deeply as to render the angles indistinct; large crystals frequently contain other substances, or are hollow in the line of the axis; transparent or translucent; lustre vitreous; scratches quartz; fracture uneven or conchoidal: sp. gr. 2.67.

Chem. Char. Infusible, but turns white and turbid. With borax, it fuses into a nearly transparent glass.

Comp. Silex 68; alumine 15; glucine 14; lime 2; oxide of iron 1.—*Vauquelin.*

Dist. Char. It differs from the emerald in being of a paler green; apatite is much softer and dissolves in nitric acid, it also phosphoresces on hot coals. The greenish variety of tourmaline, resembles the beryl, but is softer, electric by heat, and fusible alone.

Beryl belongs to primitive rocks, and particularly to that variety of granite called graphic. It is associated with garnets, quartz, chrysoberyl, schorl, topaz, &c.

Local. Siberia, Persia, on the confines of China. Limoges, in France. Aberdeen, in Scotland. Peru, Brazil, Saxony, and Elba.

U. S. Haddam, Brooklyn, Litchfield, Chatham, and Middle Haddam, *Conn.* Crystals 7 or 8 inches long have been found at Haddam. One in the cabinet of Yale College is 7 inches long, and 9 in the diagonal diameter.—*Silliman.* Germantown, Chesnut Hill, East Marlborough, and in Chester County, *Penn.* Chesterfield, Goshen, and in the vicinity of Boston and Northampton, *Mass.* At Goshen, two rose colored emeralds have been found, one of which is an inch and a half long.—*Gibbs.* In the state of Maine, it is found more or less constantly to an extent of 30 miles in the counties of Lincoln and Cumberland, also at Topsham and Bowdoinham.—*Cleveland.* Cumberland, *R. I.*

Uses. Beryl is occasionally employed in jewelry, but its pale color and numerous fissures commonly render it unfit for this purpose. The greenish variety is set with a steel colored, or greenish blue foil. The pale or nearly limpid variety is set on a black ground like the diamond, or on a silvery foil.

Obs. 1. The beryl is mentioned in scripture as the eighth stone in the high priest's pectoral, or according to Calmet, the twelfth, with the name of *Napthali*, engraved on it. According to some learned writers, our beryl is the same with that meant in scripture.

2. The only remarkable differences between the emerald and beryl are in their colors, which however produce such an uninterrupted series, that only arbitrary limits can be fixed within it. The color of emerald, is emerald green; all the varieties of other colors are beryl. —*Mohs.*

Species [illegible]. EMERALD.

Emerande, H. Rhomboidal Emerald. J. Emerald. A. P. C.

Ext. Char.—Colors, lively emerald green, or bluish green, always rich and beautiful; occurs in long six-sided prisms, generally perfect, and variously terminated; structure imperfectly foliated; not so large as beryl; scratches quartz; lustre vitreous and shining; becomes electric by friction; crystals seldom more than two or three inches long; transparent or translucent; sp. gr. from 2.60 to 2.77.

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Fig. 36. A six-sided prism, acuminated by six planes corresponding with the lateral planes.

Fig. 37. A six-sided prism, terminated by a six-sided pyramid, the planes of which are set on the angles of the prism, with the angles of the summit truncated.

Chem. Char. Fusible with difficulty into a porous glass. With borax slowly dissolves into limpid glass.

Comp. Silex 64.5; glucine 13; alumine 16; lime 1.6; oxide of chrome 3.25.—*Vauquelin.*

Dist. Char. It is known from beryl by its deeper and richer green, and from green tourmaline by the same quality. From apatite by its greater hardness and insolubility in acids, and from chrysoberyl, by being less hard, more transparent, and of a brighter green.

The emerald has been found chiefly in secondary countries, but it is supposed that its proper situation is in primitive rocks.

Local. The finest emeralds formerly came from Manta, in Peru, but it is said that this mine is exhausted, and that the best are now found in the valley of Tunca, in Santa Fe, where they occur in granite.

Obs. 1. The emerald was well known to the ancients, and was the third stone according to Calmet's arrangement, on the high priest's breast-plate of judgment, with the name of *Zebulon* inscribed on it.

2. In the time of Pliny, this stone was held in so high estimation, that it was seldom or never engraved upon, which probably is the reason, that scarcely any well authenticated antique engravings

exist on this gem. The moderns have, however, engraved upon it, as there exists in the royal collection at Paris, a head of Henry IV, and another of Lewis XIV, on the emerald.

An emerald is said to have existed at the Chapel of our Lady, at Loretto, in Italy, larger than a man's head, and for which an English gentleman offered 90,000 crowns.

3. Keysler, in his travels has given the outline of an emerald, which he saw at the monastery of Reichenau, in Switzerland, and which was presented by Charles the Fat. This emerald, says he, weighs 28lb. 3qrs., and could be sold for £6,550 sterling per pound.

Later authors, however, say that this is *green fluor*, or *green glass*.

4. Probably the largest real emerald ever found, was that possessed by the inhabitants of the valley of Manta, in Peru, which according to De la Vega, was about the size of an ostrich's egg. When the Spaniards arrived there, it was worshipped, as the goddess, or mother of emeralds, and smaller ones were brought to it as offerings.

5. But perhaps the most magnificent specimen of genuine emeralds in the world, was presented to the cathedral of Loretto, by one of the Spanish kings. It consists of a mass of white quartz, thickly implanted with emeralds more than an inch in diameter.

6. According to Mohs, the locality where the ancients procured their emeralds, had been lost until within a few years, but has been re-discovered in Mount Zalara, Upper Egypt, in granite and mica-slate.

Uses. Emeralds are cut and polished for the most expensive kind of jewelry. Those of the first quality require no foil, but are set on a black ground like the diamond; inferior ones are set with a green gold foil, or on green satin.

Species 69. GADONOLITE.*

Gadonolite, H. Prismatic Gadonolite, J. M. Gadonlite, A. P. C.

Ext. Char.—Colors, greenish, or brownish black; occurs massive, and rarely in crystals which are ten-sided prisms; lustre splendent, or shining resinous; slightly translucent; scratches glass; fracture conchoidal: sp. gr. 4.20.

Chem. Char. Before the blowpipe it intumesces and throws out cauliflower-like ramifications.—*Phillips.*

Mohs says it decrepitates, but does not melt except in small splinters.

Cleveland says that it becomes red as if burning. In nitric acid it loses its color, and is converted into a jelly.

Comp. Ittria 54.75; silex 21.25; glucine 5.5; alumine 0.5 oxide of iron 17.5; water 5; magnesia, a trace.—*Klaproth.*

Local. Sweden, in several places.

Obs. The new earth *ittria*, was first discovered in this mineral by Dr. Gadolin.

U. S. Bolton, *Mass.*—*Webster.*

* After Gadolin, who first found it.

CLASS II.

ACIDIFEROUS EARTHY MINERALS.

Under this head are included such minerals as consist of an Earth combined with an Acid; some of them contain small portions of metal, as iron, manganese, and perhaps chrome, &c.

LIME.

This earth has never been found pure except in small quantities. For the most part it is found combined with carbonic acid, forming *carbonate of lime;* it also occurs combined with sulphuric acid, forming *sulphate of lime*, or gypsum; with phosphoric acid, forming *phosphate of lime;* and with several other substances.

Pure lime is white, hot to the taste, corrosive to the touch, and capable when water is thrown on it by degrees, of consolidating it, and extricating a degree of heat which sets wood on fire; it destroys animal and vegetable substances, and it turns vegetable blues to green.

The compounds of lime are so abundant in nature, that geologists have estimated one fourth of the crust of the globe to be formed of them.

Species 1. CARBONATE OF LIME.

Chaux carbonatée H. Rhombohedral Lime-Haloide M. Carbonate of Lime P. C.

This species includes a great variety of calcareous minerals, many of which differ widely from each other in their external characters. Some varieties occur in the form of crystals of which there is an immense number of secondary modifications: some varieties are compact, some are pulverulent, some are granular. The colors which the varieties of this species assume, are so various, as to include nearly the whole catalogue; the prevailing color however is white, or greyish white.

Chemical Characters. Infusible, but becomes caustic or quicklime before the blowpipe; effervesces with acids.

Composition. Lime 57; carbonic acid 43.—*Klaproth.*

Variety 1. CALCAREOUS SPAR.

Chaux carbonatée H. Calcareous Spar J. A. P. C. Rhomboidal Lime-Haloide M.

External Characters.—Colors, various, generally white, yellowish or grey, often red, &c. occurs crystallized; forms extremely numerous, amounting to upwards of 500 secondary varieties, all originating from an obtuse rhomboid, the alternate angles of which are 105 deg. 5 min. and 74 deg. 55 min.; fragments rhomboidal; lustre, more or less shining, often pearly; fracture uneven, but difficult to be obtained on account of the ease with which it separates at the natural joints; cleavage in direction of the natural joints, very easy and perfect, displaying smooth polished faces, transparent or translucent; the transparent, particularly that from Iceland, doubly refractive; often occurs in hemitrope, or macled crystals; yields to the knife: sp. gr. 2.72.

Only a few of the most common forms can be illustrated by figures.

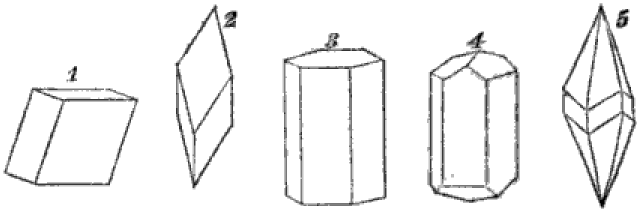

Fig. 1. The primitive rhomboidal prism.
Fig. 2. The acute rhomboid.
Fig. 3 A six-sided prism.
Fig. 4. A hexahedral prism with pentagonal sides, and terminated by pentagonal faces.
Fig. 5. A dodecahedron, composed of two six-sided pyramids joined base to base; each face being a scalene triangle. This variety at first view appears as two triangular pyramids, but on closer inspection, each of the three larger sides will be found to contain two scalene triangular faces. These crystals are commonly grouped, so that only one of the pyramids appear distinct. It is a common variety and bears the name of *hog-tooth* spar.

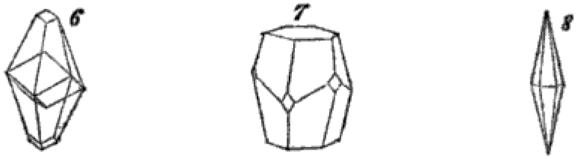

Fig. 6. The double six-sided pryamid, with the summits truncated, and an outline of the primitive form in the centre.
Fig. 7. The same with truncated summits and solid angles.
Fig. 8 An elongated, double six-sided pryamid.

Observation. Its localities are exceedingly numerous. Fine crystals of some of its varieties being found in almost every limestone country. A considerable variety of beautiful specimens are found at Lockport, *N. Y.*

Phillips says the rarest and most beautiful crystals are found at Derbyshire, and the northern parts of England.

Distinctive Characters. From the carbonates of lead, strontian and barytes; and also from the sulphates of barytes and strontian; it may be distinguished by its burning to quicklime: sulphate of lime does not effervesce with acids.

Variety 2. ARGENTINE.

Chaux carbonatée nacrée argentine H. Slate Spar J.

External Characters.—Colors, milk white, reddish, or greyish white; lustre, pearly; occurs in thin tabular plates, generally curved, or undulated; translucent, or nearly opake: structure of the massive, slaty, presenting curved shining layers; yields to the knife; easily broken; phosphorescent on hot coals.

Chemical Characters. Infusible, but decripitates and separates into thin plates, and finally becomes caustic quick-lime. Effervesces with acids.

Composition. Lime 56; carbonic acid 39.33; silex 1.66; oxide of iron 1; water 2.—*Klaproth.*

It is found in primitive rocks.

Localities. Saxony, Norway, Cornwall, Granard in Ireland, &c.

U. S. Southampton lead mine, *Mass.*

Var. 3. SATIN SPAR.

Chaux carbonatée fibreuse H. Satin Spar P. C.

Ext. Char.—Color, yellowish white, white or pale red; occurs massive, consisting of fine delicate fibres adhering closely together; lustre, that of satin; bears a fine polish; often chatoyant; translucent.

Composition. Lime 50.8; carbonic acid 47.6.—*Pepys.*

Localities. The finest specimens are from Cumberland, *Eng.*

U. S. near Baltimore, *Md.*; Cumberland Valley, *Pa.*; Newburyport, *Mass.*

Observation. Satin Spar when polished is a very beautiful mineral. It is used for inlaying, and for the manufacture of ornaments, as necklaces, ear rings, &c. instead of pearl. It is now a scarce mineral.

Var. 4. AGARIC MINERAL. ROCK MILK.

Chaux carbonatée spongieuse H. Agaric mineral A. P. C.

Ext. Char.—Color, yellowish or greyish white; occurs in soft earthy masses, composed of particles slightly cohering; soils the fingers; opake; tender; spongy; for a moment swims on water; effervesces with acids.

Compositon. Nearly pure carbonate of lime.

Obs. It is disintegrated marble.

It is found in veins, in calcareous rocks.

Var. 5. APHRITE.* EARTH FOAM.

Aphrite A. P.

Ext. Char.—Color, white; occurs in masses, composed of scales, of a shining pearly lustre; opake; soft to the touch.

It is found in cavities, or veins in calcareous rocks.

Subspecies 1. *STALACTICAL CARBONATE OF LIME.*

Chaux carbonatée concretionne H. Stalactie. Carbonate of lime P.

Ext. Char.—Colors various, mostly white or yellowish white, or grey; occurs in concretions, stalactical, botryoidal; mammellated and in long pendulous concretions, like icicles; lustre pearly, or silky.

Var. 1.—*Stalactite.*—It occurs in long straight pendulous masses, or hollow tubes; or in larger tuberose, irregular masses, with a rough, warty surface; sometimes several round pieces are joined together, making irregular flattened masses; fracture fibrous, often radiating from the centre of the mass; translucent.

Obs. Stalactites are found attached to the roofs of caverns in limestone countries, where they are continually forming.

How formed. The water percolates through the limestone rocks where it becomes impregnated with calcareous particles. On exposure to the air of the cavern, the water evaporates, leaving the particles of limestone, which adhere, become solid, or form hollow tubes; probably according to the nature of the surface where the stalactite begins to form.

Sometimes the branch of a tree, which happens to be in a proper situation, serves as a nucleus for the stalactite, and becomes incrusted with the limestone, the wood remaining perfectly preserved.

Var. 2.—*Stalagmite. Alabaster.*—Color white or yellowish, commonly arranged in undulated lines, or in concentric circles; structure foliated, fibrous, or compact; translucent.

Obs. The water which drops from the forming *stalactites*, or tricles down from the roof, or the sides of the cavern, forms the *stalagmite* on its floor. Sometimes the stalactite and the stalagmite meet,

* From the Greek;—a foam-like substance.

forming pillars which rest on the floor, and support the roof. These deposites sometimes fill large caverns, producing imitative forms, as of altars, pillars, and with the help of the imagination, of animals, priests in their robes, &c.

Uses. When the stalagmite is compact, of a good color, and translucent, it is employed in the manufacture of ornamental and useful articles under the name of *alabaster*. Of this, candlesticks, vases, the frames of time-pieces, boxes, &c. are made.

Remark. Compact gypsum is also worked into articles of ornament and use, and called alabaster. The two kinds are easily distinguished by a drop of sulphuric or nitric acid, which will cause an effervescence on the stalagmite, but not on the gypsum. The stalagmite is also harder than the gypsum.

Localities. One of the most famous localities is the grotto of Antiparos; another is Woodman's cave in the Hartz; several localities exist in Derbyshire, &c.

U. S. Madison's cave, on the north side of the Blue Ridge, and Wier's cave, both in *Va.*

Subspecies 2. *GRANULAR LIMESTONE.*

Chaux carbonatée saccaroide H. Granular foliated Limestone J. Granular Limestone A. P. C.

Ext. Char.—Colors, white, grey, yellowish, bluish grey, reddish, greenish; sometimes these colors run in stripes, spots, or clouds; occurs massive, composed of minute grains, or crystals of a lamellar structure, and brilliant lustre; fracture splintery, or slaty; translucent.

Obs. 1. Some specimens very nearly resemble *loaf sugar* both in texture and color.

2. It never contains organic remains, as shells, but frequently encloses quartz, garnets, mica, talc, &c. Hence it is a primitive rock.

3. Primitive limestone forms immense mountains, in many parts of the globe. A considerable proportion of the great chain in Northern Asia, reaching from the Uralian mountains to the river Amur, an extent of more than 1000 leagues, is of this kind of rock. The Pyrennees are also in part formed of primitive limestone, and in the Alps large beds of primitive marble are found.—*Pinkerton.*

Local. These are so numerous that only such as are quarried can be given.

Statuary Marble.—*The finest and most perfect kinds of primitive limestone, have, from time immemorial, been employed in architectural decorations, and in statuary Hence it is commonly called* statuary marble.

Egyptian Marble.—Colors milk-white, with silvery scales of mica; also, greyish white, passing into blue; but the most beautiful is black. The red marble of Upper Egypt, called the *rosso antico,* of which the Indian Bacchus is made, and other exquisite remains, is said to surpass in beauty all other marbles.

Parian Marble.—This was employed by the most ancient Greek sculptors; but being yellowish and coarse grained, it was supplanted by that of Etruria, and afterwards by that of Carrara.

The Venus de Medici, Diana hunting, and Venus leaving the bath, are of Parian marble.

Pentelican Marble.—This comes from the vicinity of Athens. It is white, with black crystals of hornblende, and occasionally green veins of talc. Of this, some of the noblest Grecian monuments are constructed. A Bacchus in repose, a Jason, a Paris, &c. of this marble remain at Paris.

Translucent Marble.—At Venice, and in the different towns of Lombardy, are columns of marble so translucent that the light of a candle is visible through pretty thick masses.

Elastic Marble.—Tables of ancient elastic marble are still extant at Rome. Pinkerton supposes that this quality may be imparted by certain modifications of heat. Prof. Cleveland states that flexible marble is found at Pittsford, *Vt.* and at Pittsfield, *Mass.* and that according to the experiments of Dr. Meade, it looses this property on being heated, but regains it on being plunged into water.

The foreign specimens of this kind which I have seen are opake, and without polish, resembling fine sandstone.

Luni Marble. Carrara Marble.—These two kinds come from adjacent localities. That of Luni is pure white, and is preferred to that of Carrara, which is often stained with veins of grey.

The quarry of Luni is said to have been opened in the time of Julius Cæsar.

Laconian Marble. Verde Antico.—This came from Mount Taygetus in Laconia, and is among the most celebrated and ancient marbles. It is described as being of a most cheerful green, like that of tender herbs or grass, variegated with veins of a glassy white, winding in a spiral manner.—*Pinkerton's Petrology.*

AMERICAN MARBLES.—*The United States afford many varieties of primitive marble, several of which have been quarried for useful and ornamental purposes.*

Philadelphia Marble—Color white, or greyish white, sometimes variegated with veins or clouds, of blue. It receives a fine polish, and is extensively employed.

Potowmac Marble.—This is a breccia, and is composed of rounded and angular fragments from the size of a pea to that of an ostrich's egg. Colors red, white, grey, and blackish brown intermixed, so as to give the whole a highly variegated aspect. It bears a fine polish and is a singularly beautiful marble. Of this marble are formed the shafts of the columns in the chamber of Representatives at Washington. They are about twenty feet high, and two feet in diameter. The locality of this marble is about fifty miles above Washington, on the banks of the Potowmac, in *Md.*—*See Cleveland.*

New-Haven Marble.—Predominant color, grey, or bluish grey, richly variegated with veins, or clouds of white, green, or black; some specimens are clouded with yellow, or orange; in others the prevailing color is green with black clouds of chromate, and magnetic oxide of iron. The principal quarry is seven miles from New-Haven, *Ct.* Prof. Silliman observes, that when this marble contains the green colors, it belongs to the variety usually called *verde antique.* Chimney pieces of this marble, of which there are four in the Capitol at Washington, cost from $250 to $500 each.

Vermont Marbles.—The state of Vermont affords several beautiful Marbles, viz.

Middlebury Marble.—Prevailing color, grey, running into dark brown of different shades. Some specimens are pure white. This marble receives a fine polish, and is sawn for tombstones, chimney pieces, &c. Prof. Hall states, that during the years 1809 and 10, 20,000 feet of slabs were cut by one mill containing sixty-five saws, and that the sale of marble during the same period amounted to about 11,000 dollars in value.

Quarries have also been opened at Pittsford, Shaftsbury, and Scranton, in *Vt.—Cleveland.*

Massachusetts affords several quarries of Marble.

Prof. Dewey states that the annual value of the marble quarried in Berkshire county alone, amounts to more than 40,000 dollars. The localities in this state are ***Lanesborough*** ; the color is white and brownish. *Stockbridge*, color white, or clouded with dark shades. *Sheffield*, color white, or clouded with dark shades.—*Robinson.*

Thomaston Marble.—Colors, white or greyish white, diversified with veins of a different color. In the finest pieces, the predominant color is grey, or bluish grey, interspersed by whitish clouds. It is a rich and beautiful marble, receives a fine polish, and is well fitted for ornamental purposes. Three mills, containing in all 150 saws, are employed in sawing and polishing the marble. The price of the best slabs is two dollars a square foot, and about 12,000 feet are annually sold.—*Cleveland.*

Subsp. 3. *COMMON LIMESTONE.*

Chaux carbonatée compacte, H. Common Limestone, A. P.
Compact Limestone, C.

Ext. Char.—Colors white, yellowish white, grey, brown, reddish, bluish, black, &c.; occurs compact, sometimes granular; fracture large conchoidal or splintery, sometimes earthy; lustre dull, or glimmering; sometimes it is variegated or striped of different colors; translucent on the edges, or opake. Sp. gr. 2.6; yields to the knife.

Chem Char. It burns to quick lime and effervesces with acids.

Comp. It is an impure carbonate of lime, and generally contains portions of silex, alumine, or oxide of iron.

Obs. 1. It is sometimes difficult to distinguish secondary or compact limestone from primitive marble, without referring to its locality. In fact common limestone runs into marl on the one side, and primitive marble on the other.

2. Secondary limestone of the oldest formation contains oxide of iron, sulphuret of lead, manganese, sulphuret of zinc, &c. but generally no organic remains.

3. The newer formations are *conchitic*, or contain shells. Pinkerton says that some of the most compact varieties of marble are of this kind.

4 It is understood that conchitic limestone is of course of secondary formation. But it is not true that every secondary limestone contains shells.

5. Secondary limestone is sometimes granular, but perhaps only when it is passing into the primitive kind.

Uses When burnt it furnishes quicklime, which when slacked, and mixed with a portion of sand forms mortar, an article of indispensable use in building, plaistering the walls of houses, &c. It is also employed extensively as a building stone and some of the most beautiful marbles belong to this species.

CONCHITIC, OR SECONDARY MARBLES.

Pinkerton, in his Petrology, has enumerated a great variety of conchitic marbles. From him we shall extract an account of some of the most singular and beautiful.

Lumachella Marble.—Color grey or brown; often deep brown, containing shells which form circles or semicircles, of a golden color; also shells, which in certain directions throw out blood-red reflections, similar to the Labrador feldspar. Some specimens also reflect the green and blue tints of the opal, and nearly with equal splendor.

Obs. 1. This marble was known to the Romans. Its locality, formerly unknown, has been re-discovered. It is found in small quantities at Bleyberg in Carinthia.

2. From the examination of a specimen of this singular and most beautiful marble, in the cabinet of D. Watkinson Esq. of this city, it is obvious that the red reflections, spring from the fragments of a shell: but which is not discoverable, except on close inspection.

Panno di morto,—or funeral pall.—Color deep black, sprinkled with white shells, like snails, an inch or more in length, at distant and rather regular intervals.

Obs. This kind is sold at Rome and is very scarce and highly esteemed. Its locality is unknown.

England produces some beautiful shell marble.

Pentworth Marble.—Color grey with a cast of green, and thickly set with shells, some of which are filled with white spar, giving it a variegated and beautiful appearance.

Bristol Marble. This is a fine black marble interspersed with white shells.

Yorkshire, produces a grey marble, sprinkled with enthrochites.

Italy is famous for its beautiful marbles.

Florence, *Lucca*, and *Pisa*, are decorated with a brick-red marble, containing white ammonites.

Fiorito Marble. This kind is marked with spots resembling flow-ors. Two columns of it, very rich in colors, are said to have been placed in Napoleon's Museum at Paris. They were of Roman workmanship, and were discovered in the ruins of Gabium, four leagues from Rome.

Ruin Marble or *Pictorial Marlite.* This marble is found in the vicinity of Florence. It presents angular figures of a yellowish brown, running into a deep brown color, on a base of light brown, and yellow, gradually passing into a light grey.

At a certain distance, slabs of this marble so nearly represent drawings done in bistre, on a ground of yellowish brown, that it would be difficult to convince one to the contrary.

"One is amused" says Brard, "to observe in it kinds of ruins; there it presents a Gothic castle half destroyed; here ruined walls; in another place, old bastions; and what still adds to the delusion is, that in these natural paintings there exists a kind of ærial perspective, very sensibly perceptible. The lower part, or what forms the first plane, has a warm, and bold tone; the second follows it, and weakens as it increases in distance; the third becomes still fainter, while the upper part, presents in the distance, a whitish zone, and finally, as it reaches the top, blends itself, as it were with the clouds."

These different colors are produced by the infiltration of different colored oxides of iron, into the fissures of this marble. It never bears a high polish.

Fine specimens of this marble of a foot or two square, sometimes sell for exhorbitant prices.

Spain offers the conchitic marbles of *Grenada*, and *Cordova*, of a deep red, with white shells.

France abounds with shell marbles.

From *Narbonne*, comes a deep black kind, with white belemnites.

From the department of *Aube*, is brought a grey marble, made up of little shells, with now and then a large ammonite.

Caen Marble. This beautiful variety comes from Caen, in Normandy. It is of a chocolate brown, with white madrepores, of all sizes and descriptions, beautifully variegated with blue and red. Of this the tables and chimney pieces of Paris are made. In most of the coffee houses may be seen tables of this marble.

Languedoc or *St. Baum Marble.* This is of a fiery red color, mingled with white and grey shells disposed in convoluted zones.

The eight columns which decorate Napoleon's triumphal arch in the Carousel at Paris, are of this marble.

The *United States as yet presents but few localities of shell marble. Prof. Cleveland has noticed the following.*

In *Pennsylvania, Northumberland Co.* is a black marble containing white specks, like the Kilkenny marble.

In *New York* near *Hudson*, is a greyish brown marble, beautifully variegated with encrinites and other organic remains.

Near *Seneca Lake* is found a variegated marble, which has a fine grain, receives an excellent polish, and will probably be much employed.

Var. 1. FETID CARBONATE OF LIME.

Chaux carbonatée fetide, H. Swine stone, A. P. Fetid carbonate of lime, C.

Ext. Char.—Color, white, or greyish white; does not differ in external characters from common limestone. when scraped with a knife, or struck with a hard body, it exhales an offensive odor, resembling that of rotten eggs.

Chem. Char. Before the blowpipe it loses its odor, and burns to quick lime; effervesces with acids.

Obs. The offensive odor is owing to the sulphuretted hydrogen, which probably comes from a small quantity of bitumen or sulphur, included in this variety. This quality is lost on the surface, and in small fragments, by exposure to the air.

It is sometimes found in nodular masses.

It occurs with common limestone and gypsum, and is said to form mountains.

Local. Germany, France, England, &c.

U. S. Allegany Ridge *Md.* Near Rhinebeck, Hyde Park, near Black river, Niagara Falls and Batavia, *N. Y.* Northford, *Conn.* Stockbridge, *Mass.*

Var. 2. BITUMINOUS LIMESTONE.

Chaux carbonatée bituminifère, H. Bituminous Carbonate of Lime, C. Bituminous Limestone, A. P.

Ext. Char.—Color, brown, passing into dark brown or black; structure compact, or sometimes lamellar; when rubbed, struck, or heated, emits an unpleasant bituminous odor.

Chem. Char. Loses both color and odor by heat, and burns into quicklime.

Comp. Lime 49.65; carbonic acid 40.10; alumine 8.80; silex 0.60; bitumen 0.60; water 0.25.—*Clark.*

It belongs to secondary rocks, and is sometimes found with coal.

Uses. *Phillips* says, that in Dalmatia, it is so bituminous that it cuts like soap, and is employed in the construction of houses; when raised, they set fire to the walls, the bitumen burns out, and the stone becomes white; the roof is then put on and the house finished. It is also polished as a marble.

Local. Ireland, Scotland, England, and France.

U. S. Near Middletown, *Conn.* where it presents distinct impressions of fish.

Var. 3 ARGILLO-FERRUGINOUS LIMESTONE.

Calp, C. Argillo-Ferruginous Limestone, P.

Ext. Char.—Colors, bluish, black, or greyish blue; occurs massive, in beds, and in globular and spheroidal pieces; gives an argillaceous odor when breathed on; when burnt it is of a buff color; tougher than common limestone.

Chem. Char. Turns yellowish under the blowpipe; does not fall to powder when slacked; effervesces with acids.

Comp. Carbonate of lime 68.0; silex 18.0; alumine 7.5; bitumen 3.0; iron 2.0.—*Knox.*

Obs *Lias* limestone, which encloses ammonites and a great variety of sea shells, with the bones of unknown animals, is similar to calp in composition. Lias is employed as a lithographic stone, and occurs at Lyme, in Dorsetshire.

Uses. Calp is sometimes used as a building stone.

Some varieties form a cement which hardens under water.

Subsp. 4. *CONCRETED CARBONATE OF LIME.*

Concreted Carbonate of Lime, C.

This subspecies contains two varieties, both of which appear to be formed by a succession of layers.

Var. 1. OOLITE. ROESTONE.*

Chaux carbonatée globuliforme, H. Oolite, J. P. C.

Ext. Char.—Colors, whitish, yellowish white, or ash grey; occurs in masses composed of globular particles of the size of mustard seed, adhering by a calcareous cement; the particles are composed of concentric layers; fracture splintery; opake.

Obs. 1. It is soft when taken from the quarry, but hardens in the air. The houses of Bath are for the most part built of this variety of common limestone, which occurs in great beds above the mountain lime of England.—*Phillips.*

2. This stone is however said to be liable to disintegration, and therefore is not the best material for building.

Var. 2. PEASTONE. PISOLITE.

Peastone, J. A. P. Pisolite, C.

Ext. Char.—Colors, yellowish white, brownish, or reddish; occurs massive, composed of distinct spheroidal concretions, which are formed of thin concentric layers, generally with a grain of sand at the centre as a nucleus; these concretions are about the size of a pea, and are united by a calcareous cement; they are often flattened by mutual contact.

Obs. Pisolite is found among alluvial deposites, particularly at Carlsbad in Bohemia, and in the waters that supply the baths of St. Philip, in Tuscany. It has a singular and interesting appearance.

*Because it resembles the roe of a fish.

Subsp. 5. *CHALK.*

Chaux carbonatée crayeuse, H. Chalk, A. P. C.

Ext. Char.—Color, white, or yellowish white; occurs massive; fracture earthy; meagre to the touch; dull; opake; soft; soils the fingers; adheres to the tongue; gives a white streak.

Chem. Char. Effervesces with acids; burns to quicklime.

Comp. It is nearly a pure carbonate of lime.

Obs. 1 It is one of the newest secondary formations. It often contains shells, and the remains of amphibious and land animals; also nodules of flint, from which gun flints are made.

2. Chalk sometimes forms beds, rising into hills several hundred feet high, and which are remarkable for the smooth regularity of their outlines.

Local. England, particularly in the counties of Kent, Hampshire, Berkshire, and Sussex. France, in various places. Poland, and Ireland.

Uses. When compact, it is used as a building stone. It furnishes lime for cement and for manure, and is used in polishing metals and glass. It is also used by mechanics to mark out their work; by starch makers and chemists to dry precipitates on, and in medicine, it is employed as an absorbent.

Subsp. 6. *MARLE.*

Argile calcifère, H. Marl, A. P. Marle C.

Ext. Char.—Colors, grey, yellowish, or bluish grey, and reddish purple; occurs massive; structure compact, or slaty; falls in pieces by exposure to the air, and is then plastic in water; soft to the touch; easily cut with a knife; soils the fingers.

Chem. Char. Fusible into a slag; effervesces with acids.

Comp. Carbonate of lime 50; silex 12; alumine 32; iron and oxide of manganese 2.—*Klaproth*

Obs. Marl is associated with secondary limestone, chalk, and gypsum. It often contains the remains of birds, the bones of animals and fish, and sometimes even wood. It is essentially composed of carbonate of lime and clay.

Uses. It is employed as a manure, and on soils of a certain kind it is highly valued.

Obs. The solid marls, on exposure to the air and moisture, crumble to dust.

Var. 1. LUDUS HELMONTII. SEPTARIA.

This name is given to nodules, or speroidal masses of calcareous marl, usually from one inch, to eighteen inches in diameter, whose interior presents numerous fissures, or seams, which divide the mass into irregular prisms. These fissures are generally lined or filled by some crystallized substance, which is usually calcareous spar, sometimes quartz, or sulphate of barytes; thus dividing the mass into distinct partitions or *septa*; and hence the name *Septaria*.

Var. 2. BITUMINOUS MARLE.

Bituminous Marle, J. P. Bituminous Marlite, C.

Ext. Char.—Color, greyish, or brownish black; occurs massive; structure slaty, often curved; lustre shining, or glimmering; soft and meagre to the touch: sp. gr. 2.38.

It occurs in beds with the oldest limestone.

Obs. 1. It contains fish, sometimes in regular layers, which are converted into coal. The scales are often converted into copper ore. The bodies of these fish are contorted as though they had died by violence. Werner thinks they were killed by the sudden formation of sulphuretted hydrogen.

2. It also contains ores of copper, which are smelted. At Thuringia extensive works are established for the extraction of copper from these ores.

Subsp. 7. *MADREPORITE.**

Chaux carbonatée Madreporite, H. Prismatic Lucullite, J. Madreporite, P. C.

Ext. Char.—Color, greyish black; occurs in large roundish masses, composed of prismatic diverging concretions; fracture lamellar, or curved; translucent or opake; yields to the knife.

Chem. Char. When heated, or rubbed, it gives the odor of sulphuretted hydrogen.

Comp. Carbonate of lime 93; with a little magnesia, iron, silex and carbon.—*Kirwan.*

Local. Norway, Greenland, Salzberg.

Subsp. 8. *CALCAREOUS TUFA.*

Calc Tuff, J. Tufa, A. P. Calcareous Tufa, C.

Ext. Char.—Color, grey, or yellowish grey; occurs in light porous, or spongy masses, often containing leaves, moss, or other vegetable matter; also incrusting other substances: it is soft, opake, and rough; sometimes compact enough for building stone.

Obs. 1. Tufa is a stone which is gradually formed, and daily increasing from the depositions of springs and streams impregnated with calcareous particles. As the water passes along it deposites this limestone mud on whatever happens to be in its way. Hence tufa is a very impure carbonate of lime, containing silex, leaves, shells, wood &c.

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* From its resemblance to certain *Madrepores.*

2. Pinkerton observes, that a fine calcareous tufa is formed in ancient acqueducts, in the same manner as it is in tea-kettles, in limestone countries, viz. by the deposition of particles of lime from the water.

3. The same author states that the church of St. Peter at Rome, is constructed of a tufa daily formed in the waters of the Anio.

Species. 2. ARRAGONITE.*

Chaux carbonatée Arragonite, H. Arragonite, J. P. A. C. Prismatic Lime-Haloide. M.

Ext. Char.—Color, white, or yellowish white, greenish grey, and pearl grey; occurs crystallized, in the form of six-sided prisms, with equal sides; also, in six-sided prisms, of which the two opposite lateral planes are broad, the four others being narrow. These crystals on close inspection appear to have longitudinal joints down each lateral face, as though made up of several smaller crystals closely fitting each other. Sometimes the prisms are so short as to resemble octohedrons, or even tables, and sometimes it forms a peculiar kind of twin crystal, or two crystals are seen crossing each other, or a small one projecting out of the side or summit of the larger. They are often deeply striated; structure coarsely fibrous; lustre shining vitreous; doubly refractive through oblique surfaces; translucent, or transparent; scratches marble.

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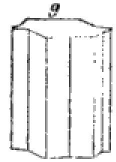

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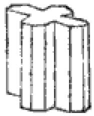

Fig. 9. a six-sided prism, composed of several small prisms applied to each other longitudinally, and appearing striated, or cracked down each plane.

Fig. 10, a crystal, formed of four smaller crystals aggregated, so as to leave the half of each distinct.

Chem. Char. Thin fragments of transparent crystals decrepitate in the flame of a candle; other varieties lose their transparency and become friable. It phosphoresces on red hot iron, and is soluble in nitric and muriatic acid, during which process the carbonic acid is disengaged.—*Mohs.*

* Because first found at Arragon in Spain.

Comp. Carbonate of lime 95.2965 ; carbonate of strontian 0.5090 ; water 0.1544.—*Stromeyer.*

Dist. Char. The chrystalline forms, and the general aspect of arragonite will distinguish it from carbonate of lime, and from strontian. It is also harder than carbonate of lime, and does not like strontian tinge flame purple, but burns to quicklime.

Obs. 1. The phosphorescence takes place, only when the particles are small, and at the instant they fall on the hot iron.

2. In a fine specimen of arragonite before me, from Weir's cave, *Va.* the largest crystals appear to consist of bundles of smaller ones adhering together, and terminating in one, two, or three-sided summits. Among the smaller ones, some are gradually and finely acuminated, while others are abruptly truncated, and terminate in one, or two principal faces. Some appear to be cylindrical, and stand in aggregated radiating masses, the points only appearing distinct; others are branched, sending forth smaller crystals under various and uncertain angles ; the whole being garnished at every point with fine crystals, standing in every direction.

Remark. The branched variety is often found in the cavities of iron ore, and hence has been called *Flos Ferri*, or *Flowers of Iron.*

It was first found at Arragon in Spain, associated with gypsum.

Local. Hungary, Transylvania, Bohemia, Scotland, Iceland, Siberia, Chimborazo, &c.

U. S. Weir's cave, *Va.* Suckasunny mine, *N. J.*

Species 3. MAGNESIAN CARBONATE OF LIME.

This species has several varieties, which vary considerably in the proportion of lime and magnesia.

Var. 1. DOLOMITE.*

Chaux carbonatée magnesifère, H. Magnesian Limestone, P. Magnesian Carbonate of Lime, C.

Ext. Char.—Color, white, often with a tinge of yellow, or grey ; occurs massive, often of a slaty texture ; consists of fine crystalline grains, which are lamellar ; lustre glimmering ; translucent on the edges ; when struck, or thrown on a hot iron, mostly emits a phosphorescent light, which is visible in the dark ; softer than primitive limestone, which it strongly resembles : sp. gr. 2.85.

Chem. Char. Effervesces feebly with acids ; under the blowpipe, after the carbonic acid is expelled, it phosphoresces with exceeding brightness, turns opake and falls into grains.

Comp. Carbonate of lime 52.0 ; carbonate of magnesia 46.5 ; oxide of iron and manganese 0.75.—*Klaproth.*

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* From the celebrated Dolomien.

Dist. Char. Its slow effervescence will distinguish it from primitive limestone.

It is found in veins, in primitive rocks, with iron, primitive limestone, tremolite, lead, zinc, quartz, &c.

Local. Pyrennees, Saxony, France, Sweden, &c.

U. S. Near the city of New York. Washington, Milford hills, and Litchfield *Conn.* Great Barrington, Sheffield, Stockbridge, Pittsfield, Williamstown, and Adams, *Mass.*

Var. 2. BITTER SPAR.

Chaux carbonatée magnesifère primitive, H. Rhomb Spar, J. Bitter Spar, P. Chrystallized Magnesian Carbonate of Lime, C.

Ext. Char.—Color, greyish or yellowish white; occurs in obtuse rhomboidal crystals, the alternate angles of which are 106 deg. 15 min. and 73 deg. 45 min.; structure foliated; lustre pearly and shining; cleaves into rhomboids; translucent; brittle; very easily separable into rhombs, at the natural joints by a blow.

Chem. Char. Burns to quicklime; effervesces feebly with acids.

Comp. Carbonate of lime 52; carbonate of magnesia 45; oxide of iron 3.—*Klaproth.*

Dist. Char. It is sometimes difficult to distinguish this variety from calcareous spar. In general, its slow and feeble effervescence will distinguish them. A surer method is solution in sulphuric acid, which, if magnesia be present, it will be precipitated by carbonate of potash, or soda; the solution also will be bitter.

It is found in chlorite, steatite, or serpentine; with talc, asbestus, &c.

Local. Sweden, Tyrol, Siberia, &c.

U. S. Near New Haven, *Conn.* Williamstown, Middlefield, and Southampton, *Mass.*

Var. 3. MIEMITE.*

Chaux carbonatée magnesifère lenticulaire, H. Miemite, J. P. C.

Ext. Char.—Color, green or greenish white; occurs massive, and in rhomboidal crystals; fracture foliated; lustre splendent and pearly; translucent; fracture foliated and curved; brittle.

Comp. Carbonate of lime 53; carbonate of magnesia 42.50; iron and manganese 3.—*Klaproth.*

Local. Tuscany in gypsum. Greenland with wavellite, and arragonite.

Var. 4. GURHOFIAN.† COMPACT DOLOMITE.

Ext. Char.—Color, snow white; structure compact;

* From Miemo in Tuscany, where it is found.

† From Gurhoff, where it is found.

fragments sharp; fracture conchoidal; somewhat resembling semi-opal.

Chem. Char. Dissolves with effervescence, in hot nitrous acid.

Comp. Carbonate of lime 70.50; carbonate of magnesia 29.50.—*Klaproth.*

Local. Gurhoff, in Lower Austria.

Var. 5. MAGNESIAN LIMESTONE.

Magnesian Limestone, A. P. C. Brown Dolomite, J. Macrotypous Lime-Haloide, M.

Ext. Char.—Color, yellow or buff; occurs in amorphous masses; lustre glimmering; texture somewhat sandy; translucent on the edges.

Comp. Carbonate of lime 61.5; carbonate of magnesia 44.8; insoluble matter 1.6.—*Thomson.*

Obs. The great range of hills, extending from Nottingham to Sunderland in England, are entirely composed of it.

The lime obtained from it is greatly esteemed for cements, being less subject to decay, owing to its absorbing less carbonic acid from the atmosphere than the lime of common limestone.—*Phillips.*

When magnesia exists in considerable quantity in a soil, it wholly destroys vegetation. Large tracts in France are barren from this circumstance.

2. A *flexible* variety of magnesian limestone, is found in Sunderland in England. It is slaty, and fusible. This quality is lost by drying.—*Phillips.*

Var. 6. FERRO-MAGNESIAN CARBONATE OF LIME.

Chaux carbonatée ferro-manganesifere, H. Pearl-spar, P. Brown-Spar, J. C.

Ext.Char.—Colors, white or greyish, yellowish, or reddish white; occurs in laminated masses, and in obtuse rhomboids, with curved faces; sometimes only the thin edges or angles of the crystal is curved, or turned up; lustre pearly; structure foliated; crystals often placed partly over each other, so as to give the mass a scaly appearance; also, it occurs of a fibrous texture; translucent; sp. gr. 2.5.

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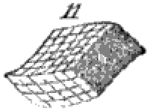

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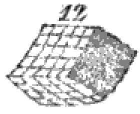

Figs. 11 and 12, show the common appearance of these crystals. They are irregular rhomboids, having their faces curved, or their angles contorted in various directions.

Chem. Char. Before the blowpipe, decrepitates with violence, and turns dark grey, or brown; with borax it fuses with ebulition, into a yellowish green enamel; soluble slowly, and with little effervescence in nitric acid.

Comp. Lime 27.97; magnesia 21.14; carbonic acid 44.6; oxide of iron 3.4; of manganese 1.5.—*Heisinger.*

Dist. Char. Its peculiar contorted crystallization, with its slow effervescence, will distinguish it from rhomb-spar, and other carbonates; sparry iron ore is darker and heavier.

Obs. Phillips thinks it probable that pearl-spar passes into sparry iron ore.

Pearl-spar is found in metallic mines, with quartz, limestone, iron ore, zinc, lead, &c.

Local. Derbyshire, Devonshire, Cornwall.

U. S. Near Lancaster, *Penn.* Liecester, on the Genesee, Clinton, and Bethlehem, *N. Y.* Leverett, and Charlestown, *Mass.*

Species 4. SILICIOUS CARBONATE OF LIME.

Silicious Carbonate of Lime, C.

Ext. Char.—Color, greyish white; occurs in mammillary concretions, in amorphous masses, and in rhombic crystals; structure granular; fracture presents small crystalline faces; often friable; when solid, gives fire with steel; opake; resembles a sandstone; C.; sp. gr. 2.6.

Chem. Char. In nitric acid, its calcareous part, about one third of the whole, dissolves with effervescence. C.

Comp. It sometimes contains 44 per. cent. of carbonate of lime. C.

Obs. Its crystals are found either solitary, or in groups, in certain cavities, existing in beds of calcareous sandstone. When these cavities, usually filled with sand, are in part empty, it is sometimes the case, that one half of the crystal, in the state of a pure carbonate of lime, projects into the cavity, while the other half of the same crystal is silicious. C.

It is found only at Fontainbleu and Nemours in France.

Var. 1. TABULAR SPAR.

Spathentable, H. Schaalstein, W. C. Tabular Spar, J. A. P.

Ext. Char.—Colors, greyish white, often tinged red, green, or yellow; occurs massive, composed of thin laminæ; structure imperfectly foliated; translucent, or opake; phosphorescent when scratched; cleaves into prismatic pieces; fracture splintery; yields to the knife, and is sometimes friable: sp. gr. 2.8.

Chem. Char. In nitric, a few bubbles escape and the fragment falls into powder. Fusible with ebullition into a white glass.

Comp. Silex 50; lime 45; water 5.—*Klaproth.*

It is a rare mineral, and has been found only in Ceylon, and two or three other places.

Var. 2. CHELMSFORDITE—*Dana.*

Ext. Char.—Colors, white, grey, green, and red, of various shades; occurs amorphous and crystallized, in rectangular, or slightly rhomboidal prisms, variously truncated; crystals interlaced; lustre pearly, glimmering, or dull; fracture splintery, fine grained, and imperfectly foliated; cleavage, either indistinct, or parallel to the bases of the prisms; phosphoresces when projected in powder on hot iron: sp. gr. 2.10 to 2.60.

Chem. Char. Fusible with ebullition into a white porous enamel. The amorphous effervesces feebly with nitric acid, and falls in grains.

Local. Chelmsford, *Mass.* in a bed of carbonate of lime, and micaceous schistus.

Remark. Chelmsfordite was discovered and named by Drs. J. F. and S. L. Dana of Boston. It has not been analyzed, but its general characters coincide so nearly with those of schaalstein, as to leave little doubt of its being a variety of that mineral, and they have accordingly so arranged it.

In placing Schaalstein and Chelmsfordite, as varieties of the present species, I have been guided by the analysis of the former, and the probable composition of the latter.

Species 5. PHOSPHATE OF LIME.

Chaux phosphatée, H. Rhombohedral Apatite, J. Phosphate of Lime, P. C. Rhombohedral Fluor-Haloide, M.

This species embraces several varieties, which vary considerably in their external characters, and chemical composition.

Var. 1. APATITE.*

Ext. Char.—Colors, white, yellowish white, greenish yellow, blue, bluish green, and reddish, colors pale; occurs in six-sided prisms, terminated by one or more planes, or by a six-sided pyramid, variously truncated; prisms short; cross fracture conchoidal; lustre vitreous; translucent; often longitudinally striated; yields to the knife.

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* From the Greek, signifying to deceive, because it resembles other minerals.

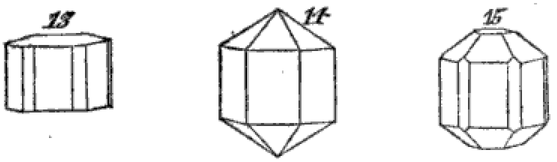

Fig. 13, the primary form, a short six-sided prism.

Fig. 14, a six-sided prism, terminated by six-sided pyramids.

Fig. 15, the same, with the lateral edges and summits truncated.

Chem. Char. Infusible; dissolves slowly and without effervescence in nitric acid; or effervesces slightly from foreign matter; phosphoresces on hot iron.

Comp. Lime 55; phosphoric acid 45.—*Klaproth.*

Dist. Char. It resembles beryl, and emerald, but wants their hardness, and is soluble in acids. From carbonate of lime it differs, by its slight effervescence; fluate of lime is fusible.

It is found in primitive rocks, with garnets, fluor, tin, iron and quartz.

Local. Bohemia, Saxony, Moravia, Spain, several parts of England, &c.

U S. Germantown, and Hamilton, *Penn.* At the former place it is in grass-green crystals.

Several places in *New Jersey.* Near Wilmington, *Del.* Near Crown Point, color clove brown. Near New York, color apple green; and West Farms, white, *N. Y.* Milford hills, pale green; *Conn.* Topsham, pale green; *Maine.*

Var. 2. ASPARAGUS STONE.

Asparagus Stone, J. P. C.

Ext. Char.—Colors, asparagus green, greenish white, white and transparent; occurs in crystals only; form, six-sided prisms, with six-sided pyramidal terminations; planes sometimes striated longitudinally; angles subject to truncation; does not phosphoresce.

Chem. Char. Dissolves in nitrous acid without effervescence.

Comp. Lime 54.28; phosphoric acid 45.72.—*Klaproth.*

Dist. Char. It has been confounded with apatite, but differs from it in color; in the general smooth surface of its planes; in its acuter terminations; in its non-phosphorescence; and in dissolving in acids without effervescence.—*Jameson.*

It is found in primitive rocks.

Local. Grenada in Spain, in abundance; Vesuvius, Norway, and near Havre in France.

U. S. Germantown, *Penn.* Highlands, at Anthony's Nose. Near Lake Champlain, and on the island of New York, *N. Y.* Morris county, *N. J.*

Var. 3. MASSIVE PHOSPHATE OF LIME.

Chaux phosphatèe terreuse, H. Phosphorite, J. P. Massive Phosphate of Lime, C.

Ext. Char.—Colors, greyish, reddish, or yellowish white; occurs massive, with a curved lamellar, or granular structure; aspect earthy; opake; diversified with spots or zones; phosphoresces by heat and friction.

Comp. (Hungarian.) Lime 47; phosphoric acid 32.25; fluoric acid 2.5; silex 0.5; oxide of iron 0.75; water 1; sand mixed with clay 11.5.—*Klaproth.*

Pinkerton says, that it is reported by some to form hills, and by others only thick strata, in the province of Estremanda in Spain. Phillip's says, that it sometimes contains crystals of apatite.

Dist. Char. It has much resemblance to curved lammellar barytes, but it is harder and lighter.—*Jameson.*

Var. 4. SILICIOUS PHOSPHATE OF LIME.

Chaux phosphatèe silicifere, H.

Ext. Char.—Color, grey, shaded with violet; occurs in porous masses; fracture earthy, granular, or a little foliated; phosphoresces strongly; gives fire with steel.

It is found in Bohemia.

Species 6. FLUATE OF LIME. FLUOR.*

Chaux fluatée, H. Octohedral Fluor, J. Fluate of Lime, P. C. Octohedral Fluor-Haloide, M.

This species is found crystallized, nodular, compact, and earthy. It therefore comprehends several varieties of which the crystallized is by far the most beautiful, and important,

Var. 1. CRYSTALLIZED FLUATE OF LIME.

Ext. Char.—Colors, purple, red, green, yellow, grey, blue, white, and perfectly limpid and transparent; occurs in crystals; form the octohedron, with its varieties, the cube and rhomboidal dodecahedrons, variously truncated; structure lamellar, or foliated; cleaves into the form of the octohedron, tetrahedron, and rhomboid; lustre, shining vitreous; crystals generally smooth; yields easily to the knife: sp. gr. 3.10.

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* From the Latin *fluo* to flow, because it is used as a flux.

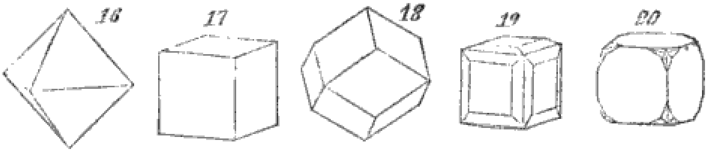

Fig. 16, the primary octohedron.
Fig 17, the cube, a form under which it most frequently occurs.
Fig. 18. the dodecahedron, with rhombic faces.
Fig. 19, the cube, with bevelled edges.
Fig. 20, the cube, with each solid angle bevelled, or replaced with six planes.

Obs. 1. A great variety of other forms are enumerated. Mr. Phillips states that his collection presents upwards of seventy varieties of form. The same author has given a figure of one crystal, bounded by fifty-four planes, and another in his possession from Devonshire, bounded by three hundred and twenty-two planes.

2. This mineral is rendered very interesting by the great variety and beauty of its colors, and the peculiarly distinct forms in which its crystals are often found.

Chem. Char. Fusible with ebullition into an opake globule; with borax into a transparent glass. In powder with warm sulphuric acid, emits fluoric acid gas, which is employed in etching on glass; phosphorescent on hot iron.

Comp. Lime 72.14; fluoric acid 27.86.—*Berzelius.*

Dist. Char. Its rich colors and peculiar property of corroding glass will distinguish it from other minerals; from the gems it is readily known, by its want of hardness.

It is found mostly in metallic veins which traverse primitive rocks.

Local. Mount Blanc, St. Gothard, Saxony, Germany. Cornwall and Derbyshire, abundant. In the tin mine, St. Agnes, Cornwall, are found the most splendid varieties; also in the lead mines of Derbyshire, fine specimens occur.

U. S. Shenandoah County, and at Shepherdstown, *Va.* Peters Creek, 17 miles from Shawneetown, Fork of Grand Pierre Creek, 27 miles from the same place, *Illinois.* West side of the Blue Ridge, *Md.* Smith County, *Ten.* Near Franklin Furnace, and near Hamburg, *N. J.* Near Saratoga Springs, *N. Y.* At Middletown and Huntington, *Con.* At Thetford, *Vt.* Southampton lead mine, *Mass.* White Mountains, *N. H.*

Var. 1. NODULAR FLUATE OF LIME.

Nodular Fluor, P.

Ext. Char.—Colors, blue, brown, purple, grey, reddish, and yellow, variously intermixed with white, and transparent; it is the result of imperfect crystallizations; the colors run in zones or bands, often quite distinct, or are variously shaded, or intermingled with each other, forming tints of a great variety of colors. Some parts of a specimen will be transparent, others translucent, or even opake.

Obs. This variety comes from Derbyshire, and is commonly known by the name of *Derbyshire-spar.* It is called *blue john* by the miners, and is found in veins or detached masses, from three inches to a foot in thickness.

Uses. It is formed into vases, obelisks, candlesticks, &c. for ornamental purposes. It bears a high polish, and its great variety of rich colors renders it remarkably beautiful, and in great request.

Var. 2. COMPACT FLUATE OF LIME.

Chaux fluatée compacte, H. Compact Fluor, J. P. Compact Fluate of Lime, C.

Ext. Char.—Colors, various shades of green, blue, violet, and red; texture granular; translucent on the edges; phosphorescence chiefly green; harder than common fluor.

Local. Cornwall, Norway, Hartz, &c.

Var. 3. *Earthy Fluate of Lime.*—It occurs in friable masses, or in the state of powder.

It is found in several of the mines in England, and in Saxony and Norway.

Var. 4. CHLOROPHANE.*

Chlorophane, P C.

Ext. Char.—Color, pale violet; structure imperfectly lamellar; does not much resemble the other varieties; translucent.

Obs. It is curious on account of its phosphorescence. When placed on hot iron, it does not fly, but gives out the most beautiful emerald green light. The experiment may be made on a hot shovel carried into the dark.

Local. Cornwall and Siberia.

U. S. New Stratford, *Ct.* When placed on hot iron in a dark room, it emits a very pure emerald green light; masses even one inch in diameter, become illuminated in a few seconds, and continue distinctly luminous when removed to a room lighted by candles, or when viewed in weak day light.—*Silliman.*

Var. 5. *Fetid fluate of Lime, C.* The external characters of this mineral do not sensibly differ from those of the common colored varieties of fluate of lime. But when broken, or scratched by a point of steel, it emits a strong fetid odor, resembling that of carburetted hydrogen.—*Cleveland.*

Local Near Shawneetown, *Illinois.* First observed by *Mr. A. E. Jessup.*

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* From its green light, when heated.

Species 7. SULPHATE OF LIME.

Chaux sulphatée, H. Gypsum, A. P. Axifrangible Gypsum, J. Prismatoidal Gypsum-Haloide, M.

The varieties of this species differ widely in their external characters, but are composed of nearly the same proportions of lime and sulphuric acid.

It occurs crystallized, fibrous, granular, earthy, and compact.

Var. 1. CRYSTALLIZED SULPHATE OF LIME.

Chaux sulfatée crystallisée, H. Foliated Sulphate of Lime, C. Selenite, P.

Ext. Char.—Colors, white, either pure, or with shades of yellow, violet, brown or red; occurs in foliated masses, and in regular crystals; form of the foliated, oblique hexahedral tables, each of the lateral faces of which is bevelled; or in flat crystals which are oblique parallelopipids; form of the regular crystals, hexahedral and octahedral prisms, with oblique terminations; crystals often united, somewhat in the stellular form, or the smaller crystals are attached obliquely to the larger ones; structure foliated; cleavage very perfect in one direction; lustre shining pearly; transparent or translucent; soft; yields to the nail; inelastic: sp. gr. 2.310.

Chem. Char. Turns white and opake, swells, and finally, in small fragments, melts into a white enamel; does not effervesce with acids, nor burn to lime.

Comp. Lime 32; sulphuric acid 46; water 22.—*Bergman.*

Dist. Char. It resembles mica and talc; but mica is elastic, does not instantly turn opake on being heated, and is harder than selinite; talc is unctuous to the touch, and of a greenish tinge.

Obs. 1. The massive selinite sometimes appears in broad, shining, transparent laminæ, a foot or more long, and several inches wide, without the least appearance of distinct crystals, but resembling plates of mica.

Beautiful specimens of this kind are occasionally found among the gypsum from Nova Scotia.

2. Selinite often occurs in the form of *lenticular* crystals. These sometimes occur disseminated in the compact, or granular gypsum, or are collected into groups in the form of roses, stars, &c.

Var. 2. FIBROUS GYPSUM.

Chaux sulphatée fibreuse, H. Fibrous Gypsum, J. P. C.

Ext. Char.—Colors, white, grey, reddish, and yellowish; occurs in extremely fine, delicate, and nearly separate fibres, of a shining silky lustre, and either straight, or gently curved; sometimes it is nearly compact, taking the form of a concretion.

Obs. This beautiful variety is polished for ornamental purposes.

Var. 3. GRANULAR GYPSUM.

Foliated Granular Gypsum, J. Granular Gypsum, P. C.

Ext. Char.—Colors, white, yellowish, and reddish; occurs in masses composed of small laminated crystals, which present shining faces, either straight or curved; translucent on the edges; very soft; yields to the nail.

Obs. This is a very common variety, and appears to be intermediate between selenite and compact gypsum.

Var. 4. COMPACT GYPSUM.

Chaux sulfatée compacte, H. Compact Gypsum, J. P. C.

Ext. Char.—Colors, white, reddish, or yellowish, often running in veins, or clouds; occurs massive; fracture compact; lustre glimmering; translucent, or opake; easily cut with a knife; the white often resembles spermaceti.

Obs. 1. This variety forms the *gypseous alabaster* of which cups, vases, candlesticks, and other ornaments are made; some specimens after being polished, are translucent, and at a few feet distance can hardly be distinguished from spermaceti. Beautiful ornaments of this mineral, and in great variety, come from Italy. A manufactory of the same kind is also established at Derby, *Eng.*

2. The beautiful white translucent alabaster, of which the Italian ornaments now so common in this country, are made, comes from Castelino, in Tuscany, 35 miles from Leghorn. The most perfect is found about 200 feet below the surface of the earth. The yellowish variegated kind called *alabastro agatato*, or agate alabaster, is found at Sienna, from 20 to 30 feet below the surface.

The bluish variety comes from Guercieto, and is remarkably beautiful, being elegantly variegated with blue, purple, and red.

The principal manufactory of these articles is at Volterra, 36 miles from Leghorn, where about 5,000 persons live by this kind of labor, and from whence these ornaments are transported to all parts of the world.

This information we obtained from one of the proprietors of the manufactory.

3. This kind of alabaster may be readily known from the calcareous kind, by its softness and want of effervescence with acids.

Var. 5. EARTHY GYPSUM.

Earthy Gypsum, J. P. C.

Ext. Char.—Colors, yellowish white, white or yellowish grey; occurs in small scaly or dusty particle s dull; soils the fingers; light; particles cohere slightly, or not at all.

Obs. It is found enclosed in, or lying upon formations of gypsum. Jameson says, it is found particularly in wet seasons. Prof. Cleveland thinks that it proceeds from the disintegration of the other varieties.

Var. 6. SNOWY GYPSUM.

Chaux sulfatée niviforme, H. Scaly foliated Gypsum, J. Snowy Gypsum, C.

Ext. Char.—Color, snow white; occurs in minute scales, having the appearance of newly fallen snow; exceedingly delicate and tender; easily reduced to powder.

It is found in small masses among the other varieties.

Var. 7. PLAISTER OF PARIS.

Chaux sulfatée calcarifére, H. Montmatrite, J. Plaister of Paris, C.

Ext. Char.—Color, yellowish, or brownish; occurs in masses, composed of small grains, sometimes of a crystalline appearance, and sometimes earthy; fracture earthy; dull; soft; easily broken; yields to the nail.

Chem. Char. Effervesces slightly with acids, owing to its containing a portion of lime. In other respects its chemical characters do not differ from the other varieties.

Comp. That of Montmatre, near Paris, contains about 17 per cent. of carbonate of lime, and a small portion of the oxide of iron.

Obs. 1. *Plaister of Paris* is the name commonly used in commerce for the whole species, probably from the circumstance of its having been first exported from the vicinity of Paris.

2. This variety occurs in great abundance at Montmatre, near Paris, and is said to produce the best plaister known in commerce.

3. Sulphate of lime belongs to transition and secondary formations. Its occurrence as a primitive rock has also been asserted. But Saussure, who observed gypsum in several places on the Alps, mixed with layers of mica, has notwithstanding recorded his opinion against its primitive origin. The gypsum of Nova Scotia, of which vast quantities are employed for manure and other purposes, presents, it is believed, no organic remains. Having examined great quantities of this gypsum, with a view to determine its geological character, and having interested the workmen, where it is broken and ground, to

observe any organic remains that might occur, the writer has never been able to detect a single shell, or other organized substance in it.

The secondary gypsum of Germany, it is believed, sometimes contains organic remains.

That of Montmatre contains vast quantities of shells, skeletons of birds, quadrupeds, and even vegetable substances.—*Cuvier. Pinkerton.*

Uses. Gypsum is ground and spread on certain soils as a manure. (For information on this subject, see Davy's Agricultural Chemistry.)

It is employed when calcined, in ornamenting rooms in *stucco*, in taking the impressions of medals, in casting statues and busts, &c. and when mixed with lime, it is used in plaistering the walls of houses.

Casts, busts, &c. of plaister, are easily polished when dry, by rubbing the surface with talc.

Remark. Broken articles of plaister are mended by first wetting the surfaces to be joined, then mixing the calcined plaister with gum water, and applying it before it hardens.

Local. Hungary, Italy, Bohemia, England, and most other countries. Nova Scotia, in extensive quarries.

U. S. Niagara, near the Falls, and at the foot of Goat Island. Onondaga and Madison Counties, near Cayuga Lake, (at the three last named places, it is quarried.) Manlius, Lockport, and in several other places, *N. Y.* Martha's Vineyard, and Milton, *Mass.* Saltville, on Holstein river, (quarried,) near Preston's salt works, and at the head waters of Staunton river, *Va.* St. Mary's County, on the Patuxet, on the Potomac, near Fort Washington, and near Baltimore, *Md.* It is also found in many other places in the U. States, in small quantities.

Species 8. ANHYDROUS* GYPSUM.

Chaux anhydro-sulfatée, H. Anhydrite, J. Anhydrous Gypsum, A. P. Anhydrous Sulphate of Lime, C.

This species occurs crystallized, granular, fibrous, and compact. It therefore affords several varieties.

Var. 1. MURIACITE.†

Chaux anhydro-sulfatée lamellaire, H. Sparry Anhydrite, J. C. Muriacite, P.

Ext. Char.—Colors, white, violet, bluish or reddish; occurs crystallized in rectangular prisms, sometimes differing little from a cube, and sometimes so short as to become tabular; structure lamellar, with joints parallel to the planes of the prism; lustre shining pearly transparent or translucent; soft; yields to the nail.

* Anhydrous, without water, because it contains no water of crystallization.

† Muriacite, because it sometimes contains muriatic acid.

Chem. Char. Infusible, but is reduced without exfoliation to a white friable enamel; does not effervesce with acids.

Comp. Lime 40; sulphuric acid 60.—*Vauquelin.*

Lime 41.75; sulphuric acid 55; muriate of soda 1.—*Klaproth.*

Dist. Char. It does not like the sulphate of lime, exfoliate and melt into a hard enamel, but under the blowpipe is converted into a friable enamel.

Local. Switzerland, and Tyrol.

U. S. Lockport, *N. Y.*

Var. 2. GRANULAR ANHYDRITE.

Scaly Anhydrite, J. Granular Anhydrite, C. Granular Anhydrous Gypsum, P.

Ext. Char.—Colors, greyish, greenish grey, bluish or reddish; occurs in concretions; structure granular, or confusedly foliated, sometimes bladed, or contorted; lustre shining, pearly; translucent.

It often contains a little muriate of soda.

Var. 3. FIBROUS ANHYDRITE.

Fibrous Anhydrite, J. C. Fibrous Anhydrous Gypsum, P.

Ext. Char.—Colors, greyish, greenish grey, bluish or reddish; occurs in masses composed of fibres, either straight and parallel, or diverging; translucent on the edges; lustre, shining, pearly.

Var. 4. COMPACT ANHYDRITE.

Compact Anhydrite, J. P. C.

Ext. Char.—Colors, white, grey, blue and red; occurs massive and sometimes contorted; fracture splintery, passing into flat conchoidal: translucent on the edges; scratches calcareous spar.

Comp. Lime 42; sulphuric acid 56.50; muriate of soda 0.25.—*Klaproth.*

Local. It is found in the salt mines of Poland.

Var. 5. SILICEOUS ANHYDRITE.

Chaux anhydro-sulphatée quartzifére, H. Siliciferous Anhydrous Gypsum, P. Silico-Anhydrous Sulphate of Lime, C. Vulpinite, J.

Ext Char.—Colors, greyish white, veined with bluish grey; occurs in distinct massive concretions; structure laminated; translucent on the edges; lustre, splendent; soft; brittle:

Comp. It contains 8 per cent of silex.—*Vauquelin.*

It is found with limestone at Vulpino, in Italy.

Obs. It takes a fine polish and is employed for ornamental purposes.

Species 9. NITRATE OF LIME.

Chaux nitratée, H. Nitrate of Lime, P. C.

Ext. Char.—Colors, white, yellowish, or greyish white; occurs in fibrous efflorescences; often united in the form of silken tufts, also in delicate needles, and in a state of powder; tastes bitter and disagreeable.

Chem. Char. On burning coals it slowly melts away, and emits slight detonations; soluble in water and very deliquescent.

Comp. Lime 32; nitric acid 57.44; water 10.57.—*Klaproth.*

Dist. Char. Its bitter taste, and its ready deliquescence will distinguish it from nitrate of potash.

It is generally found with the nitrate of potash, and occurs about old walls, in caverns, and on calcareous rocks among vegetable remains.

Local. U. S. It is abundant in the caverns of Kentucky.

Species. 10. SILICEOUS BORATE OF LIME.

Chaux boratée silicieuse, H. Prismatic Datolite. J. Datholite, Borate of Lime, P. Siliceous Borate of Lime, C. Prismatic Dysthene-Spar, M.

Ext. Char.—Color, greyish or greenish white; occurs massive and crystallized; form, the rhombic prism, with the lateral edges, and solid angles, variously truncated; sometimes the two opposite angles, and sometimes all the angles are truncated, or bevelled; the two opposite angles are often replaced by three planes, forming a prism of ten sides; fracture imperfectly conchoidal; lustre shining between vitreous and resinous; translucent; yields to the knife; sp. gr. about 3.

Chem. Char. Intumesces into a white mass, and then melts into a globule of a pale rose color; forms a jelly with acids; in the flame of a candle, turns white, opake, and becomes friable.

Comp. Lime 84; boracic acid 21.67; silex 37.66; water 55.—*Vauquelin.*

Dist. Char. It sometimes resembles prehnite; but is not electric by heat, and its hardness is sensibly inferior.—*Cleveland.*

Var. BOTRYOLITE.*

Botryolite, J. P. C.

Ext. Char.—Color, white, greyish, and red in concen-

* From the Greek, resembling grapes.

tric circles; externally yellowish grey; occurs in botryoidal masses, and in mamillary concretions, formed of concentric layers; texture fibrous or earthy; sp. gr. 2.8.

Comp. Lime 39.5; silex 36; boracic acid 13.5; water 6.5; oxide of iron 1.—*Klaproth.*

This species is found at Arendal in Norway.

U. S. Near Passaic Falls, *N. J.* It was discovered by *J. Pierce, Esq.* and is well characterized.

Species 11. ARSENIATE OF LIME.

Chaux arseniate, H. Pharmacolite, P. J. M. Arseniate of Lime, C.

Ext. Char.—Color, white, or greyish white; surface often tinged red, or violet by arseniate of cobalt; occurs in minute fibres, or in acicular crystals, commonly aggregated into botryoidal masses; lustre silky, or dull; sp. gr. 2.6.

Chem. Char. Evaporates in dense white vapor, with the odor of arsenic, leaving the lime. Soluble in nitric acid without effervescence.

Comp. Lime 25; arsenic acid 50.54; water 24,46.—*Klaproth.*

Dist. Char. Its chemical characters will distinguish it from the minerals it most resembles.

Local. Andreasburg in the Hartz. Near Furstemburg in Germany, with cobalt and sulphate of lime.

Genus 2—ALUMINE.

This earth derives its name from alum, of which it is the base. It never occurs pure, but may be obtained so by chemical means, when it is of a clear white. It occurs very universally in argillaceous soils, and enters into the composition of several gems, as the sapphire and ruby. In the species belonging to this genus, it is combined with acids, and forms the basis of several salts.

Species 1. SUBSULPHATE OF ALUMINE.

Aluminite, J. M. Sub-sulphate of Alumine, P. C.

Ext. Char.—Color, white, or yellowish white; occurs massive in small round or reniform pieces; translucent, or opake; fracture earthy; yields to the nail; adheres to the tongue; light.

Chem. Char. Infusible, but loses more than half its weight by the heat.

Comp. Alumine 30.2; sulphuric acid 23.4; water 46.4.—*Stromeyer.*

Local. Newhaven, Sussex, *Eng.* Halle, in Saxony.

Var. 1. SILICEOUS SUBSULPHATE OF ALUMINE.
Siliciferous Sub-sulphate of Alumine, P.

Ext. Char.—Color, between milk, and snow white; occurs of the consistence of hogs lard; smooth to the touch; translucent, except in patches, where it is opake and granular; on exposure to the air, it dries and splits into masses like starch, some of which effervesce on the surface, while others are translucent, and resemble the finest pieces of gum arabic.—*Phillips.*

Chem. Char. By ignition it loses 90 per cent. of its weight.

Comp. Alumine 6.5; sulphuric acid 3.0; water 88; silex 2.4.—*Henry.*

Local. This singular mineral was found in the old workings of a coal mine near Oldham in Lancashire.

Species 2. SUBPHOSPHATE OF ALUMINE.
Hydrargillite,—*Davy*. Wavelite.* Sub-phosphate of Alumine, P. Phosphate of Alumine, C.

Ext. Char.—Colors, white, yellowish white, greenish or bluish; occurs in minute crystals in the form of rhombic prisms, with dihedral terminations; these are grouped, or collected into hemispherical, or globular concretions; sometimes appearing like down, but more commonly radiating from a centre, with a pearly or silken lustre. It is often attached to other minerals, in distinct, round, stellular spots, presenting, when the mineral is of a different color, a singular and beautiful appearance; translucent.

Chem. Char. Infusible, but becomes white and opake, and loses its crystalline form: gives a greenish tinge to the flame; Aikin says, that with sulphuric acid it corrodes glass.

Comp. Alumine 35.35; phosphoric acid 33.40; fluoric acid 2.06; lime 0.50; water 26.90; oxides of iron and manganese 1.25.—*Berzelius.*

Dist. Char. It resembles zeolite, but this is fusible. Its property of corroding glass, is not constant, but may sometimes be seen by placing a little of it in powder with sulphuric acid on a piece of glass and warming it over a lamp.

Local. Barnstable in Devonshire; Cornwall; New Castle, and other places in England. Brazil, Bohemia, and the Hebrides. First discovered at Barnstable by *Dr. Wavel.*

Obs. A mineral found at Richmond, Berkshire county, *Mass.* is supposed to belong to the present species. It occurs stalactical or in concre ions composed of minute radiating fibres; color greenish or greyish, white; scratches carbonate of lime. Infusible.

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* After *Dr. Wavel,* its discoverer.

Genus 3.—MAGNESIA.

Like the other earths, magnesia when pure, is perfectly white. That sold by apothecaries, is obtained by the decomposition of the sulphate of magnesia. It is also found native in small quantities. It enters into the composition of a considerable variety of minerals. It forms the basis of several native salts, being found combined with the carbonic, sulphuric, and boracic acids.

Species 1. CARBONATE OF MAGNESIA.

Magnesite, J M. Carbonate of Magnesia, P. C.

Of this species there are four varieties, viz. crystallized, compact, earthy, and pulverulent.

Var. 1. CRYSTALLIZED CARBONATE OF MAGNESIA.

Crystallized Carbonate of Magnesia, C. P.

Ext. Char.—Color, white; occurs in delicate acicular crystals, radiating, or diverging, and possessing the lustre of satin; also in flesh colored crusts, not more than two lines thick, having a polished, or sparry structure. It is totally soluble in sulphuric acid.—*Cleveland.*

Local. Staten Island, *N. Y.* Discovered by James Pierce, Esq. in veins, or cavities in magnesite and steatite.

Var. 2. COMPACT CARBONATE OF ~~LIME.~~ Magnesia

Magnesia carbonatée, H. Magnesite, J. A. Carbonate of Magnesia, P. C.

Ext. Char.—Colors, grey, or yellowish; occurs amorphous, tuberous, and spongiform; fracture, dull, splintery, and flat conchoidal; nearly opake; yields to the nail externally; internally harder than calcareous spar; adheres to the tongue; absorbs from 9 to 10 per cent of water, and becomes translucent on the edges.

Chem. Char. Soluble with effervescence, but slowly, in muriatic and sulphuric acids; infusible, but hardens under the blowpipe so as to scratch glass.—*Aikin.*

Comp. Magnesia 58; carbonic acid 49; water 3.—*Klaproth.*

Dist. Char. The bitter solution which it forms when dissolved in sulphuric acid, and its not burning to quicklime, will distinguish it from chalk, and other forms of carbonate of lime. It does not, like clay, become plastic with water.

Local. Upper Stiria, Moravia, Italy, Spain, and Silesia.

U. S. Bare Hills, near Baltimore.

Var. 3. EARTHY CARBONATE OF MAGNESIA.

Ext. Char.—Color, whitish or yellowish white; occurs in porous masses; fracture earthy; yields easily to the nail; adheres to the tongue; sometimes swims on water.

Local. Samos, Negropont, Moravia, and Cornwall.

Obs. It is called *Meerschaum* in the east, and is used for the same purposes as Fullers earth is with us.

Var. 4. PULVERULENT CARBONATE OF MAGNESIA.

Pulverulent Carbonate of Magnesia.—*Pierce.*

Ext. Char.—Color, yellowish white; occurs in small masses, which fall to powder on drying; soft to the touch; soils the fingers; soluble in sulphuric acid.

Local. India.

U. S. Hoboken, *N. J.* Discovered by James Pierce Esq. Staten Island, *N. Y.* Roxborough, *Penn.*

Species 2. SULPHATE OF MAGNESIA.

Prismatic Epsom Salt, J. M. Magnesie sulfatée, H. Sulphate of Magnesia, A. P. C.

Ext. Char.—Color, white, or greyish white; occurs in crystalline fibres, adhering together longitudinally; lustre silky or pearly; translucent; not very brittle; taste, bitter and nauseous.

Chem. Char. Soluble in water, from which it is precipitated by the carbonate of potash or soda. Under the blowpipe, it boils, gives off its water of crystallization, and remains a white, infusible, spongy mass.

It is found on the surface of decomposing gypsum, or schistus, on the surface of particular soils, and in mineral waters.

Local. Epsom,* in England, and Sedlitz, in Bohemia. At these places, it is abundant in mineral springs.

U. S. Mammoth Cave, *Ky.* Greenbriar and Monroe counties, *Va.* Near Corydon, *In.* in abundance. Coeymans, *N. Y.*

Species 3. BORATE OF MAGNESIA.

Magnesie boratée, C. Hexahedral Boracite, J. Boracite, P. Borate of Magnesia, C. Octahedral Boracite, M.

Ext. Char.—Colors, yellowish, greyish, or greenish white; occurs crystallized in the form of a cube, variously modified by truncation; sometimes all the edges are truncated, but in every case the diagonally

*Whence Epsom salt, the common name of the species.

opposite angles are differently modified, sometimes by simple truncation, and sometimes by bevelment; the solid angles are subject to the same diversity: fracture uneven, passing into flat conchoidal; lustre glistening; transparent or translucent; sometimes gives sparks with steel; pyro-electric, the opposite angles being in opposite electrical states.

Chem. Char. Fusible into an opake white glass.

Comp. Magnesia 16.6; boracic acid 83.4.—*Vauquelin.*

Dist. Char. Its peculiar character of possessing opposite electricities at its opposite angles, and the dissimilar opposite modifications of its angles, will distinguish it from all other minerals which it resembles.

Local. Lower Saxony, embedded in gypsum; near Kiel, in Holstein, embedded in anhydrous gypsum.

Genus 4.—BARYTES.

When pure, barytes is white, has a caustic, somewhat alkaline taste, and by the chemists is placed among the alkaline earths. It is a strong poison. It never occurs pure in nature, but is found combined with the carbonic and sulphuric acids, forming carbonate of barytes, and sulphate of barytes.

Species. 1. CARBONATE OF BARYTES.

Baryte carbonatée, H. Rhomboidal Baryte, J. Carbonate of Barytes, P. C. Di-Prismatic, Hal-Baryte, M.

Ext. Char.—Colors, white, or greyish white, or yellowish, bluish, or greenish; occurs massive, stalactical, and in crystals; form, resembling closely the common crystals of quartz, viz. six-sided prisms, terminated by six-sided pyramids; sometimes with the apices truncated; fracture of the massive undulated; structure fibrous or bladed; lustre glistening; translucent or opake; scratches carbonate of lime: sp. gr. 4.4.

Chem. Char. Fusible into a white enamel; soluble with effervescence, in dilute nitric, or muriatac acid, a little of which tinges burning alcohol yellow.

Comp. Barytes 78; carbonic acid 22.—*Klaproth.*

Dist. Char. Its weight will distinguish it from the minerals it resembles, except strontian and the sulphate of barytes. The sulphate does not effervesce; and carbonate of strontian, when dissolved in an acid, and mixed with alcohol, tinges the flame purple, instead of yellow.

Obs. 1. The cells of the massive variety of this substance, often contain the crystallized variety.

2. When reduced to thin plates, it gives by refracted light, two images, one bright, and the other nebulous.—*Cleveland.*

3. The native carbonate of barytes, is next to arsenic, one of the strongest of mineral poisons. When dissolved in muriatic acid, it is employed in minute doses, as a remedy in certain diseases

Local. It was first discovered by Dr. Withering in Lancashire, England, hence *Witherite*, one of its names. It has since been found in several other places in England, in Hungary, Stiria, and Siberia.

U. S. Near Lexington, *Ky.*

Species 2. SULPHATE OF BARYTES.

Prismatic Baryte, or Heavy Spar, J. Sulphate of Barytes, P. C. Prismatic Hal-Baryte, *M.* Baryte Sulfatée, H.

Ext. Char.—Colors, white, yellowish white, flesh red, greenish white, and bluish; occurs crystallized and massive; primitive form, a right four-sided prism, whose bases are rhombs; subject to a variety of modifications by truncation; structure lamellar, with cleavage in three directions: crystals sometimes curved; lustre shining, between pearly and vitreous; yields easily to the knife; translucent: sp. gr. 4.446.—*Mohs.*

Obs. These crystals are generally so short, as to take the tabular form.

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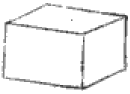

Fig. 21. The primary form, a right prism, with rhombic bases.

Chem. Char. Decrepitates, becomes vitrified on the outside, and finally melts into an opake white enamel. If colored with oxide of copper, the flame, on its first application, is tinged green, otherwise not; if the enamel be applied to the tongue, it tastes like rotten eggs; it does not effervesce with acids.

Comp. Barytes 67; sulphuric acid 33.—*Klaproth.*

Dist. Char. Its specific gravity will distinguish it from the minerals it most resembles, except strontian, carbonate of barytes, and carbonate of lead. Strontian after fusion never gives the fetid taste of barytes; it gives a purple flame, when dissolved in an acid, and burned with alcohol; carbonate of strontian effervesces; carbonate of lead effervesces, and is reduced to the metallic state under the blowpipe.

Sulphate of barytes is found in considerable variety of form and structure, and therefore admits of a number of sub-divisions.

Obs. Among the more remarkable tints which occur in this species, Mohs, has noticed the following, viz. smalt-blue, pale sky-blue, almost indigo blue, woad-brown, and hair brown, bright red and yellow.

Var. 1. LAMELLAR SULPHATE OF BARYTES.

Straight lamellar and prismatic heavy-spar, J. Lamellar Sulphate of Barytes, C.

Ext. Char.—Colors, white, yellowish white, grey, reddish, bluish, or greenish; occurs crystallized, sometimes distinct, but commonly in foliated masses; form, the right rhombic prism, subject to a great variety of truncations, or bevelments; crystals compressed into a tabular form; generally aggregated into masses, so as to present, when broken, longish granular particles, of various sizes; translucent; lustre shining; pearly; fragments rhomboidal; easily broken.

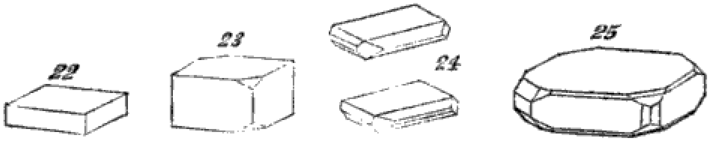

Fig. 22. A four-sided table, a common form.

Fig. 23. A right prism with rhombic bases, modified by the truncation of its alternate solid angles.

Fig. 24. A four-sided table with truncated terminal, or narrow faces, and solid angles.

Fig 25. The same, with the narrow faces modified by bevelment, and its angles by truncation.

Obs. 1. The crystals are often colorless and transparent, and although generally small, Lowry mentions one, six inches long.

2. The laminæ of this variety are often curved, and sometimes unite in a point like the petals of a flower.

3 Sometimes the folia are set on their edges, forming thin crystals called *cockscomb* spar.

Var. 2. COLUMNAR HEAVY SPAR.

Baryte sulphatée barillaire, H. Columnar Heavy-Spar, J. Columnar Sulphate of Barytes, C.

It consists of very thin crystals, which are aggregated longitudinally, or are collected into bundles, or columnar groups; structure foliated; the columns striated; lustre pearly; translucent.

Var. 3. FIBROUS HEAVY-SPAR.

Baryte sulphatée concretionée-fibreuse, H. Fibrous Sulphate of Barytes, C.

Ext. Char.—Color, chesnut brown; occurs in botryoidal, or reniform masses; structure fibrous; lustre, shining resinous; transparent; brittle.

Comp. Sulph. barytes 99; with a trace of iron.—*Klaproth.*

Var. 4. RADIATED HEAVY-SPAR.

Baryte sulphatée radiée, H. Bolognian Stone, P. Radiated Sulphate of Barytes, C.

Ext. Char.—Color, grey, or yellowish grey; occurs in roundish masses, composed of radiating minute crystals, which appear to come from the centre, and to project unequally on the surface, giving it a rough exterior; fracture foliated; translucent.

Obs. This variety being calcined, then mixed with mucilage of gum arabic, and formed into small pieces, and again heated, has the property, after exposure to light, of shining in the dark. It is then called Bolognian phosphorus.

It is found at Bologna, in Italy, hence the name.

Var. 5. GRANULAR HEAVY-SPAR.

Baryte sulphatée granulaire, H. Granular Heavy-Spar, P. Granular Sulphate of Barytes, C.

Ext. Char.—Colors, white, yellowish, or greyish white; occurs massive; structure finely granular; grains, crystalline and lamellar; lustre shining; feebly translucent.

Comp. It contains 10 per cent of silex.—*Klaproth.*

Var. 6. COMPACT HEAVY-SPAR.

Baryte sulphatée compacte, H. Compact Heavy-Spar, J. Compact Sulphate of Barytes, C.

Ext. Char.—Colors, white, greyish, or reddish white; occurs massive; fracture coarse, earthy, dull, soft, and brittle.

Local. It is found in Bohemia, Saxony, and in the mines of Derbyshire.

Var. 7. EARTHY HEAVY-SPAR.

Earthy Sulphate of Barytes, C.

It occurs in earthy particles slightly cohering; lustre glimmering, or dull; heavy.

Local. It is found near Freyberg, Saxony, also in Bohemia, Derbyshire, &c.

Subsp. 1. ***FETID SULPHATE OF BARYTES.***

Baryte sulfatée fetide. Hepatite, J. A. P. M. Fetid Sulphate of Barytes, C.

Ext. Char.—Colors, yellowish, brownish, or blackish; occurs in globular masses; structure foliated; gives a sulphureous odor when rubbed, or heated ; in other respects it resembles the common varieties.

Comp. Sulphate of barytes 85.2 ; sulphate of lime 6 ; alumine 1 ; oxide of iron 5 ; carbon 0.5.—*Klaproth.*

Uses. The pure white varieties are ground and used as a white paint, either alone or mixed with white lead, which cannot be considered as an imposition.—*Mohs.*

Obs. Crystals of the present species have been artificially obtained by dissolving sulpho-cyanuret of barium in sulphuric acid, and allowing this solution to be slowly decomposed by the influence of the atmosphere.—*Mohs.*

Sulphate of barytes is found in veins, in primitive transition and secondary rocks. Its localities are numerous, though it seldom occurs in large quantities. It is commonly found with the ores of lead, copper, zinc, &c.

Local. Its foreign localities are numerous, being found in almost every country where mines are explored.

U. S. Cheshire, Berlin, Farmington, Hartford, and Southington, *Con.—Silliman.* Hatfield.—*Gorham.* Southampton.—*Eaton.* Middlefield and Greenfield, *Mass.—Hitchcock.* Livingston's lead mine.—*Shaeffer.* Little Falls, on the Mohawk.—*Eaton.* The Highlands, near the Hudson, *N. Y.—Pierce and Torrey.* Near Newton, Sussex County.—*Chilton.* On the west side of Paulin's Kill, and near Scotch Plains, *N. J.—Pierce and Torrey.* Perikomen lead mine.—*Wetherill.* Buck's County, 3 miles west of New Hope.—*Lea.* Bedford County, at the foot of Blue Ridge, *Penn.—Wister.* Liberty, Frederic County, and Washington County, *Md.—Hayden.* Near Lexington, *Ken.—Jessup.* Several of the lead mines in Missouri.—*Schoolcraft.*

Genus 5.—STRONTIAN.*

This earth in many respects resembles that of barytes. It is white and fuses with difficulty. It is never found pure in nature, but is combined with the carbonic and sulphuric acids, forming a carbonate and sulphate of strontian.

Species 1. CARBONATE OF STRONTIAN.

Strontiane carbonatée, H. Carbonate of Strontian, P. C. Di-prismatic Baryte, or Strontianite, J. Peritomous Hal-Baryte, M.

Ext. Char.—Colors, white, greyish, or greenish white ; occurs crystallized, fibrous, massive, and stellated ; form, the hexahedral prism, modified by truncation, or terminated by pyramids ; structure divergingly fibrous, or bladed ; lustre, shining pearly ;

* From its having been first observed at Strontian, in Scotland.

fracture, fine grained, uneven ; crystals small or acicular, often attached to the massive ; yields to the knife ; brittle : sp. gr. nearly 4.

Chem. Char. Becomes glazed on the outside, but does not melt ; tinges the flame purplish red ; effervesces with nitric, or muriatic acid, and a paper dipped in the solution, burns with a purple flame ; with borax dissolves into a clear globule.

Comp. Strontian 69.5 ; carbonic acid 30.—*Klaproth.*

Dist. Char. It resembles carbonate of barytes, but the carbonate melts without tinging the flame. It is found in primitive rocks, with the ores of lead, zinc, and copper, and often accompanied by sulphate of barytes, and calcareous spar.

It has not been discovered in the U. States.

Species 2. BARYTIC CARBONATE OF STRONTIAN.

Barystrontianite, *Traill*, P. C.

Ext. Char.—Color, internally, yellowish white, externally, greyish white ; lustre, when broken, weakly shining, and pearly ; cross fracture, uneven or splintery ; transparent on the edges ; soft ; brittle : sp. gr. 3.7.

Chem. Char. Infusible ; effervesces with acids.

Comp. Carbonate of strontian 68.6 ; sulphate of barytes 27.5 ; carbonate of lime 2.6 ; oxide of iron 0.1.—*Traill.*

Local. Stromnes, in one of the Orkney islands.

Species 3. SULPHATE OF STRONTIAN. CELESTINE.*

Strontiane sulphatée, H. Celestine, Sulphate of Strontian, P. Sulphate of Strontian, C. Prismatoidal Hal-Baryte, M.

Ext. Char.—Colors, white, greyish white, yellowish white, or reddish, and more rarely light blue ; occurs fibrous, massive, stellated, and crystallized ; form, the primitive, a right rhombic prism, the alternate angles of which, according to Phillips, are 104 deg. and 76 deg. ; structure lamellar, with joints parallel to the faces of the prism, that parallel to the base being particularly distinct ; lustre shining, between pearly and resinous ; translucent or transparent ; yields to the knife ; brittle : sp. gr. 3.6.

Chem. Char. Melts before the blowpipe into a white friable enamel, without very sensibly tinging the flame ; after a short exposure

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* Sky blue, from its color.

to heat, it becomes opake, and then acquires a somewhat caustic, acrid flavor, very different from that of sulphuretted hydrogen, which heavy-spar acquires in similar circumstances.—*Aiken*. Phosphoresces on hot iron.

Comp. Strontian 58; sulphuric acid 42.—*Klaproth*.

Dist. Char. It resembles the carbonates of strontian and barytes, and the sulphate of barytes. But the distinctive characters given under each of those species, will distinguish this, from them.

Obs. Werner divided this species in the fibrous and foliated. Jameson says, it may be divided into compact, fibrous, radiated, and foliated; but besides the crystallized, he has described only the fibrous and foliated varieties, with distinctness.

Var 1. FIBROUS CELESTINE.

Strontiane sulfatée fibreuse, H. Fibrous Celestine, J. Fibrous Sulphate of Strontian, C.

Ext. Char.—Colors, milk white, passing into blue, or sky blue; occurs massive, in plates and in fibrous crystals; lustre of the longitudinal fracture, shining; cross fracture glistening and pearly; fracture in one direction foliated; translucent; loses its color in keeping; easily broken: sp. gr. 3.8.

This variety is rare. It sometimes occurs in thin beds or layers like gypsum, its fibres being perpendicular to the sides of the bed.—*Cleveland*.

Local. Montmatre, near Paris, Switzerland, Sicily, and in several places in England and Scotland.

U. S. Frankstown, in the Bald Eagle mountain, *Penn*.

Var. 2. FOLIATED CELESTINE.

Foliated Celestine, J. Foliated Sulphate of Strontian, C.

Ext. Char.—Colors, white, grey, bluish, or sky blue; occurs massive, and crystallized, in four or six-sided prisms, variously modified; sometimes the four-sided prism is terminated by four-sided pyramids; and sometimes the termination is dihedral; often this form is deeply truncated on its lateral edges, so as to produce a six-sided prism, crystals often flat or tabular; fracture imperfectly foliated; strongly translucent; crystals sometimes transparent.

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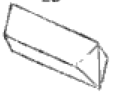

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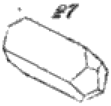

Fig. 26. A four-sided prism, terminated by a two-sided summit, standing no the obtuse lateral angle of the prism.

Fig. 27. A four-sided tabular prism, terminated by a four-sided summit, standing on the obtuse lateral edge of the crystal, and partly on its broad plane.

Local. Bristol and Yorkshire, England. Edingburg, the Tyrol, and near Cadiz. Sicily presents fine crystals.

U. S. Lockport, (*Silliman*,) and Moss Island, *N. Y.* The latter discovered by Prof. Douglass. Near Baltimore, *Md.—Cleveland.* Presque Isle, on the Maumee river, *Ohio.—Silliman.* Grose Island, in Lake Huron, *Mich.—Cleveland.* Magnificent crystals have been brought from Strontian Island, in Lake Erie.—*Mohs.*

CLASS III.

ACIDIFEROUS ALKALINE MINERALS.

This Class includes such minerals as consist chiefly of an alkali, united with an acid. Some of the species contain foreign matter, rendering them very impure. This division includes but a few articles.

Genus 1.—POTASH.

This Genus contains only one species.

Species 1. NITRATE OF POTASH. NITRE.

Potasse nitratée, H. Nitrate of Potash, P. C. Prismatic Nitre, J. Prismatic Nitre-Salt, M.

The well known salt, nitre, or saltpetre, often occurs native, in greater or less quantities. It is found in capillary crystals, and crusts, of a saline cooling taste; transparent or translucent; deflagrates when thrown on burning charcoal, and dissolves in water.

It is particularly found on old walls, and in the earth, and decayed substances of ancient buildings. It is also found in some calcareous countries, and in ancient situations, once inhabited, but now lying waste.

Local. Several plains in Spain; on the chalk formations in some parts of France, in the Grottos of Mount Hamberg, in Germany. In Hungary, Arabia, Italy, Persia, and other countries.

In many of these countries, nitre is extracted from the earth in particular places by lixiviation, and after being purified and crystallized, is fitted for commerce.

U. S. Rackoon Mountain, *Geo.* abundant in a cavern, the earth of which contains from 3 to 10lbs of salts to the bushel. It is partly nitrate of lime, which is decomposed by wood ashes.—*Cornelius.* Madison County, *Ken.* in a cave 646 yards long, and about 40 feet broad. The earth contains both nitrate of potash, and nitrate of lime. It is lixiviated, and the nitrate of lime decomposed by wood ashes. Kentucky furnishes large quantities of nitre, from this and other localities.—*Cleveland.* In some parts of the state of Kentucky, it is said that masses of native nitre are found weighing several pounds.

Nitre is also obtained from earth found in sheltered places, in several parts of *Ohio.*—*Atwater.*

Uses. Its principal employment is in the manufacture of gun powder, and the nitric acid. It is also used in the curing of meat; for the purpose of obtaining oxygen for chemical experiments, for medicinal purposes, for fluxes, &c.

Genus 2.—SODA.

Soda is found combined with carbonic, sulphuric, nitric, boracic, and muriatic acids, forming sulphate, carbonate, nitrate, borate, and muriate of soda.

Species 1. CARBONATE OF SODA.

Soude Carbonatée, H. Prismatic Natron, J. Carbonate of Soda, P. C. Hemi-Prismatic Natron-Salt, M.

Ext. Char.—Colors, greyish, or yellowish white; occurs crystallized, massive, fibrous, encrusting, and efflorescent; the massive is compact or granular; the fibrous, often radiated; lustre glistening; translucent; taste, urinous and saline.

Chem. Char. It effervesces with acids, and when dissolved in muriatic acid, forms *common salt;* in sulphuric acid, forms *glauber's salt.*

Comp. (When pure,) soda 22; carbonic acid 15; water 62.

Obs. It is always impure in the natural state, being mixed with various portions of muriate, and sulphate of soda, or muriate of lime.

This salt is found in many parts of the world in crusts, on certain decomposing rocks, in lakes, on the surface of the soil, or in the waters of certain springs.

Local. Bohemia, dissolved in the hot springs of Carlsbad. Egypt, in the Natron Lakes. These are six in number, situated in a barren valley westward of the Delta. The edges of these lakes in the hot and dry season, are surrounded by a band of white salt, several yards in breadth It consists chiefly of natron, but is mixed with common salt. Hungary contains several lakes, which in winter are full of water, but in summer when the water evaporates, saline efflorescences appear, consisting of natron with a little glauber's salt, and epsom salt. One crop being gathered, another appears in a few days, and this harvest continues until fall. Africa, between Tripoli and Fezzan, contains large quantities of the radiated variety, called *trona.* It lies in a thin stratum, in a bed of common salt. From this place it is said hundreds of tons are annually collected.

Uses. It is principally employed in the manufacture of soap and glass. It is also used in the Levant to give a sharper taste, to smoking tobacco, by mixing a little with it. The ancient Egyptians are said to have made use of *natron,* in preparing the bodies of their dead for mummies.

Species 2. SULPHATE OF SODA. GLAUBER SALT.

Soude sulfatée, P. Prismatic Glauber-Salt, J. Sulphate of Soda. Glauber's Salt, P. C.

Ext. Char.—Colors, greyish, or yellowish white; occurs in efflorescences and in an earthy form, but is more commonly dissolved in certain mineral waters. When water containing it, is evaporated, it yields prismatic crystals with dihedral summits; when exposed to the air, they soon effloresce, or lose their water of crystallization, and fall into a white powder. It rarely if ever is found in native crystals; taste, saline and nauseously bitter.

Comp. (When pure.) Soda 15; sulphuric acid 27; water 58.

It is found in many mineral waters, generally with other salts, as epsom and common salt, and perhaps, is the result of the mutual decomposition of these two salts.

Local. It is found in the lakes of Austria, Lower Hungary, Siberia, and Russia. Near Madrid, it is said to occur in efflorescences at the bottom of a ravine. Indeed, small quantities of it are found in most countries.

The glauber's salt, generally used in medicine, is prepared from *bittern*, the liquor which remains after the extraction of common salt from sea-water.

Species 3. NITRATE OF SODA.

Soude Nitratée, H. Nitrate of Soda, P. M.

This salt is described by Mariano de Rivero, in the Ann. des Mines for 1821, p. 596, as occurring in immense quantity in the district of Tarapaca, in Peru, near the frontiers of Chili, and three day's journey from La Conception. It there forms a bed many feet thick, which in many places appears on the surface, and occupies an extent of more than forty leagues. The salt appears occasionally as an efflorescence, sometimes crystallized, but more often mixed with clay or sand; to the taste it is cool and bitter; it is deliquescent, and when exposed to heat, it behaves like nitrate of potash; it contains a little sulphate of soda. Very large quantities of this salt purified by solution and crystallization, have already been imported into Europe.—*Phillips.*

Species 4. BORATE OF SODA. BORAX.

Soude Boratée, H. Prismatic Borax, J. Borate of Soda, P. C. Prismatic Borax-Salt, M. Tincal.

Ext. Char.—Color, white, sometimes with a tinge of blue or green; occurs in prismatic crystals, variously terminated, and yielding to cleavage parallel to the sides of the primitive form, which is an oblique rhombic prism; translucent or transparent; sometimes opake.

Chem. Char. Intumesces largely, gives somewhat of a crackling noise, and fuses into a transparent globule, which is unalterable by the heat of the blowpipe.

Comp. Soda 17; boracic acid 36; water 47.—*Berzelius.*

This salt is supposed to have been known to the ancients, and to be the substance called *crysocolla*, by Pliny. It is brought from the East Indies, in an impure state, and in commerce is denominated *tincal.* After being purified, which is done by the Dutch and British, it is called *borax.*—*Thompson.*

Tincal is brought chiefly, if not only, from Thibet, where it is procured from a lake which is entirely supplied by springs. The edges and shallows of the lake are covered with a stratum of borax, which is dug up in considerable masses, and the holes thus made, are gradually filled by a fresh deposition.—*Phillips.*

It is said also to be met with in Ceylon, and in considerable quantity in Potosi.—*Mohs.*

Uses. Borax is made use of as a flux, and is especially useful in testing mineralogical specimens, and particularly ores. It enters into the composition of artificial gems, and is used in soldering, and in medicine.

Obs. The purification of tincal is an art confined to a few chemists, and the process is kept a secret.

Speccies 5. MURIATE OF SODA. COMMON SALT.

Soude Muriatée, H. Hexahedral Rock-Salt, J. Muriate of Soda, P. C.

Pure rock salt is so universally known as to require no description. Its primitive form is a cube, and into this it may readily be cleaved; structure lamellar; translucent, or transparent.

Chem. Char. It decrepitates violently, but, between two pieces of charcoal, may be fused; when it tinges the flame yellow, diffuses itself over the surface of the charcoal, and sinks into its substance. Heat does not increase its solubility in water.

Comp. Soda 53.44; muriatic acid 46.55.—*Berzelius.*

Obs. In its impure state, as it is commonly raised from the mine, rock salt is in large and solid masses of a crystalline structure, and of a reddish or bluish color; translucent, presenting impurities to the eye in spots, or veins.

It is almost always associated with gypsum, which either lies above, or below it, or both, or is intermixed with it. Sometimes the gypsum is so impregnated with the salt, as to be worth working on that account.

Common salt is one of the most abundant productions of nature. Besides the immense beds of it, which are known to exist in different parts of the world, together with inland springs, which contain it in large quantities, the ocean contains about a thirtieth part by weight, of common salt, and may be considered its greatest repository.

Local. Spain, contains vast quantities of rock salt. In Spanish Navarre, between Caparosa, and the river Ebro, is a hill of considerable elevation, and about four hundred paces long, by eighty wide, composed of rock salt, with interposing layers of gypsum.—*Bowles.*

But a much more remarkable deposit of the same kind exists at Cordova, sixteen miles from Barcelona in Spain. This is a mountain of massive rock salt, about four or five hundred feet high, and a league in circumference. It is without chasms, crevices, or layers. The color of this salt is white, sometimes red or blue.—*Bowles.*

Obs. 1. *Ulloa*, mentions the vast deposites of rock salt which exist in *Peru*, and says the mountains of salt are equally as high as those which yield silex and mercury. These mines of salt form a part of the grand chain of the Andes, and are situated ten or twelve thousand feet above the level of the sea.

2. In *Siberia*, there is said to be a mountain of rock salt, one hundred and eighty feet high, and one hundred and twenty feet in length. —*Pinkerton.*

3. *Poland and Hungary* afford immense quantities of common salt. The celebrated mines near Cracow, have been wrought since 1251. One of the shafts of this mine is more than a thousand feet deep.

In descending to the bottom, says Shaw, the visitor with surprise, finds a subterraneous commonwealth of families, who have their peculiar laws and polity. They have public roads, horses and carriages. These horses when once immured in this destination, never more see the light of day, and many of the people are buried alive in this abyss, having been born there, without ever having made a journey to the surface of the earth. This subterraneous community have several chapels hewn out of the rock salt, and many crucifixes and images of saints, before which lights are constantly burning.

4. *Germany*, *Italy*, *Russia*, *Sweden*, *Norway*, and almost every other country possess either mines of salt, or springs from which it is produced by evaporation.

5. *England* yearly exports great quantities of salt. From the springs in Worcestershire, 16,000 tons are annually produced ; and 156,000 tons of rock salt are annually raised from the great deposit, near Norwich, in Cheshire.

U. S. The *United States* are well supplied with the means of manufacturing this indispensible article. Salt springs are numerous, and most of them situated far inland, thus preventing the necessity in many instances, of transporting so heavy an article to any great distance by land.

Salt springs exist in *Arkansas*, *Missouri*, in several places at the head waters of the *Ohio*, in *Virginia*, *Kentucky*, *Illinois*, *New-York*, *&c.*

Near Shawneetown, *Illinois*, is a spring which yields annually 150,000 bushels of salt. It sells at 70 cts. per bushel.—*Schoolcraft.*

Near the Muskingum, in Ohio, is a salt spring, which furnishes 80 bushels of salt daily.—*Atwater.*

The state of *New-York* furnishes more than 500,000 bushels of salt yearly.—*Gibbs.*

The whole quantity of salt annually extracted from saline springs in the United States, was several years ago estimated at one million of bushels.—*Cleveland.*

Genus 3.—AMMONIA.

Ammonia, or *Volatile Alkali*, when pure, exists only in a gaseous form. It is composed of about 98.24 nitrogen, and 1.76 hydrogen. Sir Humphrey Davy, from his experiments, was led to suppose that its base was a metal, but this requires further proof.

It is found combined with the sulphuric and muriatic acids, forming sulphate, and muriate of ammonia.

Species 1. SULPHATE OF AMMONIA.

Ammonique sulfatée, H. Sulphate of Ammonia, J. C. P.

Ext. Char.—Color, greyish or yellowish; occurs in stalactities and crusts; externally it is usually covered with a whitish dust; taste acrid and bitter.

Comp. Ammonia 40; sulphuric acid 42; water 18.—*Phillips.*

Local. Sienna, in Tuscany, surrounding certain small lakes; also in the lavas of Etna and Vesuvius.

Species 2. MURIATE OF AMMONIA.

Ammonique muriatée, H. Octohedral Sal Ammoniac, J. Muriate of Ammonia, C. P. Octohedral Ammoniac-Salt, M.

Ext. Char.—Colors, greyish white, white, yellow, green, and brownish black; occurs massive, with a fibrous structure, plumose, in crusts, and in angular crystals, of which the cube is the primary form; taste, pungent and saline; externally, dull; internally, shining and vitreous.

Comp. (That of Vesuvius,) muriate of ammonia 99.5; muriate of soda 0.5.—*Klaproth.*

Obs. 1. The crystals are small, and intersect each other.

2. Jameson, from Estner, enumerates the following forms, besides the cube under which it appears. Complete rhomboid. Rectangular four-sided prism, accuminated by four planes. Garnet dodecahedron, sometimes truncated on all the edges.

3. When rubbed with quicklime, it emits the odor of ammonia.

It is the product of volcanoes, or of art.

Local. Etna, Solfatera, Vesuvius, Lipari, Hecla, and other volcanic countries.

The *sal ammoniac* of commerce, was formerly brought from Egypt, but is now prepared in large quantities in several parts of Europe, and particularly at Paris. Different processes are employed in its manufacture. At Paris, two separate kilns are constructed, into one of which are put a mixture of common salt and sulphuric acid, and into the other animal matters, as parings of hides, horns, hoofs, &c. On the application of heat, muriatic acid gas, is extricated from one kiln, and ammonia from the other. These two gases are conveyed in pipes to a chamber lined with lead, where they combine and form *muriate of ammonia.* In England, a process somewhat different is employed.

CLASS IV.

ACIDIFEROUS ALKALINO-EARTHY MINERALS.

The minerals arranged under this Class, contain an alkali and an earth, acidified by the sulphuric, or fluoric acids, forming salts of different characters. The species are few in number, and some of them but little known.

Species 1.—SULPHATE OF ALUMINE AND POTASH.

Alumine sulfatée alkaline, H. Octahedral Alum, J. Alum, P. Octahedral Alum-Salt, M.

Ext. Char.—Colors, white, yellowish, or greyish white; occurs in efflorescences on argillaceous minerals, chiefly on alum slate, or alum stone; also in crusts and stalactites, or massive, with a fibrous texture; taste, sweetish and astringent.

Comp. Alumine 15.25; oxide of iron 7.50; potash 0.25; sulphuric acid and water 77.—*Klaproth.*

(Artificial Alum.) Alumine 10.50; potash 10.40; sulphuric acid 30.52; water 48.58.—*Vauquelin.*

Obs. Native alum is found in volcanic countries, but more commonly on alum slate, where it is formed by the combination of the alumine, potash, and sulphuric acid, which the stone contains.

Local. Scotland, in the coal mines near Paisley. Bohemia, in many places on alum slate. In the vicinity of volcanoes, as Stromboli, Solfatera, Vesuvius, &c.

U. S. Catskill Mountain, and twelve miles from Cattskill, *N. Y.* Navesink Hills, *N. J.* Several places in Ohio. Pownal, *Vt.* Leyden, *Mass.* Bolton, *Conn.*

Mode of making Alum.—Ferber says, that the rocks which yield the Roman alum, are situated at Tolfa, in Italy. In color, they are white, or whitish grey. They are considerably elevated, and full of large excavations made by the workmen, who descend by ropes, and procure the kind proper for use, by blasting.

Having raised the alum stone to the surface of the earth, it is first calcined in a wood fire, and then, while hot, thrown into reservoirs of water, where it remains until the alum is extracted by the water.

The liquor is then drawn off and boiled in brass pans, until it is in a proper state for the alum to crystallize, when it is removed into wooden coolers, and allowed to shoot into crystals. While boiling, a quantity of lime is mixed with the lixivium.

Obs. The alum rock contains sulphate of iron, alumine, and potash. The calcination converts the sulphur to sulphuric acid, which uniting to the alumine and potash, forms *sulphate of alumine and potash, or alum.* When the rock contains no alkali, a little is added, and for this purpose, wood ashes is commonly used.

At Cape Sable, *Md.* is a manufactory of alum. The ore consists of earthy lignite, mixed with pyrites. This is piled in heaps and suffered to remain in that state for about a year, when the sulphur is acidified by the action of the atmosphere. It is then lixiviated, and the liquor concentrated by boiling, when crystals of alum are formed.—*Cleveland's Mineralogy.*

Species 2. ALUM-STONE.

Lave altérée alunifere, H. Rhomboidal Alum-stone, J. Alum-stone, P. C. Rhombohedral Alum-Haloide, M.

Ext. Char.—Colors, greyish white, brownish, or reddish; occurs massive and crystallized; form the obtuse rhomboid, variously modified by truncation, one or more of the solid angles being commonly replaced; crystals very minute, and generally found in the cavities of the massive; massive, translucent; yields to the knife; fracture conchoidal, splintery, or sometimes earthy: sp. gr. from 2.42 to 2.77.

Chem. Char. Decrepitates, emits a sulphureous gas, and afterwards absorbs moisture from the tongue, and gives the taste of alum; insoluble in water.

Comp. Alumine 43.92; silex 24; sulphuric acid 25; potash 3.08; water 4.—*Vauquelin.*

Obs. Prof. Mohs says, that on charcoal, by itself, it does not melt, but is fusible with borax into a colorless glass, and that when reduced to powder, it is soluble in sulphuric acid.

Local. Tolfa, near Rome; also in Tuscany, and Hungary, and in the vicinity of several burning mountains. According to Cordier, as quoted by Phillips, it exists in almost all burning mountains.

Uses. It is used in the manufacture of alum, and the superior quality of that produced at Tolfa, is ascribed to the employment of this mineral.—*Mohs.*

Species 3. ALKALINE FLUATE OF LIME.

Alumine fluatée alkaline, H. Pyramidal Cryolite. Cryolite, P. Fluate of Soda and Alumine, C. Prismatic Crayone-Haloide, M.

Ext. Char.—Colors, white, greyish white, or brownish; occurs massive; structure perfectly lamellar, with joints parallel to all the planes of a rectangular prism; translucent; becomes transparent by immersion in water; not so hard as fluor: sp. gr. 2.94.

Chem. Char. Fuses into a transparent globule, which becomes opake on cooling.

Comp. Alumine 21; soda 32; fluoric acid and water 47.—*Vauquelin.*

Local. West Greenland, in two small layers in gneiss, one of which contains the white variety, and the other those that are colored.

Species 4. AMBLYGONITE.

Amblygonite, J. C. P. M.

Ext. Char.—Colors, greenish white, or sea green; occurs in rhombic prisms, which are rough externally; cleavage parallel to the sides of the prism; lustre brilliant; transparent, or translucent when in thin laminæ; hardness equal to feldspar; sp. gr. 3.00.

Chem. Char. Easily fusible, with intumescence into a white enamel.

Comp. Alumine, lithia, phosphoric, and fluoric acids.

Berzelius considers it as a double sub-phosphate of alumine and lithia, containing fluoric acid.

Local. Near Penig, in Saxony, where it occurs in granite along with tourmaline and topaz.

Species 5. ANHYDROUS SULPHATE OF SODA AND LIME.

Glaubérite, H. Glauberite, J. P. C. Prismatic Brithyne-Spar, M.

Ext. Char.—Color, yellowish or greyish white; occurs massive, and in the form of flat rhombic prisms; lateral planes striated transversly; the terminal ones smooth; structure foliated; lustre vitreous; streak white; semi-transparent; yields to the knife: sp. gr. 2.7.

Chem. Char. Fusible with decrepitation, into a white enamel. If thrown into water it becomes opake, and is partly dissolved. The same happens if exposed to a moist atmosphere.

Comp. Sulphate of soda 51.0; sulphate of lime 49.0.—*Brongniart.*

Local. Near Ocana, in New Castle, also in Upper Austria.

Species 6. POLYHALLITE.*—*Stromeyer.*

Polyhallite, P. C. M.

Ext. Char.—Color, brick red or colorless; occurs

* From the Greek, signifying a stone of many salts.

in amorphous masses, partly compact and partly fibrous; fibres, parallel or curved; transparent or translucent; the compact yields to cleavage parallel to all the planes of the cube; brittle; scratches calcareous spar; sp. gr about 2.77.

Chem. Char. In the flame of a candle becomes an opake mass of a brownish color; melts instantly before the blowpipe.

Comp. Sulphate of lime 28.25; anhydrous sulphate of lime 28.42; anhydrous sulphate of magnesia 20.03; sulphate of potash 27.70; muriate of soda 0.19; red oxide of iron 0.34.—*Stromeyer.*

Local. Ischel, in Upper Austria; also at Vic, in Lorraine; in both places among rock salt.

CLASS V.

ALKALINO-EARTHY MINERALS.

The Minerals belonging to this Class, consist of Earths in various proportions; including generally, in their composition, one or more of the alkalies. Many of them also contain small quantities of the oxides of one or more metals, as iron, or manganese, from which they derive their colors; but these are not considered essential ingredints.

Species 1. MICA.*

Mica, H. K. A. P. C. Glimmer, W. Rhomboidal Mica, J. Rhombohedral Talc-Mica, M.

Ext. Char.—Colors, white, green, brown, black, red, yellowish, and bluish; occurs crystallized, massive, and disseminated; form, six-sided tables, and oblique rhombic prisms; structure perfectly foliated; lustre glittering, or somewhat metallic; translucent; the white variety in thin pieces, transparent; easily separable into thin plates, which are flexible and elastic to a high degree; yields easily to the knife; sp. gr. about 2.7.

Chem. Char. Fusible into an enamel of different colors, depending on that of the mica.

Comp. (From Siberia.) Silex 48; alumine 34.25; potash 8.75; oxide of iron 4.5; of manganese 0.5; water 1.25.—*Klaproth.*

Obs. There is much difference in the composition of the several colored varieties.

Dist. Char. Talc, which it most resembles, is unctuous to the touch, and inelastic. Foliated gypsum, which it also resembles, is inelastic, and in the heat of a candle, instantly turns white and opake. Cyanite is harder, inelastic, and infusible.

Var. 1. *Plumose Mica.*—The most common color is greyish white, but it may assume any of the colors of the species. It occurs in fine delicate crystals, diverging from a central line, so as to imitate the feathers of a quill, or plume, whence the name.

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* Vulgarly called isinglass. Its name comes from the Latin *mico*, to shine, or glitter.

Var. 2. LAMINATED MICA.

Mica foliace, H. Laminated Mica, C. Muscovy Glass.

It occurs in large plates, which, according to Hauy, are sometimes found in Russia a yard in extent. It is easily separated into thin shining laminæ.

Mica, although it does not form beds alone, is a very abundant mineral, being universally distributed among primitive rocks, and forming an essential ingredient in granite, gneiss, and mica slate.

Hence its localities are in every primitive country, and only a few where fine specimens occur, will be mentioned.

Local. U. S. Germantown, *Penn.* in six-sided tables and prisms.—*Wister.* In the Highlands, at Muno iron works, *N. Y.* in black six-sided tables, six inches in diameter.—*Pierce.* Woodbury, *Conn.* violet colored; also at Watertown, occurs the plumose variety, and near Hartford, in small crystalline masses resembling the garnet. Bellows Falls, *Ver.* rose colored.—*Silliman.* Brunswick, *Maine,* of a beautiful green.—*Cleveland.*

Uses. It was formerly employed for the windows of houses instead of glass, and until lately, was used in the Russian ships of war, it being not so liable as glass to be broken, by the discharge of cannon. At the present time, it is used instead of horn or glass, in lanterns, and for enclosing objects for the microscope.

Lowry says, that in Siberia, mica is quarried, and employed for the purposes to which glass is applied in Europe.

Species 2. LEUCITE.*

Amphigene, H. Dodecahedral Zeolite or Leucite, J. Leucite, A. P. C. Trapezoidal Kouphone-Spar, M.

Ext. Char.—Colors, greyish white, white, and reddish white; occurs in small angular masses, apparently rounded by attrition; also in crystals, whose sides are bounded by twenty-four equal and similar trapeziums; crystals sometimes elongated; angles often rounded; transparent, passing into opake; lustre, shining vitreous; structure obscurely lamellar; scratches glass with difficulty: sp. gr. 2.47.

Chem. Char. Infusible alone; with borax, slowly dissolves into a diaphinous glass.

Comp. Silex 53.75; alumine 24.62; potash 21.35.—*Klaproth.*

It is found in the products of volcanoes, which circumstance will serve to distinguish it from the minerals it most resembles.

Local. Italy and Bohemia, in basalt and lava. The road from Rome to Frascati, is said in many places to be covered with it.

* Signifying a white stone.

Species 3. ANDALUCITE.*

Feldspath apyre, H. Prismatic Andalusite, J. M. Andalusite, A. P. C.

Ext. Char.—Color, reddish, or purplish red; occurs massive and in rectangular, or slightly rhombic prisms; structure lamellar, with joints parallel to the sides of a rhombic prism; translucent or opake; easily frangible; sp. gr. about 3; scratches quartz, and sometimes spinelle.

Chem. Char. Infusible alone, with borax, melts into a limpid glass.

Comp. Alumine 52; silex 38; potash 8; oxide of iron 2.—*Vauquelin.*

Dist. Char. It is distinguished from felspar, by its greater hardness and higher specific gravity, and from corundum by its inferior specific gravity and its form.—*Jameson.*

It is found in primitive rocks only.

Local. Andalusia, in Spain. Forez, in France, in a vein of felspar. Near Freyberg, and at Penig, in Saxony. Wicklow and Kilkenny, in Ireland.

U. S. Readfield, in *Maine.*—*Cleveland.* East Bradford, *Penn.*

Species 4. BUCHOLZITE.†

Bucholzite, *Brandes.* Bucholzite, P. C.

Ext. Char.—Colors, black, and white, arranged in spots; occurs amorphous; lustre glittering, and glassy, or sometimes waxy; the black part separates into fibres; cross fracture conchoidal; structure indistinctly lamellar; fragments wedge-shaped; opake or translucent on the edges; scratches glass.

Comp. Alumine 50; silex 46; potash 1.5; oxide of iron 2.5.—*Brandes.*

Local. The Tyrol. First noticed by Dr. Brandes.

U. S. Brandywine Creek, *Del.*—*Nuttall.*

Species 5. ICHTHYOPHTHALMITE.‡

Apophyllite, H. J. P. C. Ichthyophthalmite, A. Axtomatous Kouphone-Spar, M.

Ext. Char.—Colors, white, greyish white, greenish, or rose red; occurs in square prismatic crystals, and in laminated masses; crystals often truncated on the solid angles, by triangular planes, so as to give them a

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* From Andalusia, in Spain, where it was first found.

† After Bucholz, the chemist.

‡ From the Greek, meaning fish-eye-stone, owing to its peculiar lustre.

four-sided pyramidal termination; lustre glistening and pearly; structure foliated and easily separable into thin shining plates, like those of selenite; brittle; translucent, or nearly transparent: sp. gr. about 2.5.

Chem. Char. Exfoliates, and finally melts into a blebby glass. In nitric acid, divides into flakes.

Comp. Silex 51; lime 28; potash 4; water 17.—*Vauquelin.*

Dist. Char. It resembles adularia, sulphate of strontian, and barytes. It is much softer than the first, and does not like barytes give a fetid taste when melted, nor like strontian, a sour one. Neither of these substances form flakes in nitric acid.

Local. Utoe, in Sweden, in a lamellar limestone. Arendal, in Norway. East Gothland. Fassa, in the Tyrol, and in the isle of Sky.

U. S. Near Lake Champlain, *N. Y.*—*Cleveland.* Near Saybrook, *Conn.*—*Gibbs.*

Var. 1. ALBIN.*

Albin, W. P. C.

Ext. Char.—Color, opake white; occurs in crystalline and laminated masses; forms a jelly with nitric acid; found in Bohemia.

Species 6. NACRITE.†

Talc granuleux, H. Nacrite, Bt. J. Scaly Talc, P.

Ext. Char.—Colors, pearl white, greenish, or grey; occurs in minute aggregated scales; lustre pearly; friable; unctuous to the touch; adheres to the fingers; gives out an argillaceous odor when breathed on; swells on being moistened.

Chem. Char. Swells, and melts with ease.

Comp. Silex 50; alumine 26; lime 1.5; potash 17.5; oxide of iron 5; and a trace of muriatic acid.—*Vauquelin.*

Dist. Char. Lepidolite, which it resembles, is of a lilac color, and not so unctuous. It is more easily fused than talc, and never is of so dark a color as chlorite.

Obs. It is met with in small masses in the cavities of primitive rocks, and particularly in quartz.

Local. Near Freyberg, in Saxony. At Piedmou, and in Bohemia.

U. S. Farmington, *Conn.* Smithfield, *R. I.*

Species 7. HAUYNE.‡

Haüyne, J. A. P. C. Latialite, H.

Ext. Char.—Colors, indigo blue, and opake, or blue.

* From the Latin *albus*, white.
† From the French, *nacre*, *pearl.*
‡ In honor of the celebrated Hauy.

or bluish green, and translucent; occurs in grains, in crystals, and massive; form the dodecahedron, with brilliant faces; harder than quartz; very brittle; structure imperfectly foliated; lustre vitreous: sp. gr. 3.

Chem. Char. Fusible with loss of color, into a porous glass; with borax into a diaphanous glass, which turns yellow on cooling. In powder, it forms a jelly with acids.

Comp. Silex 30; alumine 15; sulphate of lime 20.5; lime 5; potash 11; oxide of iron 1; water 17.5.—*Phillips.*

Local. In the vicinity of Nemi, Albano, and Frascati, in Italy, associated with mica, leucite, and augite. Also near Vesuvius, and Tiree, one of the Scottish Isles, in limestone.

Species 8. OBSIDIAN.

Lave Vitreuse Obsidienne, H. Indivisible Quartz, J. Obsidian, W. P. C. Empyrodox Quartz, M.

Ext. Char.—Colors, black, greyish, or brownish black; also, greenish, bluish, or yellow: occurs in roundish, or angular masses; fracture large conchoidal, with round circular lines, increasing in dimensions from the point of fracture; lustre splendent and vitreous; translucent on the edges, or opake; scratches glass; easily broken, and flies like glass: sp. gr. about 2.35.

Chem. Char. Swells, and finally melts into a spongy mass. It does not melt into a solid glass even at a white heat.

Comp. (That of Hecla.) Silex 78; alumine 10; potash 6; lime 1; oxide of iron and manganese 3.6.—*Vauquelin.*

Obs. 1. Obsidian in its aspect, fracture, and lustre, very much resembles colored glass, as the thick part of a broken junk bottle. It also may resemble pitchstone.

2. Sometimes it is variegated, presenting several colors in the same specimen, and some pieces exhibit a play of colors, with a pearly lustre.

3. The origin of obsidian has been a subject of considerable doubt and dispute among mineralogists. Some supposed from the circumstance of its being commonly found in the vicinity of volcanoes, that it is of igneous origin, and that, indeed it is only a mixture of siliceous and alkaline substances reduced to glass by volcanic fire, hence it is often called *volcanic* glass.

4. On the contrary, obsidian has occasionally been found with the remains of decomposed granite, gneiss, and porphyry, and even alternating with beds of the latter. Other mineralogists, therefore suppose that it is of aqueous origin.—*See Pinkerton's Petrology.*

5. But it is said, that wherever obsidian has been found, there always exists marks of volcanic agency in the neighborhood; so that on the whole, there is little doubt but this substance owes its origin to volcanic heat.

Local. Hecla, and in almost every part of Iceland. Also in the Lipari Islands, in Teneriffe, Peru, Mexico, &c.

Var. 1. PEARLSTONE.*

Lave Vitreuse Perlée, H. Pearlstone, A. P. C.

Ext. Char.—Colors, grey, greyish black, brownish, reddish, or yellowish; occurs in large, coarse, angular concretions, consisting of grains or smaller concretions composed of lamellæ; concretions often embrace a neucleus of obsidian; surface smooth and shining; lustre pearly; translucent on the edges, or opake; scratches glass; very fragile; gives an argillaceous odor, when breathed on: sp. gr. 2.34.

Chem. Char. Fusible with intumescence into a white frothy glass.

Comp. Silex 75.25; alumine 12; lime 0.5; potash 4.5; oxide of iron 1.6; water 4.5.—*Klaproth.*

Obs. Pearlstone occurs in the same geological situations with obsidian, and the same arguments and objections are brought for, and against its igneous and aqueous origin.

Local. Tokay, in Hungary, where it is found enclosing black masses of obsidian. Cape de Gatt, in Spain. Antrim, in Ireland, &c.

Species 9. GIESECKITE.—*Stromeyer.*

Ext. Char.—Colors, externally brownish, internally greenish, intermixed with black; occurs in six-sided prisms; fracture uneven, splintery; cleavage not perceptible; lustre waxy; has the appearance of soapstone, more than of a crystalline mineral; opake or translucent on the edges; yields to the knife; streak whitish; scratches glass: sp. gr. 2.7 to 2.9.

Comp. Silex 46.27; alumine 33.82; magnesia 1.2; potash 6.2; oxide of iron 3.35; water 4.8.—*Stromeyer.*

Local. Greenland, from whence it was brought by *Sir C. Giesecke.* Hence the name.

Species 10. FELSPAR.†

Feldspath, H. Prismatic Feld-Spar, J. M. Felspar, A. P. C.

Few minerals are more widely diffused than this. It forms a necessary part of most primitive and many secondary rocks Its colors are various, but it has a peculiar lustre, and a foliated structure, by which it is easy to distinguish it from other minerals.

It has several varieties which all agree in respect to structure and peculiarity of lustre.

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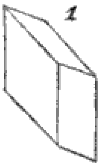
* From its pearly lustre.

† From the German, signifying field-spar, from its being often found loose in fields.

Var. 1. COMMON FELSPAR.

Common Felspar, K. J. A. P. C.

Ext. Char.—Colors, white, yellowish, grey, brown, bluish, red, and green; occurs massive, disseminated, and crystallized; form, an oblique prism, the sides of which are unequal, and vary from four to ten in number; primitive form, the oblique parallelopiped; common forms, a broad six-sided prism, terminated by dihedral summits, the planes of which stand on the narrow faces of the prism; an oblique four-sided prism, flatly bevelled on the extremities; a six-sided prism, terminated by five unequal faces; structure foliated; cleavage in two directions; lustre shining, and often pearly; translucent; the dark varieties nearly opake; cross fracture conchoidal; fragments rhomboidal; crystals generally indistinct, and closely aggregated, crossing each other, or forming hemitropes; scratches glass: sp. gr. 2.54.



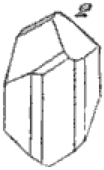


Fig. 1. An oblique parallelopiped, the primitive form.

Fig. 2. A short six-sided prism, truncated on four of its lateral edges, forming a ten-sided crystal with alternate broad and narrow faces, and terminated by four unequal planes.

Chem. Char. Fusible into a white translucent enamel.

Comp. Silex 62.83; alumine 17; potash 13; lime 3; oxide of iron 1.—*Vauquelin.*

Remark. There is considerable difference in composition, of the different varieties of this species, and particularly in respect to the quantity of alumine, and potash which they contain.

Obs. 1. This variety is very generally diffused, and perhaps is more common than any other mineral, with the exception of quartz, the ores of iron, and carbonate of lime.

2. It forms a constituent part of gneiss, granite, and mica-slate, among primitive rocks; and of greenstone, and most volcanic substances, among those of secondary formations. It also occurs in porphyry and sienite.

3. Felspar, according to Pinkerton, intermixed with small quantities of other minerals, forms entire mountains in several parts of the globe.

4. Felspar with garnets, forms a mountain in the west of Scotland. In Siberia, the common foliated felspar, forms entire mountains. In the north of Scotland, there are mountains, and large strata of the same mineral.

Var. 2. ADULARIA. MOON-STONE.

Felspath Adulaire, Bt. Felspath Nacre, H. Adularia, J. A. P. C.

Ext. Char.—Colors, white, bluish white, sometimes with tints of green, yellow or red; occurs in rolled masses, in crystals of the forms above described, and disseminated in granite; lustre pearly. and especially when cut and polished, it throws out greenish and bluish white chatoyant reflections from the interior; fracture uneven; cleavage in two directions; crystals often present the hemitrope arrangement, which in polished specimens becomes obvious from the different directions of the grain, or laminæ: sp. gr. 2.54.

Chem. Char. Fusible into a transparent glass.

Comp. Silex 64; alumine 20; lime 2; potash 14.—*Vauquelin.*

Dist. Char. From common felspar into which it passes, it differs in being more translucent, and in displaying strong pearly reflections. Cat's-eye is harder, and has not its foliated structure; it is harder than ichthyophthalmite, strontian or barytes, the two last also possess peculiar chemical properties. Spodumene splits, and flies when heated.

Adularia is found in cavities of granite, gneiss, clay-slate, and limestone.

Local. St. Gothard yields the finest specimens, sometimes a foot in thickness. Beautiful specimens also come from Ceylon.

U. S. Ticonderoga, *N. Y.* of a milk white color, also on the margin of Lake Champlain, at a place called Split-rock.—*Hall.* Near Baltimore, *Md.*—*Gilmor.* Germantown and Conestoga creek, *Penn.* Haddam, *Conn.* Near the city of New York. Southampton, Oakham, and West Springfield, *Mass.*

Obs. 1. According to Jameson, the water opal, and the fine opal of the Italians, as well as the sun-stone, which is distinguished by its red color and beautiful silvery reflections, are varieties of adularia.

Uses. Adularia is sometimes polished for jewelry. It is commonly cut with a convex surface like the cat's-eye, but is easily distinguished from it, by observing that the reflections proceed from particular points on a plane surface, whereas in the cat's-eye, the pearly light is obvious in every direction.

Var. 3. GLASSY FELSPAR.

Glassy Felspar, J. A. P. C.

Ext. Char.—Colors, greyish, or yellowish white; occurs commonly in broad four-sided crystals, terminated by two planes ; lustre vitreous, or glassy ; crystals cracked in various directions ; transparent or translucent.

Local. Solfatera, Bohemia, and Hungary, in pumice. Isle of Arran, in Scotland, in pitchstone.

Var. 4. LABRADOR OPAL.

Feldspath Opalin, H. Labrador Felspar, A. P. Opalescent Felspar, C.

Ext. Char.—Colors, smoke grey, with spots of opalescent, or irridescent, variable tints, consisting of blue, fire red, green, brown, yellow, or orange, according to the direction in which the light falls upon it ; sometimes several of these colors are perceptible at the same instant, but more commonly they appear in succession, as the stone is turned towards the light ; occurs massive ; structure like that of common felspar, and easily recognised as one of that family.

Obs. 1. This most beautiful variety was discovered by the Moravian Missionaries, on the Island of St. Paul, situated on the coast of Labrador.

2. Dr. Anderson, who gave an account of this mineral soon after its discovery, describes it as displaying all the variegated tints of color that are to be seen in the plumage of the peacock, pigeon, or most delicate humming-bird.

3. Specimens of it being sent to England, they were bought with great avidity, and the desire among the collectors, all over Europe, to possess specimens was so great, that single pieces were sold at £20 sterling.

Local. Near Petersburg, Russia. Near Laurwig, in Norway. Bohemia, Saxony, and Labrador.

U. S. Near Lake Champlain, *N. Y.* in an iron mine.—*Gibbs.* Near Pompton Hills, *N. J.* in a large rounded mass.

Remark. That of Labrador often contains magnetic oxide of iron.

Uses. It is highly valued as a curiosity, and is cut and polished for ring stones, and breast-pins. When cut in an oblong convex shape, or *en cabochon,* as the French term it, most of the colors are apparent at the same instant. When held between the eye and the light, it appears of a dingy grey color, and without the least beauty, and one is the more astonished after viewing it in this manner, to witness the beautiful display of colors which it exhibits by the reflected light.

Var. 5. GREEN FELSPAR.

Ext. Char.—Color, apple green ; occurs in the common form of the species. It is called *Amazon Stone.*

Local. Uralian Mountains.

U. S. Near Baltimore, *Md.* in granite. At Cow Bay, on Long Island, *N. Y.* color apple geen.—*Pierce and Torrey.* Topsham, *Maine*, in imperfect crystals.—*Cleveland.*

Var. 6. COMPACT FELSPAR.

Feldspath Compacte, H. Compact Felspar, A. C. P.

Ext. Char.—Color, white, bluish white, greenish, reddish, brown and flesh red, colors sometimes arranged in spots or stripes; occurs massive, disseminated, and in crystals; texture compact, or minutely foliated; fracture conchoidal; lustre glimmering; translucent on the edges; sp. gr. from 2.60 to 2.74.

Chem. Char. Fusible alone into a white porous enamel.

Comp. Silex 51; alumine 30; lime 11.25; soda 4; oxide of iron 1.75; water 1.26.—*Klaproth.*

It is one of the constituent parts of primitive, transition, and secondary rocks. It sometimes occurs in large beds, or even forms hills.

Local. Saxony, Tyrol, Scotland, &c.

U. S In the Fishkill Mountains, *N. Y.* in gneiss. Malden, Dorchester, and Milton, *Mass.* Colors, sometimes red and white, arranged in veins.

Obs. 1. This variety resembles hornstone, and sometimes jasper.

2. According to M. Godon, as quoted by Cleveland, the vicinity of Boston furnishes compact felspar perfectly analagous to the Turkey stone, (hone); and also a veined variety, which strongly resembles certain antique engraved stones wrought by the Greeks and Romans in *basso-relievo.*

Var. 7. FETID FELSPAR.

Fetid Felspar, C. Necronite.*—*Hayden.* Sill. Jour. Sci. Vol. 2.

Ext. Char.—Color, clear white, or bluish white; occurs amorphous, and crystallized in hexahedral prisms, resembling the beryl, and in rhomboids similar to the form of felspar; structure lamellar; transparent, passing into opake; scratches glass, and even felspar in a slight degree; when struck, or pounded emits a most noisome cadaverous smell.

Chem. Char. Infusible, and unalterable even with borax in the strongest heat of a smith's furnace. Acids do not effect it, either cold or hot.

Local. This mineral appears to have been first described by Dr. Hayden, of Baltimore, who discovered it in 1819, about 21 miles from that city. It occurs in primitive marble, associated with brown mica, sulphuret of iron, and tremolite.

* From the Greek, in allusion to its cadaverous smell.

Var. 10. ANORTHITE.—*Rose.*

Anorthite, M.

Ext. Char.—Color, and streak, white; occurs massive, composed of rhomboidal prismatic, aggregated crystals, resembling those of albite; cleavage perfect in two directions; fracture conchoidal; lustre upon the planes of cleavage, pearly; in other directions vitreous; translucent or transparent; hardness, that of felspar: sp. gr. 2.65 to 2.76.

Chem. Char. Fusible like the other varieties of the species, the globule being turbid.

Comp. Silex 44.49; alumine 34.46; oxide of iron 0.74; lime 15.68; magnesia 5.26.—*Rose.*

Dist. Char. It is entirely decomposed by concentrated muriatic acid.

Local. Mount Vesuvius, lining the cavities of limestone, and associated with augite.

Obs. This mineral has recently been discovered.

Species 11. TALC.

Talc, Bt. A. P. C. Rhomboidal Mica, J. Prismatic Talc-Mica, M.

Ext. Char.—Colors green of various shades, as emerald, or apple green, or greenish white; occurs massive, consisting of thin folia easily separable with the fingers, also indurated and in crystals; lustre shining; translucent; in thin plates transparent; soft and very unctuous to the touch; yields easily to the nail; folia curved, undulated, or straight; lustre shining, pearly; color of the thin lamina white.

Chem. Char. Before the blowpipe it turns white, the laminæ separate, and the thin fibres become glazed. With borax it melts with effervescence into a greenish transparent glass.

Comp. Silex 61; magnesia 30.5; potash 2.75; oxide of iron 2.5; water 0.5.—*Klaproth.*

Dist. Char. It resembles mica, but this is both flexible and elastic, while talc is elastic but not flexible. Chlorite and nacrite are fusible without difficulty. Its unctuosity will also distinguish it from these substances, and from selenite, and cyanite.

It occurs in primitive rocks, as granite and serpentine, and though common in small quantities, is never very abundant.

Local. U. S. Grafton, Windham, Cavendish, Ludlow, &c. *Ver.*—*Hall.* Smithfield, silvery white, with rhomb spar.—*Webb.* Near Baltimore, *Md.* fibrous, ligniform, and foliated.—*Hayden.* Delaware County, *Penn.* sometimes crystallized; also on the Schuylkill, ten miles from Philadelphia, of a fine green color with rhomb spar.—*Lea.* Haddam and Litchfield. *Conn.* Southampton, Cummington and Middlefield, *Mass.* Brunswick, *Maine*, in limestone with actinolite; colors, silver white, and apple green.—*Cleveland.*

Var. 1. INDURATED TALC.

Indurated Talc, J. A. P. C.

Ext. Char.—Color, greenish grey; occurs massive; texture compact; structure slaty; lustre a little pearly; less soft and unctuous than common talc; translucent on the edges; insensibly passes into stealite. It is found in primitive mountains, in clay-slate and serpentine.

Local. Austria, the Tyrol, Switzerland, Scotland, &c.

Dist. Char. It has a strong resemblance to potstone, but is more unctuous, and less hard.

Uses. This variety is employed by Tailor's, to trace out their work on woolen cloth.

Species 12. STEATITE. SOAPSTONE.

Talc Steatite, H. Steatite, J. A. M. P. Common Steatite, C.

Ext. Char.—Colors, various shades of green, grey, white, yellow, and red, and always dull; grey and white are the most common; colors commonly arranged in spots, veins, or clouds; occurs massive, forming large beds, or hills; fracture splintery, or uneven, with marks of confused crystallization on close inspection; yields easily to the knife, and may be cut when first taken from the quarry; unctuous to the touch; translucent on the edges; leaves a shining streak; sp. gr. about 2.50.

Chem. Char. Hardens, turns black, but is hardly fusible.

Comp. Silex 64; magnesia 22; oxide of iron 3; water 5.—*Vauquelin.*

Obs. Soapstone sometimes presents pseudo-morphous crystals, in the form of carbonate of lime or quartz, which appear to have been moulded into cavities once occupied by true crystals.

Dist. Char. It is less unctuous to the touch than indurated talc, into which it passes. Jameson observes, that the white variety approaches to lithomarge, and the green to fuller's earth, but both of these are softer and adhere to the tongue. Serpentine is harder than steatite, and not so unctuous.

Steatite occurs in masses, and in beds of considerable extent, in primitive mountains. Sometimes according to Pinkerton, it forms mountains or hills of considerable dimensions.

Local. Cornwall, in England. Bohemia, Scotland, Spain, Hebrides, &c.

U. S. New Haven, Litchfield, and Somers, *Conn.* At the latter place it is quarried extensively. On the Schuylkill, ten miles from Philadelphia, *Penn.* It is extensively employed. Staten Island, *N. Y.* in abundance. Smithfield, *R. I.* It is employed in the arts.—*Eaton.* Grafton, *Ver.* This steatite is employed in the construction of aqueducts —*Hall.* Orford, *N. H.* It occurs in large quantities, and is extensively employed.—*Hall.* Near the Falls of St. Anthony, *Louisiana.*

Obs. 1. According to Pinkerton, the Arabs made use of soapstone instead of soap.

2. The inhabitants of New Caledonia, it is confidently said, either eat a soft kind of soapstone alone, or mix it with their food.

3. Humboldt says, that a certain race of inhabitants on the Oronoko, are almost entirely supported by a kind of soapstone, for three months in the year.

Uses. Soapstone is extensively employed in the arts of life, for various purposes. It is soft and well fitted for turning, cutting, or sawing. It is bored for aqueducts, and will probably come into general use for this purpose, being much cheaper than lead, and without the least deleterious property. It resists the fire, and is well calculated for the backs of chimneys, and the sides of fire places, &c. After being heated, it will receive a tolerable polish, and might be employed for jambs instead of marble.

Var. 1. POTSTONE.

Talc ollaire, H. Potstone, K. J. P. C.

Ext. Char.—Colors, greenish grey, passing into leek green, often spotted; occurs massive; texture compact; structure slaty; unctuous to the touch; often yields to the nail; not easily broken; lustre glistening; opake; fracture earthy, or uneven; odor argillaceous; sp. gr. nearly 3.

Comp. Silex 38; magnesia 35; iron 15; alumine 7; with a little lime and fluoric acid.—*Weiglib.*

It is found with serpentine, argillite, and soapstone.

Local. Como, in Lombardy, where it has been quarried more or less, ever since the days of Pliny, and turned into culinary vessels—hence the name *potstone.*

Remark. It is often difficult to distinguish potstone, from indurated talc and soapstone. It is, however, commonly less unctuous than the former, and more compact and finer grained than the latter.

Var. 2. AGALMATOLITE.

Talc Graphique, H. Steatite Pagodite, Bt. Agalmatolite, P. Chinese Figure Stone.

Ext. Char.—Color, greenish, or yellowish green; sometimes with veins of lilac, or brown; occurs massive; greasy to the touch; translucent; texture compact; easily cut with the knife; receives a polish; sp. gr. 2.8.

Chem. Char. Whitens and becomes opake, but does not melt.

Comp. Silex 56; alumine 29; lime 2; potash 7; oxide of iron 1; water 5.—*Vauquelin.*

Dist. Char. It resembles nephrite in color, translucency, and texture, but is much softer.

Obs. It comes from China, carved into the form of grotesque images, and chimney ornaments. It is also found in Nagyag, in Transylvania, and in Wales.

Species 13. CHLORITE.

Talc Chlorite, H. Chlorite, J. A. P. C.

Chlorite occurs crystallized, compact, slaty, and earthy. As its name signifies, it is always of a green color, usually dark; it is slightly unctuous to the touch, but much less so than talc. When moistened it commonly yields the odor of clay. Most varieties yield to the nail.

Var. 1. CRYSTALLIZED CHLORITE.

Crystallized Chlorite, P.

Ext. Char.—Color, dark leek green; occurs in flat six-sided crystals; structure foliated, and readily divisible into thin layers; lustre shining; crystals occur separate and intersecting each other, in small masses, or investing other minerals.

Chem. Char. Fusible with difficulty into an ash-grey scoria. With borax forms a green glass.

It is found in the veins and cavities of primitive rocks, with chalcedony, axinite, felspar, &c.

Var. 2. COMMON CHLORITE.

Chlorite Compacte, H. Common Chlorite, J. A. C. Compact Chlorite, P.

Ext. Char.—Colors, leek green, or blackish green; occurs massive, composed of minute scales, or of an earthy texture; lustre shining, or glimmering; slightly unctuous: yields to the nail: sp. gr. from 2.6 to 2.9.

Chem. Char. The same as above.

Comp. Silex 26; magnesia 8; alumine 18.5; oxide of iron 43; muriate of soda and potash 2.0; water 2.—*Vauquelin.*

Remark. There is much difference in the proportions of these ingredients. Lampidius obtained only 9.7 oxide of iron, and Hoepfner obtained magnesia 39.47.

Dist. Char. It is of a darker green than talc, or epidote. Nacrite is easily fusible, and potstone is of a more compact texture.

Local. St. Gothard, England, Scotland, Saxony, &c. It is a common mineral.

U. S. Harper's Ferry, *Vir.* Chester County, *Penn.* Rye, *N. Y.* containing long and slender crystals of schorl. New Haven, Brookfield, and Saybrook, *Conn* at the latter place, in small crystals.—*Porter.* Charlestown, Brighton, Bridgewater, and West Stockbridge, *Mass.* Topsham, *Maine.*

Var. 3. CHLORITE SLATE.

Chlorite Fissile, H. Chlorite Slate, A. P. C.

Ext. Char.—Colors, green, blackish green, or greenish grey; structure slaty, or foliated; layers often curved; opake; occurs massive; appears on inspection to be composed of minute scales; lustre glistening; easily cut with a knife; slightly unctuous to the touch.

Dist. Char. From mica slate, it is known by its unctuosity and color, and from argillite and greenstone slate, by its softness, as well as the above named qualities. Talc and soapstone are more unctuous to the touch than chlorite.

This variety is found in beds, in primitive mountains, and often contains crystals of mica, magnetic iron, garnets, &c.

Local. U. S. Williamstown *Mass.* also at Westfield, containing crystals of mica.—*Dewey.* Near New Haven and West Haven, *Conn.* the latter abounding with magnetic iron.—*Silliman.*

Var. 4. GREEN EARTH.

Talc Zographique, H. Green Earth, K. J. A, P. C.

Ext. Char.—Colors, green of various shades, sometimes bluish or greyish green; occurs in small amorphous masses, or lining the cavities of amygdaloid or porphyry; fracture earthy; yields to the nail; adheres to the tongue; slightly unctuous: sp. gr. about 2.5.

Chem. Char. Fusible into a brownish black slag.

Comp. (From Verona.) Silex 53; magnesia 2; potash 10; oxide of iron 28; water 6.—*Klaproth.*

Local. Bohemia, forming beds. Mount Pazza, where it occurs in pseudomorphous crystals, of the form of augite. Near Verona, where it has been long explored.

U. S. Near Imlaytown, in Patterson, *N. J.* On the Hudson, *N. Y.* Near Boston, and at Deerfield, *Mass.* in amygdaloid.

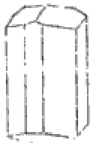
Uses. Green earth is used both raw as a green color, and burnt as a reddish brown color, for painting houses, &c.—*Mohs.*

Species 14. TOURMALINE.

Tourmaline, H. Rhomboidal Tourmaline, J. Schorl, C. Tourmaline, A. P. Rhombohedral Tourmaline, M.

Ext. Char.—Colors, green, blue, yellow, black, and white; occurs in crystals and crystalline masses; form, six, nine, or twelve-sided prisms, or six-sided prisms so truncated as to appear under six, nine, twelve or even twenty-four faces. The terminations are various, and commonly differ in the number and size of the faces at the two ends; crystals long, striated, and complete, or aggregated into irregular masses, their terminations not being obvious; translucent or opake; scratches glass; electric when heated; the end having the greatest number of faces being positive; the other negative: sp. gr. about 3.

3



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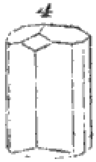

Fig. 3. A nine-sided prism, obtusely terminated by five planes. Only four of the sides and two of the planes are obvious in the figure.

Fig. 4. A three-sided prism, truncated on its lateral edges so as to present nine unequal sides, and terminated by three principal faces, to which a fourth is added by the truncation of one of the solid angles.

Var. 1. BLACK TOURMALINE.

Tourmaline Noir, H. Common Schorl, J. A. C. Schorl, P.

Ext Char.—Colors, velvet black, or brownish black; occurs massive, disseminated and crystallized, in three, six, or nine-sided prisms, variously bevelled or truncated, and obtusely terminated by an uncertain number of planes; crystal striated; opake; lustre shining, or nearly glistening; brittle: sp. gr. 3.

Chem. Char. Fusible with ease into a brownish slag. With borax, it is singular that so deep a colored mineral, should form a nearly colorless and transparent glass.

Comp. Silex 38; alumine 34; magnesia 1; potash 6; oxide of iron 21; manganese, a trace.—*Klaproth.*

Obs. 1. Schorl is a very common mineral, but it never occurs in such quantities as to form the principal part of rocks. It is disseminated in crystals, and in small masses, in primitive rocks, as granite, and quartz.

2. The crystals, though described as six, nine, or twelve-sided prisms, are commonly triangular, having three principal sides, which on inspection will be found to contain several plane faces each.

3. Black tourmaline is often a very beautiful mineral. The crystals are of all sizes, from that of a small needle, to several inches in diameter. These are often long, straight, and perfect, and when occurring in milk white quartz, produce a very handsome effect, by the contrast of color.

Dist. Char. Schorl resembles hornblende; but schorl has a vitreous lustre, a conchoidal or uneven fracture, and is electric by heat. Hornblende has a splintery fracture, a laminated structure, is softer than schorl, and is non-electric.

Schorl is found chiefly in granite and quartz, sometimes in gneiss and mica-slate.

Local. Schorlaw, in Saxony, where it was first found, and hence its name. Bohemia, Bavaria, Switzerland, Spain, Hungary, &c.

U. S. Grafton Brattleborough, and Stafford, *Ver.* Near Baltimore, *Md.* crystals sometimes more than three inches in circumference —*Gilmor.* Rhinebeck and Kingsbridge, *N. Y.* Haddam and Litchfield, *Conn.* Hallowell, Litchfield, Bowdoin, *Maine.*

Var. 2. GREEN TOURMALINE.

Tourmaline Verte, H. Green Tourmaline, C.

Ext. Char.—Color, bluish green, passing into dark leek green; occurs under the forms above described; translucent or opake; electric by heat.

Local. Ceylon, Brazil, St. Gothard, in Switzerland, and in Sweden.

U. S. Chesterfield, *Mass.* in a vein of quartz and felspar, traversing granite. The green tourmaline often encloses a prism of rose colored *rubellite* running through its axis. The crystals of tourmaline are sometimes four inches long. The same granite contains the blue tourmaline and emerald.—*Gibbs.* Also at Paris, in *Maine.*

Var. 3. YELLOW TOURMALINE.

Yellow Tourmaline, C.

Ext. Char.—Color, honey, or orange yellow; translucent or transparent; other characters common to the species.

Local. Ceylon.

U. S. Near Baltimore, *Md.* in primitive limestone. Chester County, *Penn.* in transparent crystals with oxide of titanium. Dalton, *Mass.* color, straw yellow, and from one to two inches long.

Var. 4. INDICOLITE.*

Tourmaline Indigo, H. Tourmaline Indicolite, Bt.

Ext. Char.—Color, indigo blue, often very dark ; occurs crystallized in the form of the species, but commonly less perfectly.

Local. Utoe, in Sweden, of an indeterminate form.

U. S. Harlæm Heights, *N. Y.* Goshen and Chesterfield, *Mass.* crystals often of so deep a color as to appear black. Bellows Falls, *Ver.* in primitive rocks. Hinsdale, *N. H.* in large crystals.—*Silliman.*

Var. 5. *White Tourmaline.*—*Local.* This rare variety occurs at St. Gothard, Elba, and Siberia.

U. S. Paris, *Maine.*

Var. 6. RUBELLITE.†

Tourmaline Apyre, H. Tourmaline Rubellite, Bt. Rubellite, K. A. P. C. Red Tourmaline.

Ext. Char.—Colors, red, pink, crimson, violet, or rose red ; occurs under the same forms as the species ; crystals not often distinct, being closely aggregated into groups, or variously crossing and intersecting each other ; translucent or transparent ; harder than the other varieties.

Chem. Char. Splits, intumesces, turns white, does not fuse, but vitrifies on the edges ; with borax affords a transparent glass.

Comp. Silex 42 ; alumine 40 ; soda 10 ; oxide of manganese and iron 7.—*Vauquelin.*

Dist. Char. Its fine color and its form will distinguish it, from all other minerals.

Local. Ceylon, with lepidolite. Moravia, Uralian Mountains, Ava, and Sweden.

U. S. Chesterfield, *Mass.* in red crystals, often surrounded, or embraced, by crystals of green tourmaline ; also in Goshen, *Mass.* with lepidolite, or rose red mica. Kingsbridge, 15 miles from the city of New York. Paris, *Maine.*

Obs. 1. It is sometimes cut and polished, and worn as a jewel, but is not highly esteemed.

2. Fine specimens of rubellite, on account of their variety and beauty, sometimes sell at great prices. Thus Jameson saw a three-sided prism of rubellite, of an inch in diameter, at Dresden, which cost 400 rubles, and in the collection of Mr. Greville, which he sold to the British Government, there was a specimen of the same mineral valued at £1000 sterling.

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* From its color, being that of indigo.

† From its being of a ruby red color.

Species 15. SODALITE.*—*Thomson.*

Sodalite, J. A. P. C.

Ext. Char.—Color, light green, or bluish green; occurs massive, but more commonly crystallized in rhombic dodecahedrons; cleavage parallel to the planes of the cube; structure foliated; cross fracture conchoidal; lustre vitreous; translucent; sp. gr. about 2.37.; hardness equal to that of felspar.

Chem. Char. Infusible, but the edges become rounded.

Comp. Silex 38.42; alumine 27.48; lime 2.70; soda 23.5; muriatic acid 3; oxide of iron 1; volatile matter 2.1.—*Thomson.*

Local. Greenland, with sahlite, augite, and garnet. Vesuvius, with augite, and ice-spar.

Species 16. SPINELLANE.

Spinellane, H. J. A. P. C.

Ext. Char.—Colors, bluish yellow, or brownish blue; occurs in crystalline masses, and in minute six-sided prisms, with three-sided terminations; the faces of the terminations are rhombic, and stand on alternate lateral edges of the prism, at each extremity; cleavage, parallel to the planes of the prism; scratches glass; brittle. sp. gr. 2.28.

Chem. Char. Whitens, and readily melts into a porous enamel.

Comp. Silex 43.10; alumine 29.5; lime 1.5; soda 19; oxide of iron 2; water 2.5.—*Klaproth.*

Local. Lake Laach, in the department of the Rhine, in a rock of felspar, mica, quartz, hornblende, and iron ore.

Species 17. LYTHRODES.

Lythrodes, *Karsten.* P.

Ext. Char.—Colors, red, brownish red, or yellowish, occasionally with spots of green; occurs massive and disseminated; structure imperfectly foliated; yields to cleavage, apparently parallel to the planes of a slightly rhombic prism; lustre glimmering, or resinous; cross fracture splintery and dull; slightly translucent on the edges; yields with difficulty to the knife; sp. gr. 2.5.

Comp. Silex 44; alumine 37; soda 8; water 6; lime 2.7; oxide of iron 1—*Karsten.*

Local. Norway

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* From its containing soda.

Species 18. KILLINITE.—*Taylor.*

Killinite, P. C.

Ext. Char.—Color, light green, sometimes tinged with brown, or yellow; often coated externally of a ferruginous color from disintegration; occurs massive, with the occasional appearance of prisms; structure lamellar; cleavage parallel to the lateral planes of a rhombic prism; cross fracture fine grained; translucent; yields to the knife; easily frangible; external coat yields an argillaceous odor when breathed on; sp. gr. 2.69; lustre glimmering.

Chem. Char. Becomes white, swells, and fuses into a white enamel.

Comp. Silex 52.49; alumine 24.50; potash 5; oxide of iron 2.49; oxide of manganese 0.75; water 5; with traces of lime and magnesia.—*Barker.*

Remark. Phillips says, that it greatly resembles spodumene, and that it is probable future analysis will prove the alkali it contains to be, not potash, but lithia.

Local. At Killiney,* near Dublin, in Ireland, in granite.

Species 19. EUDYALITE.†

Eudyalite, P. C.

Ext. Char.—Colors, red, or brownish red; occurs massive and crystallized in irregular, and unknown forms; may be cleaved into regular hexahedral prisms; translucent.

Comp. Silex 53.325; zircon 11.102; lime 9.735; soda 13.822; oxide of iron 7.754; oxide of manganese 2.002; muriatic acid 1.034; water 1.801.—*Stromeyer.*

Local. Greenland, with sodalite.

Species 20. SOMMITE.‡

Nepheline, H. J. C. Sommite, P. A.

Ext. Char.—Colors, greyish, or greenish white; occurs in small crystals and crystalline grains; form, a regular six-sided prism, with the lateral edges and terminal angles often replaced; cleavage parallel to the planes of the prism; cross fracture conchoidal; lustre shining, vitreous; scratches glass: sp. gr. about 3.2.

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* Hence the name.

† From the Greek, in allusion to its solubility in acids.

‡ From its occurring on *Monte Somma.*

Chem. Char. Fusible into a blebby colorless glass. Renders nitrous acid cloudy, when immersed in it.

Comp. Silex 44.11; alumine 33.73; soda 20.46; loss 0.62.—*Arfwedson.*

Dist. Char. It resembles phosphate of lime, but is harder and does not phosphoresce on hot coals.

Local. Mount Somma, near Vesuvius, with mica and idocrase. Near Rome, in lava.

Species 21. ANALCIME.*

Analcime, H. A. P. C. Hexahedral Zeolite, or Analcime, J. Hexahedral Kouphone-Spar, M.

Ext. Char.—Colors, white, grey, yellowish, or deep red; occurs crystallized in cubes, either perfect, or having its solid angles replaced by three planes; also, in twenty-four-sided crystals, the faces of which present trapezoidal figures, like those bounding the sides of the garnet; scratches glass; transparent or translucent, and sometimes opake; crystals often implanted and grouped; lustre, shining and pearly; by friction acquires a weak electricity: sp. gr. about 2.25.

Chem. Char. Fusible without intumescence into a diaphanous glass.

Comp. Silex 58; alumine 18; lime 2; soda 10; water 8.5.—*Vauquelin.*

Dist. Char. The leucite, which it resembles, commonly occurs in distinct crystals, or small masses, and never in implanted groups like the present species; leucite is also infusible. The garnet, which the red variety resembles, is much harder and heavier. Fluor-spar melts into a white globule, carbonate of lime effervesces, and from stilbite, and zeolite, it differs in crystalline form.

It occurs in primitive rocks, and in trap, and lava.

Local. Bohemia, in the Hartz, Iceland, Faroe Islands, near Edinburgh, and in several other parts of Scotland, Ireland, &c.

U. S. Patterson, *N. J.* in greenstone. East Haven, *Conn.* with agates and chalcedony. Deerfield, *Mass.* in greenstone.

Var. 1. SACOLITE.†

Ext. Char.—Color, flesh red; occurs in cubes with the solid angles truncated; nearly transparent.

Local. Mount Somma, in Italy, and Carlton Hill, near Edinburgh.

* From the Greek, in allusion to its weak electric powers.

† From its being of a flesh red color.

Species 22. CLINKSTONE.†

Clinkstone, J. A. P. C.

Ext. Char.—Colors, smoke grey, greenish grey, greyish brown, or yellowish; occurs massive; structure imperfectly slaty; fracture splintery, passing into conchoidal; lustre glimmering or dull; translucent on the edges; yields to the knife; harsh and rough to the touch; gives a ringing metallic sound when struck with a hard body; brittle; sp. gr. 2.57.

Chem. Char. Fusible with ease, into a glass slightly colored.

Comp. Silex 57.25; alumine 25.50; lime 2.75; soda 8.1; oxide of iron 3.25; oxide of manganese 0.25; water 3.—*Klaproth.*

It frequently rests on basalt

Local. Bohemia, Upper Lusace, South America, Scotland, in several places. Antrim, in Ireland, &c.

Species 23. PITCHSTONE.

Pitchstone, K. J. A. P. C.

Ext. Char.—Colors, grey, blue, green, yellow, red, brown and black of various shades, but always dull; occurs massive, and in prismatic concretions; structure slaty, sometimes curved; lustre, resino-vitreous; fracture imperfectly conchoidal; opake or translucent; scratches glass; sp. gr. from 2.32 to 2.64.

Chem. Char. Some few varieties are infusible, others melt into an enamel, the color of which depends on that of the specimen.

Comp. Silex 73; alumine 14.5; lime 1; soda 1.75; oxide of iron 1; oxide of manganese 0.1; water 8.5.—*Klaproth.*

Dist. Char. Its imperfectly conchoidal fracture will distinguish it from obsidian, which also has a more vitreous lustre than pitchstone. Its fusibility will distinguish it from flint, jasper, semi-opal, and hornstone.

It is found in primitive countries, also in trap rocks, in lava, and in formations of doubtful origin. Though generally found in veins and small masses, it sometimes forms whole mountains, as Kirwan states to be the case in Misnia; Pinkerton states the same fact in regard to certain mountains in Germany and New Spain.

Local. Cairngorum, in Scotland. Germany, in many places. Ireland, near Dublin. Mexico, Teneriffe, &c.

U. S. Bare Hills, near Baltimore, *Md.* in serpentine.

Obs. Pinkerton mentions a pitchstone porphyry which occurs at Auvergne, in France. The base is dark bottle green, with lighter green crystals of felspar. In a specimen of this kind before me, the crystals of felspar often cross each other, or are set in the form of stars, and being of a light apple green, contrasted with the dark ground, forms a beautiful mineral.

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† Because it rings when struck.

Species 24. LAVA.

Lava, J. A. P. C.

Ext. Char.—Colors, yellowish, or greenish grey, greyish black, or greenish black, sometimes sulphur yellow, and often spotted with red; occurs massive, with internal marks of fusion, being vesicular, or porous, the vesicles being empty; fracture more or less conchoidal, or fibrous; lustre glistening or shining; opake, or feebly translucent on the edges; also compact, with a dull earthy fracture, and often containing crystals of felspar, leucite, hornblende, &c.; brittle; often attracts the magnet.

Chem Char. Fusible into a dark colored glass.

Comp. (Compact lava.) Silex 51; alumine 19; lime 10; soda 4; iron 14; water 1.—*Phillips*

Dist. Char. Lava is heavier than pumice, and does not possess its fibrous aspect, nor its silky lustre.

It is found in volcanic countries only, and is the product of the action of volcanic fire on earthy minerals.

Local. Etna, Vesuvius, Hecla, and most other volcanoes.

Obs. 1. Werner and Jameson notice two kinds of lava, *slag lava*, and *foam lava*. Hauy enumerates six species, and Karsten nine. Many mineralogists, however, believe that some substances formerly included among the lavas, are not volcanic products, and consequently not true lavas.

2. Lava frequently includes crystals and other substances which are easily fusible, but which in appearance have not been altered by the fire; such are felspar and hornblende. On this account some mineralogists have doubted its volcanic origin.

3. The above description is intended to embrace only such substances as are undoubted lavas.

Species 25. PUMICE.

Pumice, C.

Ext. Char.—Colors, greyish or yellowish brown, or light smoke grey; occurs massive; structure fibrous; texture extremely porous; pores round, or elongated; lustre shining, pearly; very brittle; opake, or translucent on the edges; scratches glass and steel; fracture fibrous, or imperfectly conchoidal; yields to the knife; sp. gr. 1.4, but is sometimes so light as to swim on water.

Chem. Char. Fusible into a yellowish green glass full of bubbles.

Comp. Silex 77.5; alumine 17.5; oxide of iron 1.75; potash and soda 3.—*Klaproth.*

Obs. 1. Pumice is generally considered a volcanic product, though some geologists consider it an aqueous deposite. That it is sometimes of volcanic origin, there cannot be a doubt, as in some cases of submarine volcanoes, pumice has been formed, and floated on shore; but all volcanoes do not seem to produce it, as it is but sparingly found at Vesuvius, and not at all at Etna.

2 Pumice often contains crystals of hornblende, felspar, quartz, mica &c.

Local. Auvergne, in France. Iceland, Teneriffe, Lipari, Hungary, &c.

The pumice of commerce comes chiefly from Lipari.

Uses. It is used under the name of pumice-stone, for scouring brass, polishing certain metals and glass, and by cabinet makers for smoothing wood and varnish. In the countries where it is found, it is sometimes employed as a building stone.

Species 26. BASALT.

Lave Lithoide B saltique, H. Basalt, J. A. P. C.

Ext. Char.—Colors, greyish black, brownish grey, or bluish black; occurs in large amorphous masses, or in globular, columnar, or tabular forms; fracture splintery, or coarse grained, uneven; sometimes conchoidal; lustre feebly glimmering, or dull; opake; streak, ash grey; often porous, or vesicular; cavities sometimes of considerable size, of a flat, oblong, or round shape; often, also, porphyritic: sp. gr. from 2. ; to 3.

Chem. Char. Fusible into an opake black glass. With borax it slowly dissolves into a greenish transparent glass.

Comp. (From Saxony.) Silex 44.5; alumine 16.75; lime 9.5; magnesia 2.25; soda 2.6; oxide of iron 20; oxide of manganese 0.12; water 2.—*Philiips.*

Dist Char. It is of a darker color, and wants the greenish tinge of greenstone. It seldom rings like clinkstone; and from indurated clay and argillite, it may generally be known from the difference of lustre and fracture, as well as from the vesicles and imbedded minerals which it contains.

Obs 1 Basalt is often porphyritic, containing embedded crystals, as hornblende, olivine, felspar, quartz, mica, analcime, clay, &c. Sometimes its cavities are lined with incrustations of lime, steatite, and zeolite.

2. It frequently attracts the magnet, and is subject to decomposition, in consequence of the quantity of iron it contains.

Var. 1. COLUMNAR BASALT.

Figurate Trap, K. Columnar Basalt, C.

It occurs in columns of a prismatic form, having from three, to nine plane sides, or faces, but more commonly only five or six. These columns are of all sizes, from a few inches to several feet in diameter, and sometimes nearly an hundred feet high, occasionally straight but oftener curved. The columns are jointed, or composed of many pieces of the same shape and dimensions, lying one on the other.*

Local. Giant's Causeway, north of Ireland.

Var. 2. GLOBULAR BASALT.

Globular Basalt, *Bakewell.*

Ext. Char.—This variety occurs in tabular masses, from a few inches to several feet in diameter. They are composed of concentric spheres, or layers, one without the other, forming globes, which are filled with lesser globes, gradually diminishing in size to the centre. These spheres are cross-cracked so as to give the mass a radiated structure.

Sometimes, says Mr. Bakewell in his geology, these spheres appear compressed against each other, so as to flatten their sides. At the centre they often contain a fragment of compact basalt, or some other substance, as a piece of shell limestone, as a nucleus.

Obs. 1. Basalt is undoubtedly a secondary rock, but mineralogists disagree as to the mode of its formation. Some contend that nothing but fusion could have produced the crystalline form, and the vesicular structure of this rock; while others see no difficulty in accounting for these and other peculiarities, on the supposition of its aqueous origin, and contend that basalt is a deposit from water.

2. Notwithstanding the strong marks of fire which basalt seems to bear, there are many circumstances which discountenance its volcanic origin. It often contains substances apparently unaltered, which are easily fusible, as hornblende, felspar, and clay. It also embraces organic remains, both of animals and vegetables, and sometimes rests on coal, or bituminous wood without leaving any marks of fire on these substances. Another strong argument against its volcanie origin is that it frequently alternates with limestone, and sandstone.

3. On the whole, it is most probable that some basalts have originated from fire, and others from water. According to Phillips, the basalt of Germany is believed by most geologists, to be of Neptunian or aqueous origin, while that of France is universally acknowledged to be volcanic.

4 Probably the most remarkable locality of this rock existing, is that called the Giant's Causeway, in the north of Ireland. At this

* See Bakewell's Geology.

place, a vast number of basaltic columns stand side by side, forming the walls of a gap, from the sea into the side of the mountain. The area of this gap is about 600 feet long by 30 wide. The columns are mostly straight, and about 40 feet high.

5. Another very interesting locality of this mineral, is at Cader Idris, in North Wales, where a vast number of these columns are lying in confusion on each other, as though they had been thrown down by some terrible convulsion. Bakewell has given a drawing of this scene.

Species 27. JADE. NEPHRITE.

Jade Nephritique, H. Jade, A. P. C. Nephrite, J.

Ext. Char.—Colors, mountain green, passing into dark grass green, sometimes light sea green; occurs massive, and in rolled pebbles; fracture splintery; lustre glimmering, and greasy, when polished; translucent, sometimes only on the edges; unctuous to the touch; strongly coherent, and very difficult to break; scratches glass; structure compact; cleavage, none.

Chem. Char. Fusible into a greenish glass.

Obs. 1. The descriptions of this mineral by different authors, are quite discordant. Kirwan says, jade is infusible by the strongest heat of a furnace. Hauy and Cleveland say, it is easily fusible by the blowpipe. Aikin says, that it yields to the knife. Phillips, that it scratches quartz, &c.

2. In respect to composition, Kirwan gives, silex 47; magnesia 38; clay 4; lime 2; iron 9.

Saussure, silex 57.75; lime 12.75; alumine 1.5; oxide of iron 5; oxide of manganese 2; soda 10.75; potash 8.5; water 2.25.

3. These characters and compositions are so widely different, as to render it impossible that they should belong to the same species. It is most probable, therefore, that the same name has been applied to minerals of entirely distinct species.

4. The above specific description, applies to what the writer has considered undoubted specimens of jade.

Var. 1. AXE-STONE.

Jade ascien, H. Slaty Jade, A. Axe-stone, J. P. C.

Ext. Char.—Color, somewhat darker than that of jade; fracture obscurely slaty; slightly translucent; occurs amorphous and in rolled pebbles.

Chem. Char. Fusible by the blowpipe.

Local. New Zealand, North and South America, Corsica, Switzerland, Saxony, &c.

Uses. It is the stone of which the Aborigines chiefly made their axes, gouges, and other such like instruments; hence the name.

Local. Bohemia, Faroe Islands, Iceland, north of Ireland, near

Var. 2. SAUSSUREITE.*

Jade de Saussure, Bt. Saussureite, J. A. P. C.

Ext. Char.—Colors, deep green, greenish grey, or greenish white; occurs amorphous, and in rolled masses; scratches quartz; translucent on the edges; extremely tough; texture compact; fracture splintery; a little unctuous.

Chem. Char. Fusible before the blowpipe into a greenish glass.

Dist. Char. Jade may be known from serpentine by its toughness and greasy aspect. From jasper, pitchstone, hornstone, and compact felspar, by its want of the conchoidal fracture, great tenacity, and oily aspect.

Local. Jade or nephrite is found in China, the East Indies, Moravia, Tyrol, Switzerland, Austria, &c.

U. S. Ten miles from Philadelphia. Smithfield, *R. I.*

Obs. It was anciently considered a remedy for nephritic complaints, when worn; hence the name, *nephrite.*

Uses. Its great tenacity, observes Jameson, enables the artist to execute on it beautifully delicate figures without the risk of breaking. The Turks cut it into handles for sabres and daggers, which they prize highly. It is said even to have been wrought into chains.

Species 28. CHABAISE.†

Shabasit, W. Chabasite, J. Chabaise, A. P. C. Rhombohedral Kouphone-Spar, M.

Ext. Char.—Colors, white, yellowish white, greyish, or pale red; occurs in crystals only; form, an obtuse rhomboid, scarcely to be distinguished from a cube, its alternate angles being 94 deg. and 86 deg.; subject to various modifications; cleavage parallel to the planes of the rhomboid; scarcely scratches glass; translucent or transparent; structure lamellar; crystals often implanted, or set on other minerals; lustre vitreous: sp. gr. 2.7.

Chem. Char. Fusible with slight swelling into a white spongy mass. Acids do not act on it.

Comp. Silex 43.33; alumine 22.66; soda and potash 9.34; water 21; lime 3.34.—*Vauquelin.*

Dist. Char. From carbonate of lime and zeolite, it differs in resisting the action of acids; fluor-spar, which it also resembles, is acted on by acids, phosphoresces when heated, and decrepitates, neither of which characters belong to chabaise.

It is found chiefly in amygdaloid, basalt, and greenstone.

* In honor of M. Saussure.

† From the Greek, signifying a particular species of stone.

Oberstein, in Germany. Fassa. Island of Sky. The finest specimens come from the three first named places.

U. S. Deerfield, *Mass.* in greenstone, and balls of zeolite.—*Hitchcock.*

Var. 1. MESOLINE.

Mesoline, *Berzelius.* Ed. Phil. Jour. Vol. VII.

Ext. Char.—Color, whitish; occurs in crystalline coats, investing the surface of amygdaloid, or lining its cavities.

Chem. Char. Fusible with intumescence into a spongy mass.

Comp. Silex 47.50; alumine 21.40; soda 4.80; lime 7.90; water 18.19.—*Berzelius.*

Obs. A substance found with the mesoline, and which Berzelius has ascertained to contain the same constituents, but in somewhat different proportions, he has named *mesole.* It occurs in reniform shapes composed of crystalline fibres radiating from the centre; color, white, or yellowish.

Local. Faroe, lining the cavities of amygdaloid.

Species 29. GABRONITE.

Gabronite, H. Bt. P. C. Compact Scapolite, J.

Ext. Char.—Colors, bluish, or greenish grey, or red; occurs in compact masses; said also to occur in four-sided prisms, terminated by four-sided pyramids; structure lameller; lustre glistening, and resinous; fracture uneven and splintery; translucent on the edges; scratches glass: sp. gr. nearly 3.

Chem. Char. Fusible with difficulty into an opake globule.

Comp. Silex 54; alumine 24; magnesia 1.5; potash and soda 17.25; oxides of iron and manganese 1.25; water 2.—*John.*

Local. Arendal, in Norway, in titaniferous iron ore.

Species 30. LEPIDOLITE.*

Lepidolithe, H. Lepidolite, J. A. P. C. Rhombohedral Talc-Mica, M.

Ext. Char.—Colors, lilac red, rose red, or pearl grey; occurs massive, presenting an aggregate of minute, shining, flexible scales, or hexagonal plates; fracture fine grained, splintery; lustre, glistening and pearly; yields to the knife with ease; in powder, unctuous to the touch: sp. gr. 2.8.

Chem. Char. Fusible with ease into a transparent globule, at the same time says Aikin, tinging the flame purplish red.

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* From the Greek, signifying a scaly stone.

Comp. Silex 54; alumine 20.61; potash 9.6; oxide of manganese 0.5; lime 16; water 1.86.—*Vauquelin.*

Another variety yielded, says Prof. Gmelin. Silex 52.254; alumine 28.345; oxide of manganese 3.602; potash 6.903; lithion 4.792; fluoric acid 3.609.

Prof. Gmelin, before the analysis, supposed the mineral to have been mica, crystallized in large laminæ.—*Silliman's Journal.*

Dist. Char. Its appearance much resembles an aggregation of small scales of mica, but mica melts into a greyish or black enamel, and is not unctuous to the touch.

Obs. Lepidolite is often a very handsome mineral. Its color, approaching to that of peach blossom, in some instances, is remarkably soft and pleasant to the eye, while its scales are so disposed as to give it a glittering and brilliant lustre in whatever direction it is held.

Uses. It is cut into snuff-boxes, and various other ornaments.

Var. 1. CRYSTALLIZED LEPIDOLITE.

Ext. Char.—Color, green; resembles tourmaline, but is much softer, and easily fusible.

Local. Lepidolite occurs in Moravia, in a bed of gneiss. In Sweden, in a quartose rock. It is also found in France, Elba, and in several parts of Scotland, and Norway.

U. S. Paris, *Maine*, of great beauty. Middletown, *Conn.*

Species 31. PETALITE.

Pétalite, H. Prismatic Petalite, J. Petalite, P. C. Prismatic-Petaline-Spar, M.

Ext. Char.—Colors, greyish white, greenish, or reddish, and sometimes white; occurs in masses; structure foliated; cleavage parallel to the planes of a four-sided prism; laminæ, sometimes undulated, or scaly; lustre glistening, and sometimes pearly; rather brittle; scratches glass: sp. gr. about 2.5.

Chem. Char. Fuses with difficulty into a porous translucent glass. Sometimes the surface only is a little glazed. With borax, melts into a limpid glass.

Comp. Silex 80; alumine 15; lithia 1.75; manganese 2.50; water 0.25.—*Clarke.*

Dist. Char. It sometimes resembles white quartz, but is easily distinguished from it, by the foregoing characters.—*Cleveland.*

Local. Utoe and Sahla, in Sweden, associated with quartz and felspar. It is a very rare mineral.

U. S. Bolton, *Mass.* associated with nuttalite.

Species 32. SPODUMENE.

Triphane, H. Prismatic Spodumene, J. Spodumene, A. P. C. Prismatic Triphane-Spar, M.

Ext. Char.—Colors, greyish, or greenish white; occurs massive, and in crystals; structure laminated; cleavage parallel to the sides, and shorter diagonal of a rhombic prism; lustre shining, and somewhat pearly; translucent; scratches glass; cross fracture uneven and splintery: sp. gr. 3.19.

Chem. Char. Exfoliates a little, and then melts into a nearly limpid glass.

Comp. Silex 64.4; alumine 24.4; potash 5; lime 3; oxide of iron 2.2.—*Vauquelin.*

Dist. Char. From adularia, which it most resembles, it differs in the shape of its rhomboidal fragments, and in not emitting the peuliar moon-stone reflections. It is harder than carbonate of lime. Zoisite is commonly of a darker color, and melts into a porous glass. It is harder than ichthyophthalmite, which separates into flakes in nitric acid.

Local. Utoe, in Sweden, in a matrix of red felspar, quartz, and mica. Tyrol, in a granite rock.

U. S. Goshen, Chester, Conway, Lancaster, and Sterling, *Mass.* At Goshen, it is abundant.—*Robinson.* At Sterling, it fills the place of felspar in a granite rock.—*Silliman.*

Species 33. MEIONITE.

Meionite, H. J. A. P. C. Pyramidal Feld-Spar, M.

Ext. Char.—Colors, whitish, or greyish white; occurs in grains, or small four, or eight-sided prisms, terminated by four-sided pyramids, sometimes modified by truncation; primary form, a right prism, with square bases; structure foliated; cleavage parallel to the planes of the prismatic form; cross fracture, flat conchoidal; lustre shining, vitreous; translucent or transparent; scratches glass: sp. gr. from 2.6 to 3.1.

Chem. Char. Melts with ebullition, into a porous transparent glass.

Comp. Silex 40.8; alumine 30.6; lime 22.1; soda and lithia 02.4; oxide of iron 01.0. – *Gmelin.*

Remark. The analysis of different specimens, differs considerably.

Dist. Char. It is more transparent than scopolite. Dipyre is reddish, the present species is always whitish. It will be remembered that zeolite forms a jelly with acids.

Local. Mount Somma, near Vesuvius, from which it is ejected with other volcanic matter. It often adheres to fragments of limestone, unaltered by the heat.

Species 34. ACHMITE.*

Achmite, *Stromeyer. Mohs.*

Ext. Char.—Color, brownish black; occurs in prismatic crystals, with two broad, and several narrow faces, with accuminated terminations; cleavage distinct in four directions; fracture imperfect conchoidal; lustre vitreous; opake, or translucent on the edges; streak, a powder yellowish grey; brittle; hardness about that of felspar; sometimes occurs in twin crystals: sp. gr. 3.24.

Chem Char. Fusible with ease into a black globule.

Comp. Silex 55.25; oxide of iron 31.25; oxide of manganese 1.08; lime 0.72; soda 10.40.—*Berzelius.*

Obs. This newly discovered mineral is described in the Edinb. Philo. Jour. Vol IX Also in Mohs' Min. Vol. 3. Appendix.

Local. Eger, in Norway, imbedded in granite.

Species 35. CLEVELANDITE.†

Siliceous Felspar, *Gibbs.* C. Clevelandite, *Brooke.*

Ext. Char.—Colors, white, greyish white, bluish, and reddish, or red; occurs massive and crystallized in rhombic tabular crystals. of which the lateral edges are sometimes truncated; crystals often aggregated, so as to present stellular groups; structure laminated; cleavage, perfect in two directions; texture of the massive, approaching fibrous, being composed of slender crystals, diverging in rows from straight or curved lines, and producing a feathery aspect; translucent or semi-transparent; scratches glass: sp. gr. 2.50.

Obs. According to Phillips, some specimens afford distinct cleavage parallel to all the planes of a doubly oblique prism, yielding to the reflective goniometer, in one direction, alternate angles of 93° 30', and 86° 30'; in another direction, 119° 30', and 60° 30', and in another of 115° 65'.

Chem. Char. Fusible into a white translucent glass.

Comp. Silex 70.7; alumine 19.8; soda 9.0; lime 0.2; oxide of manganese 0.1.—*Stromeyer.*

Obs. Mr. Levy, (Ann. Philo.) has examined Clevelandite with much attention. Its primitive form, he finds, as the result of various observations, to differ from that of felspar.

The primitive of the present species, is a *doubly oblique prism,*

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* From the Greek, signifying a point, because the crystals are pointed at their terminations.

† In honor of Prof. Cleveland, of Bowdoin University, Maine.

while that of felspar is an *oblique rhombic prism.* These forms are incompatible, notwithstanding their great analogy. The two species very nearly resemble each other in every respect, and often occur in the same specimen. Clevelandite, however, Mr. Levy observes, has a certain brilliancy which does not belong to felspar. On re-examination of many specimens, heretofore considered felspar, they have been found to be Clevelandite, either entirely, or in part. Mr. Levy, indeed, considers the varieties of the present species, to be at least as numerous, as those of felspar.

Local. Mr. Turner, of Edinburgh, from whose collection Mr. Levy has made the above observations, has specimens from Dauphiny, St. Gothard, Tyrol, Piedmont, Baveno, Elba, Vesuvius, Saxony, Sweden, Norway, Siberia, Greenland, United States, and South America.

U. S. Haddam, *Conn.* Chesterfield and Goshen, *Mass.* At Chesterfield, it contains rubellite, green tourmaline, and indicolite.

Var. 1. ABITE.

Albite, A. C. M.

Ext. Char.—Color white, greyish white, or reddish; occurs in the forms of the species, but is peculiar on account of the diverging striae with which the crystals are marked; translucent; occurs in small crystals only: lustre similar to that of the species; sp. gr. 2.6.

Obs. This variety does not differ in composition from Clevelandite.

Local. Finbo and Broddo, in Sweden, with quartz and mica.

Obs. The other varieties of this species, have not yet been named, and arranged in any publication.

Species 36. SILLIMANITE.*

Sillimanite, *Bowen.* Jour. Acad. Sci. Phila. Sillimanite, M.

Ext. Char.—Color, dark grey, inclining to clove brown; occurs crystallized in four-sided rhomboidal prisms, whose alternate angles are 106 deg. 30 min. and 73 deg. 70 min.; the inclination of the base to the axis of the prism being 113 deg.; cleavage parallel to the longer diagonal of the prism: cross fracture uneven, splintery; structure lamellar; lustre of the cleavage, brilliant; of the cross fracture, vitreous; translucent on the edges; angles, and sides of the crystals often rounded; hardness greater than that of quartz; sometimes scratches topaz; brittle, and reducible to powder; sp. gr. 3.41.

Chem. Char. Infusible, even with borax. Insoluble in acids.

* In honor of Benjamin Silliman, LL. D. of Connecticut.

Comp. Alumine 54.111 ; silex 42.666 ; oxide of iron 1.999 ; water 0.510.—*Bowen.*

Dist. Char. It somewhat resembles zoisite, but the infusibility and great hardness, as well as the crystalline form, and especially the peculiar cleavage of Sillimanite, will distinguish it from this, and perhaps every other mineral.

Obs. The analysis of this species, and the quantity of several of its angles, has induced Prof. Mohs, to conclude that it may be a variety of disthene-spar, (Cyanite.) But we may remark, that minerals composed of entirely different constituents, are found to crystallize under nearly the same angles, and that the hardness and composition of Sillimanite, indicate a distinct species. The varieties of cyanite yield to the knife, while the present species scratches quartz, and even topaz. Saussure and Laugier, both found cyanite to contain lime. Saussure, found also 2.30, of magnesia. Klaproth found the same mineral to contain a little potash, neither of which belong to Sillimanite.

Local. Saybrook, *Conn.* in a vein of quartz, penetrating gneiss.

CLASS VI.

NATIVE METALS AND METALIFEROUS MINERALS.

This Class includes the native metals, together with the ores, or metals combined with other substances, as oxygen, sulphur, or acids.

Remark. In some instances, the quantity of metal does not amount to more than one third of the whole weight ot the ore, with which it is arranged, the remainder being either some other metallic substance, or clay, sulphur, or silex, &c.

Genus 1.—PLATINA.

This metal is found in its native state, and also combined with the metals, iridium, palladium, and rhodium.

Species 1. NATIVE PLATINA.

Native Platina, J. P. C. A. M. Platina Natif Ferrifére, H.

Ext. Char.—Color, steel grey, approaching to silver white; occurs in grains, seldom exceeding the size of a pea; hardness nearly equal to that of iron; malleable, and may, like iron be welded; structure sometimes lameller; but more often not obvious; streak unchanged, sp. gr. 17.33.

Chem. Char Infusible by the blowpipe. By the compound blowpipe, slowly fusible. Soluble in aqua regia only. Not oxidated by exposure to the air.

Nothing is known of the geological situation of this metal, it being found only in small grains in alluvial deposits.

Local. South America, and St. Domingo, but chiefly in the former, where it occurs with zircon, iron ore, and native gold.

Obs. 1. Native platina is not perfectly pure, but is mixed with the metals palladium, iridium, and rhodium, together with a little iron.

2. In a single instance, a mass of platina has been found weighing 1lb. 9oz. 1dr. Its diameter is about two inches, and its shape nearly round. It was found in Choco, South America, and is preserved in the royal museum at Madrid.—*Phillips.*

Uses. The infusibility of this metal and its insolubility in most of the acids, renders it extremely valuable in the construction of many useful instruments. In chemistry it is used for spoons, forceps, evaporating dishes, &c. It is also employed in the construction of philosophical instruments, for naval uses, for the covering of other metals to prevent their rusting, for painting porcelain ware, &c.

Genus 2.—GOLD.

Gold, like platina, is found only in the native state, though often alloyed with other metals

Species 1. NATIVE GOLD.

Native Gold, A. P. C. Hexahedral Gold, J. M.

Ext. Char.—Color, golden, or orange yellow, passing into greyish yellow; occurs massive, capillary, amorphous, dentritic, and crystallized, in cubes, and octohedrons with various modifications; fracture hackly; lustre metallic; soft and malleable. sp. gr. 14.85 to 19.25.

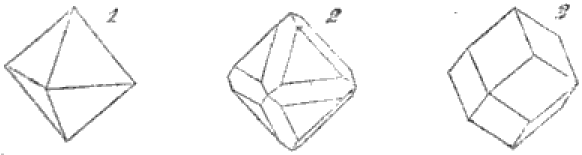

***Fig.* 1.** The octohedron.
***Fig.* 2** The same with the edges truncated.
***Fig.* 3.** The rhombic dodecahedron.

Obs. These are some of the common forms under which crystallized gold appears; but in many instances, the crystals are very irregular, and their geometrical forms difficult to determine. The crystals are generally minute.

Chem. Char. It is soluble in nitro-muriatic acid, which solution will tinge the skin of an indelible purple. Fusible with the blowpipe.

Dist. Char. The malleability of native gold will distinguish it from iron and copper pyrites, and from yellow mica, for each of which it is often foolishly mistaken.

Obs. 1. Gold is found in rocks, and in alluvial soils. The rocks, according to Kirwan, in which it most often occurs, are granite, or quartz, slate, hornstone, sandstone, and limestone. It also occurs in veins of iron ore, antimony ore, barytes, blende, &c.

2. The gold of commerce, is however, almost exclusively found in alluvial deposits, where it occurs in small particles, or grains called *gold dust*.

3. According to Mawe, the gold mines of Brazil and Africa, are entirely on the surface, the gold being separated from the sand and gravel, among which it is found, by the simple act of washing.

3. In Brazil, alone, according to the same author, above twenty

tons weight of gold, are annually procured, which forms a large share of the circulating medium of Europe.

4. In Africa, gold dust is an article of commerce, and considerable quantities are exposed for sale, or to exchange for commodities.

5. The gold of Africa, is often adulterated with those varieties of pyrites, which are nearest its color, and also with brass filings.

This fraud might easily be detected, by throwing the dust into nitric acid, which would dissolve the other substances, leaving the gold untouched.

6. Gold is found in greater or less abundance, in almost every part of the globe. Jameson observes, that although in comparison with iron, gold occurs in very small quantities, yet it is nearly as widely distributed in nature.

7. In some rare instances considerable masses of gold have been found. In 1730 a mass was found in Peru weighing 45lb. In Paraguay, several masses are said to have occurred weighing from 20 to 50lb.—Cleaveland mentions a mass found on Meadow Creek, *N. Carolina*, which weighed 28lb, and Phillips mentions one which occurred in Wicklow, Ireland, weighing 22 ounces.

8. In the viceroyalty of La Plata in South America, there are thirty gold mines, or workings.

9. The mines of Hungary are said to be the most valuable in Europe.

10. The gold mines of the United States, are confined to the state of *North Carolina*. According to the statement of Prof. Olmsted, (Sill. Jour, vol. 9.) the gold country is spread over a space of not less than a thousand square miles, in that state.

Reed's Mine, in Cabarras County, where the large mass above mentioned was found, has also afforded many smaller pieces weighing from four to six hundred penny weights.

Anson Mine, is situated in the county of Anson, on the waters of Richardson's creek. This locality was discovered three years since.

Parker's Mine, is situated on a small stream, near the Yadkin river.

These three mines are regularly wrought, by making excavations a few feet below the surface, and washing the earth in a manner similar to the process used in South America for the same purpose. The prevailing rock in the gold country is argillite. The country is of a diluvial formation, consisting of clay and sand, generally barren and the inhabitants poor.

It is not easy, observes Prof. Olmsted, to ascertain the precise amount of gold which these mines have afforded, as it is sold to merchants, and others, in small quantities, by individuals.

In 1820, the mint of the United States had received to the amount of forty-three thousand six hundred eighty-nine dollars of this gold.

Var. 1. ARGENTIFEROUS GOLD.

Argentiferous Gold, P.

Ext Char.—Color, brass yellow, passing into silver white; occurs in tabular crystals, and in cubes.

Chem. Char. Fusible into a pale yellow globule. Neither nitric, nor nitro-muriatic acid has the least effect on it.—*Phillips.*

Comp. Gold 64; silver 36.—*Klaproth.*

Local. Siberia, with hornstone and sulphate of barytes.

Genus 3.—MERCURY.

Mercury is found native, also combined with sulphur, forming a sulphuret of mercury: with muriatic acid forming a muriate of mercury; and with silver, forming a native amalgam.

Species 1. NATIVE MERCURY.

Native Mercury, J. Native Quicksilver, A. P. C. Dodecahedral Mercury. M.

Ext. Char.—Color, silver white; occurs in small globules; perfectly fluid; feels cold to the touch; lustre splendent; sp. gr. 13.

Chem. Char. Becomes volatile when heated, and flies off in white vapor.

Comp. Mercury, nearly or quite pure.

It is found in small quantities among the ores of mercury. In Idria, it occurs in limestone and sandstone.

Species 2. NATIVE AMALGAM.

Native Amalgam, P. Silver Amalgam, A. Argental Mercury, C. Dodecahedral Mercury, M. Mercure Argental, H.

Ext. Char.—Color, silver white, or greyish, often tarnished externally; occurs massive lamelliform, in plates, and in crystals; form the octohedron, and rhombic dodecahedron; fracture flat conchoidal; lustre shining; sometimes semi-fluid; cleavage none; whitens the surface of polished copper, when rubbed on it: sp. gr. 10.5.

Chem. Char. Before the blowpipe the mercury flies off in white smoke, leaving a globule of pure silver.

Comp. Mercury 64; silver 36.—*Klaproth.*

Dist. Char. Its want of ductility will distinguish it from native silver.

Local. Hungary, Siberia, and Sweden. It is found with native mercury, and cinnabar.

Species 3. SULPHURET OF MERCURY. CINNABAR.

Cinnabar, J. A. P. Mercure Sulphuré, H. Sulphuret of Mercury, C. Peritomous Ruby-Blende, M.

Ext. Char.—Color, scarlet or carmine, passing into cochineal red, and lead grey; occurs massive and crystallized in acute rhomboids, variously modified; translucent, or opake; streak scarlet red; lustre adamantine, inclining to metallic; fracture granular, or fibrous; sp. gr. 8.

Obs. It sometimes occurs in thin plates, or tabular crystals, and rarely in imitative shapes.

Chem. Char. It is volatile before the blowpipe, with the odor of sulphur.

Comp Mercury 84.5; sulphur 14.75.—*Klaproth.*

Dist. Char. From red silver ore, sulphuret of arsenic, red oxide of copper, and arseniate of cobalt, it is distinguished by entirely disappearing before the blowpipe, without the odor of garlic, or without leaving a metallic globule.

Var. 1. HEPATIC CINNABAR.

Hepatic Cinnabar, A. P. Compact Sulphuret of Mercury, or Cinnabar, C.

Ext. Char.—Color, dark red, passing into lead grey; occurs in compact masses; fracture compact, fine grained; receives a polish by friction; lustre glimmering; easily broken; opake; sp. gr. about 7.

Chem. Char. It gives a bituminous odor under the blowpipe, and evaporates, leaving a small residuum.

Comp. Cinnabar 95.5; carbon 2.3; silex 0.6; alumine 0.5; oxide of copper 0.2.—*Klaproth.*

Var. 2. FIBROUS CINNABAR. A. C.

Ext. Char.—Color, scarlet red, often with a tinge of yellow; occurs massive; structure fibrous; lustre shining silky; soils the fingers; often invests other minerals.

3. *Slaty Cinnabar.* This variety scarcely differs from the others, except in possessing irregular smooth faces, having a slaty appearance when broken.

Local. Upper Carinthia, in gneiss. Transylvania, in grey wacke. Its most important repositories are Idria, in Carniola, and Almandin in Spain. At Idria the mine has been wrought several centuries, and is now many hundred feet under the surface of the earth. A great proportion of the mercury of commerce is obtained from this locality. It occurs in beds of bituminous shale, associated with black mineral resin, grey sandstone, and limestone. The product of this mine has chiefly been sold to Spain, by a stipulation between the German and Spanish Governments.

The mines of Almandin occur in a mountain clay-slate, and shale, and have been worked more than two thousand years.

In South America, there are several quick silver mines, but the quantity of metal which they produce, is small when compared with those already mentioned.

U. S. On the borders of the lakes Huron, Michigan, St. Clair, and Erie, and at the mouth of Vermillion river, cinnabar occurs in the form of a dark red sand, which according to *Mr. Stickney*, yields about 60 per cent. of mercury.

Mode of obtaining Mercury from the Cinnabar. The cinnabar being mixed with iron filings, or lime, and placed in retorts; on the application of heat, the sulphur unites with the iron filings or lime, while the mercury being thus disengaged, is distilled over in its pure state.

Uses. A great proportion of the mercury of commerce is employed for the extraction of silver from its ores by amalgamation. According to Humboldt, the quantity employed in South America for this purpose amounts to about twenty-five thousand quintals annually.

Mercury is also used in the construction of two of the most important among philosophical instruments, the barometer and thermometer; when united with tin foil, it forms the amalgam placed over the backs of looking glasses. It is also used in the process of gilding, and in medicine it is the basis of several preparations of the highest value, and for which there is no substitute.

Species 4. MURIATE OF MERCURY.

Horn Silver, A. P. Muriate of Mercury, C. Mercure Muriaté, H. Pyramidal Pearl-Kerate, M.

Ext. Char.—Colors, greyish white, yellowish white, and ash grey; occurs massive and crystallized, in four-sided prisms, terminated by four-sided pyramids, with rhombic faces, also in crystalline crusts; translucent; streak white; crystals very small; lustre adamantine; fracture conchoidal; yields to the knife; sp. gr. 6.4.

Chem. Char. Volatile before the blowpipe.

Comp. Oxide of Mercury 88.48; muriatic acid 11.52.—*Mohs.*

Dist. Char. The muriate of silver, which it most resembles, is soft, and leaves a globule of the metal under the blowpipe.

Local. Idria in Germany, and Almandin in Spain, in cavities of sandstone, or clay, with cinnabar.

Genus 4.—SILVER.

Silver is found native, also combined with sulphur, and muriatic acid, forming sulphuret and muriate of silver. It likewise exists in themetallic state combined or mixed with several other metals.

Species 1. NATIVE SILVER.

Argent natif, H. Hexahedral Silver, J. M. Native Silver, A. P. C.

Ext. Char.—Color, silver white, often tarnished grey or reddish; occurs dentiform capillary, ramose, massive, reticulated, and in plates and spangles; also crystallized in cubes and octohedrons; sp. gr. 10 to 10.5

Chem. Char. Fusible into a globule. Soluble in nitric acid, forming a solution which tinges the skin indelible black.

Comp. Silver, with a little iron, antimony, copper, or arsenic.

Dist. Char. Its color and malleability, will always distinguish it. It is found in primitive, and secondary rocks, with the ores of silver, copper, cobalt, &c.

Local. Saxony and Suabia, in gneiss and mica slate. Bohemia, Norway, Ireland. In several places in England, and in many of the mines in South America.

U. S. Huntington, *Con.* with native bismuth. Near Portsmouth, *N. H.* a single mass has been found. Near Sing Sing, *N. Y.* in a small vein.

Obs. 1. Native silver often occurs penetrating crystals, or amorphous pieces of common quartz. These, when the quartz is transparent, are sometimes cut into various shapes, and polished as cabinet specimens, or curiosities, and are often very beautiful.

2. In several instances, large masses of native silver have been found. Thus many years since, a mass occured near Freyberg in Saxony, weighing 100lb. 1qr. Another mass was found in the mine of Konsberg, which weighed 560lb; and Jameson mentions a block of the same metal discovered in the mine of Schneeberg in Saxony, which was so large, that Duke Albert descended into the mine and made use of it as a dinner table. This huge mass when smelted, produced four hundred centners, (a centner being one hundred and ten pounds,) of pure silver.

Var. 1. AURIFIROUS NATIVE SILVER.

Auriferous Native Silver, J. K. C. A. P.

Ext. Char.—Color yellowish white, approaching to brass yellow; occurs disseminated, membranous, capillary, in plates, and crystallized in cubes.

Comp. Silver 72; gold 28.—*Fordyce.*

Local. Konsberg in Norway, and in Siberia, in primitive rocks.

Species 2. ANTIMONIAL SILVER.

Antimonial Silver, J. P. A. C. Argent antimonial, H. Prismatic Antimony, M.

Ext. Char.—Color, silver or tin white; occurs massive, in grains, and in hexahedral prisms, or cylinders; also in curved laminae; lustre metallic; yields to the knife; fracture conchoidal; not malleable; sp. gr. 9. to 10.

Chem. Char. Fusible, with the emission of antimonial vapor, into a globule of silver.

Comp. Silver 84 ; antimony 14.—*Klaproth.*

Dist. Char. It is distinguished from native silver by its want of ductility, and the antimonial vapor, under the blowpipe ; from arsenical iron, and arsenical cobalt, by its want of the garlic odor, when heated, and from white cobalt ore by not giving a blue globule with borax.

It is found in granite and clay-slate, associated with the other ores of silver.

Local. Spain, Suabia, the Hartz, Allemont, in France.

It is a rare mineral.

Species 3. ARSENICO-ANTIMONIAL SILVER.

Arsenical Silver, C. Arsenical Antimonial Silver, P. A. Argent Arsenical, B.

Ext. Char.—Color, nearly silver white, externally, with a blackish tarnish; occurs in globular and reniform masses ; structure imperfectly foliated ; sectile ; brittle ; lustre metallic and shining ; sp. gr. 9.44.

Chem. Char. Fusible, with the emission of antimonial and arsenical vapors, and the odor of garlic ; a globule of silver remaining.

Dist. Char. It is softer than arsenical iron, which leaves a magnetic globule, instead of one of silver, after the action of the blowpipe. It does not tarnish so soon as native arsenic.

Remark. Jameson says, that it passes on the one side into native arsenic, and on the other into native silver.

Local. Andreasberg, in the Hartz, with native arsenic, and the ores of lead and zinc.

Species 4. BISMUTHIC SILVER.

Molybdena-Silver, J. M. Molybdic Silver, P.

Ext. Char.—Color, light steel grey, passing into tin white ; occurs in crystalline masses, and in six-sided prisms : lustre metallic ; structure foliated ; cleavage parallel to the planes of the crystals ; soft, and somewhat elastic ; powder iron black ; sp. gr. 7.82.

Chem. Char. Fusible into small globules, which become yellow and tarnished, and are finally entirely volatalized. Soluble in nitric acid.

Comp. Bismuth 95 ; sulphur 5.—*Klaproth.*

Remarks. The specimen examined by Klaproth, under the name of the molybdic silver, must have been an entirely different mineral, as it contained neither molybdic acid nor silver ; yet this analysis is quoted both by Phillips and Mohs, as the only one appertaining to this mineral. It is most probable, therefore, that if any such mineral exists, as molybdic silver, no analysis of it has yet been given the public. It was, therefore, thought proper to change the name of this species, from *molybdic* to *bismuthic* silver, so as to make the name agree with the composition.

Species 5. SULPHURET OF SILVER.

Argent Sulphurè, H. Hexahedral Silver-Glance, J. M. Sulphuret of Silver, A. P. C.

Ext. Char.—Color, dark lead grey, often with a irridescent tarnish; occurs in cubes, and octohedrons; also recticulated, ramose, lamelliform, amorphous, and in plates; lustre metallic; cleavage imperfect; fracture flat conchoidal; malleable; easily sectile; sp. gr. 7.

Chem. Char. Fusible with intumescence, and odor of sulphur, leaving a globule of silver.

Comp. Silver 85; sulphur 15.—*Klaproth.*

Dist. Char. From native silver, it may be known by its less sp. gr. and its sulphurous odor under the blowpipe.

It occurs in primitive and secondary rocks, and is associated with the other ores of silver.

Local. Freyberg, Bohemia, many places in Peru, and Mexico, the Hartz, Cornwall, and other places in England, and in Lower Austria.

U. S. Livingston's lead mine, Columbia County, *N. Y.*

Obs. The present species is found in almost every silver mine, in greater or less quantity, and is an important ore for the extraction of silver.

Var. 1. BLACK SULPHURET OF SILVER.

Earthy Hexahedral Silver-Glance, J. Sooty Silver Ore, K. Black Sulphuret of Silver, A. P. Silver Black, C.

Ext. Char.—Color, dark lead grey, inclining to black; lustre feeble; occurs massive; pulverulent; investing and filling the cavities of other ores of silver; fracture dull and earthy; sectile; streak shining and metallic.

Chem. Char. Fusible into a slag, containing globules of silver.

Comp. Unknown.

It is found among the other ores of silver, and with native gold, and is a rich ore.

Local. Saxony, France, Mexico, Peru, Cornwall, &c.

Var. 2. FLEXIBLE SULPHURET OF SILVER.

Flexible Sulphuret of Silver, P. M.

Ext. Char.—Color, dark, nearly black; occurs massive, and in small tabular crystals, which are very flexible; cleavage perfect, parallel to the terminal planes; lustre metallic; yields readily to the knife; easily separable into thin laminae.

Comp. Silver, sulphur, and a little iron, the proportions unknown.

Local. Hungary and Saxony, very rare.

Var. 3. BRITTLE SULPHURET OF SILVER.

Brittle Silver-Glance, J. Brittle Sulphuret of Silver, A. P. Brittle Sulphuretted Antimonial Silver, C. Prismatic Melane-Glance, M.

Ext. Char.—Colors, dark lead grey, or bluish grey, passing into iron black; occurs massive and disseminated; also in hexahedral prisms, with truncated terminal edges, and so short as to become lenticular; lustre metallic, or dull; structure foliated; crystals mostly intercept each other; soft and brittle; fracture conchoidal; sp. gr. 7.

Chem. Char. Fusible with the evaporation of sulphur, arsenic, and antimony, into a globule of silver, surrounded by a slag. Soluble in nitric acid.

Comp. Silver 66.5; antimony 10; iron 5; sulphur 12; arsenic and copper 5.—*Klaproth.*

Dist. Char. It differs from black sulphuret of silver, by giving out antimonial and arsenical fumes when heated. From sulphuret of silver, in its want of malleability, and from arsenico-antimonial silver, by its darker color and brittleness.

It is found in primitive rocks with the other ores of silver, and is a rich ore.

Local. Near Freyberg, in Saxony. Bohemia, and Hungary.

Species 6. SULPHURETTED ANTIMONIAL SILVER.

Argent Antimoiné Sulphurè, H. Red Silver, J A. P. Sulphuretted Antimonial Silver, C. Rhomboidal Ruby-Blende, M.

Ext. Char.—Color, red, of various shades, passing into lead grey, and greyish black; powder crimson red; occurs in masses and grains, also dentritic, membranous, capillary, and crystallized, in hexahedral prisms, terminated by hexahedral pyramids, variously modified by truncation; also in double six-sided pyramids, with the edges replaced; lustre metallic adamantine; crystals often striated; structure imperfectly foliated; yields to the knife; translucent, opake; sp. gr. 5.20. to 6.68.

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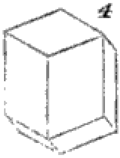

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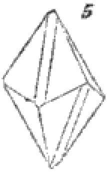

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Fig. 4. A six-sided prism, terminated by three-sided pyramids, the faces of which stand alternately on the lateral edges of the prism.

Fig. 5. A double six-sided pyramid, with the acute angles truncated.

Fig. 6. A dodecahedron, or double six-sided pyramid with the summits truncated, or replaced by three planes.

Chem Char. Fusible with antimonial fumes, into a globule of silver.

Comp. Silver 60; antimony 20.3; sulphur 14.7; oxygen 5.—*Klaproth.*

Dist. Char. From sulphuret of arsenic, it differs in having a greater specific gravity, and in leaving a globule of silver. Sulphuret of mercury is entirely dissipated by the blowpipe. The sulphuret of silver is malleable. Specular oxide of iron, after being submitted to the blowpipe is magnetic, and the red oxide of copper is easily reduced to the metallic state by the blowpipe.

It is found chiefly in granite, mica-slate, and porphyry.

Local. Saxony, Bohemia, Transylvania, Spain, Italy, and very abundantly in Mexico, and Peru.

Obs. It is a valuable ore for the extraction of silver.

Species 7. SULPHURET OF SILVER AND COPPER.

Cupreous Sulphuret of Silver, C. Sulphuret of Silver and Copper, P.

Ext.Char.—Color, lead grey, or iron black; lustre shining; fracture conchoidal; brittle; sp. gr. 6.25.

Chem. Char. Fusible into an impure globule of silver.

Comp. Silver 52.27; copper 30.47; iron 0.33; sulphur 15.78.—*Stromeyer.*

Local. Schalangenberg, in Siberia.

Species 8. EUCAIRITE.

Seleniuret of Silver and Copper, P. Cupreous Seleniuret of Silver, C. Eucairite, *Berzelius.* M.

Ext. Char.—Color, lead grey; lustre metallic; texture granular; yields to the knife, leaving a silvery lustre.

Chem. Char. Fusible with a strong odor like that of horse radish, into a grey metallic globule; soluble in nitric acid.

Comp. Silver 38.93; selenium 26; copper 23.05; foreign substances 8.90.—*Berzelius.*

Local. In a copper mine in Smoland, Sweden.

Species 9. CARBONATE OF SILVER.

Argent Carbonatée, H. Carbonate of Silver, J. C. P. A.

Ext. Char.—Color, grey, or blackish grey; occurs massive and disseminated; fracture uneven; texture fine grained. lustre glistening metallic; brittle.

Chem. Char. Fusible, and easily reduced. Effervesces in acids.

Comp. Silver 72.5; carbonic acid 12: oxide of antimony and a trace of copper 15.5.

Local. Furstenberg, Swabia, in sulphate of barytes. It is a very rare ore.

Species 10. MURIATE OF SILVER.

Argent Muriaté, H. Hexahedral Corneous Silver, J Muriate of Silver, P. C. Horn Silver, A. Hexahedral Pearl-Kerate, M.

Ext. Char.—Color, pearl grey, greenish or reddish blue, yellowish or greenish white and brown; occurs massive, investing other minerals, reniform, amorphous, and crystallized in cubes, octohedrons, and acicular prisms, variously modified; lustre glistening and waxy; soft, yields to pressure; malleable; feebly translucent; becomes brown externally by exposure; sp. gr. 5.5.

Chem. Char. Fusible in the flame of a candle. Under the blowpipe, emits muriatic acid fumes, and is reduced to a globule of silver. Rubbed on moistened zinc, it leaves a film of silver.

Comp. Muriate of silver 88.7; oxide of iron 6; alumine 1.75; sulphuric acid 0.25.—*Klaproth.*

Dist. Char. The muriate of mercury which it resembles, is entirely volatile before the blowpipe. The present species leaves a silver globule.

It is found in primitive rocks, with the other ores of silver.

Local. Friberg, in Saxony. Hungary, in several mines, South America, Cornwall, England, Siberia, Spain, and France.

It is a good ore for the extraction of silver.

Subsp. 1. *ARGILLACEOUS MURIATE OF SILVER.*

Buttermilk Silver, A. P. Argillaceous Muriate of Silver, C.

Ext. Char.—Colors, brownish white, greenish white, or pale green, externally bluish or brownish; occurs massive, and coating other minerals; fracture earthy; opake; soft, sometimes nearly fluid.

Chem. Char. It feebly agglutinates under the blowpipe, while minute globules of silver flow from the mass.

Comp. Silver 24.64; muriatic acid 8.28; alumine with a trace of copper 67.08.—*Klaproth.*

Local. Andreasberg, in the Hartz.

Obs. 1. Silver was probably unknown to the antediluvians, as it is no where mentioned in the writings of Moses, who only speaks of brass and iron, among the metals. In the time of Abraham, it appears to have been an article of common traffic, in the form of bars and ingots.—*Calmet.*

2. According to Humboldt, the late annual product of the

American silver mines may be estimated at more than 32 millions of dollars.

3. According to Shaw, the quantity of gold and silver extracted from the American mines from 1492 to 1803, has been equal in value to 5,706,700,000 dollars, of which immense sum it is estimated, that including the booty which the Spaniards took from the natives, about 5,445,000,000 was carried to Europe, making a yearly average of 17 millions and a half for 311 years.

4. The annual importation of these metals from South America to Europe has been constantly increasing. From 1492 to 1500, the yearly importation did not exceed 250,000 dollars. From 1500 to 1545, it amounted to 3,000,000. From 1545 to 1600, it was 11,000,000. From 1600 to 1700, to 16,000,000. From 1700 to 1750, 22,000,000 and a half. And lastly, from 1750 to 1803, the annual amount was 35,300,000 dollars.

Humboldt calculates the weight of silver raised from these mines in three centuries, to have been 316 million of pounds.

Genus 5.—COPPER.

Copper is found native, also combined with sulphur, with oxygen, carbonic acid, arsenic acid, sulphuric acid, muriatic acid, and with several of the metals. Its ores are very numerous, and many of them highly beautiful and interesting.

Uses. Copper next to iron, is probably the most indispensible metal, to the wants of man. Its uses are various and generally known. *Brass,* a compound, in universal use, is composed of copper and zinc. Bell metal, bronze, pinchbeck, speculum metal, and many other useful compounds are alloys of copper, with various other metals. Its salts and oxides are employed as paints, in coloring, and enameling, &c.

Species 1. NATIVE COPPER.

Cuivre Natif, H. Native Copper, A. P. C. Octohedral Copper, J. M.

Ext. Char.—Color, copper red, tarnished externally brownish black; occurs dentritic, capillary, reniform, and amorphous; also crystallized in cubes, and octohedrous, variously modified by truncation; malleable; sp. gr. 8.5.

Chem. Char. Fusible. Soluble in acids, forming salts which give a beautiful blue when mixed with liquid ammonia.

Comp. Copper, nearly or quite pure.

It is found in the veins of primitive and secondary rocks.

Local. Siberia, Swabia, Saxony, Norway, and in many of the copper mines in England.

U. S. Monroe County, *Illinois.* Near Lake Superior, *North West Territory,* a mass was found weighing by estimation 2,200lbs.

—*Schoolcraft.* Orange County, *Vir.* Blue Ridge, *Md.* Adams County, *Penn.* Woodbridge, *N. J.* Hamden Hills, *Conn.* a mass was found weighing about 90lbs. Also 12 miles from New Haven, another mass was found of 6lbs. weight.—*Silliman.*

Specis 2. SULPHURET OF COPPER.

Cuivre Sulphuré, H. Sulphuret of Copper, A. P. C. Rhomboidal Copper-Glance, J. Prismatic Copper-Glance, M.

Ext. Char.—Color, blackish lead grey, sometimes irridescent; internally lead grey, or tin white; occurs massive, and in pseudomorphous crystals; also crystallized in long tabular six-sided prisms, variously modified, and in obtuse, and acute double six-sided pyramids, with the summits often truncated; structure perfectly lameller; cleavage easy, with brilliant faces; easily broken into grains; crystals small and grouped; the massive sectile, passing into hard; fracture conchoidal; sp. gr. about 5.

Chem. Char. Fusible with the odor of sulphur, into a greyish metallic globule. Soluble in hot nitric acid.

Comp. Copper 76.50; sulphur 22; iron 0.50.—*Klaproth.*

Dist. Char. Grey copper decrepitates under the blowpipe, and is harder than the present species. Grey antimonial copper, gives out the fumes of antimony. Red oxide of copper is easily known from it, by the difference of color.

Var. 1. PSEUDO-MORPHOUS SULPHURET OF COPPER.

Cuivre Sulphuré Pseudo-morphique, H.

Ext. Char.—Color, blackish lead grey, occurs lenticular, or in small oval, flattened masses, formed of scales resembling the small cones of the pine tree, or ears of corn flattened; hence it has been called *fossil corn ears*, and was supposed by Linnæus, to be a vegetable substance penetrated by copper. It also, generally contains a little silver.

Local. Frankenberg, in Hesse.

Var. 2. VARIEGATED VITREOUS COPPER.

Cuivre Sulphuré Hepatique, H.

Ext. Char.—Colors, violet blue, greenish, and yellowish; sometimes resembles tempered steel.

Local. Mont Blanc, and Cornwall, *Eng.*

Var. 3. BLACK COPPER.

Black Copper, A. P. C. J.

Ext. Char.—Colors, bluish, or brownish black; occurs mostly disseminated in, or investing other ores of copper; friable; soils the fingers.

Chem. Char. Infusible, but gives out the odor of sulphur.

Local Cornwall.

Species 3. FERRUGINOUS SULPHURET OF COPPER.

Cuivre Pyriteux, H. Copper Pyrites, P. Yellow Copper, A. Pyritous Copper, C. Pyramidal Copper-Pyrites, M.

Ext. Char.—Colors, golden, or brass yellow, often with an external irridescent tarnish; occurs dentritic, stalactical, amorphous, in concretions, and crystallized; form, the tetrahedron, with the solid angles often truncated, also the dodecahedron, formed by raising a three-sided pyramid, on the faces of the tetrahedron; lustre shining, and metallic; structure lamellar; cleavage parallel to the faces of the octohedron; faces brilliant; crystals small and seldom perfect; yields to the knife: sp. gr. 4.3.

Chem. Char. Fusible into a black globule, which on continuing the heat, becomes magnetic. Tinges borax green.

Comp. Copper 40 to 35.5, iron 40 to 33; sulphur 20 to 35. Different specimens seldom yield the same proportions of these ingredients. It often contains a portion of silex.

Dist. Char. It resembles iron pyrites, but this is commonly of a bronze yellow, and does not tinge borax green. Native bismuth is laminated, and melts with great ease into a bright globule, that of the present species being black. Nati e gold is malleable.

It is found in primitive and secondary rocks, and is one of the most common and abundant ores of copper.

Local. Spain, Bohemia, Siberia, Silesia, Norway, Japan, Cornwall, and many other places in England.

U S. Perikomon lead mine, *Penn.* Also in Chester, Delaware County. On the Hudson, *N. Y.* in many places. Cheshire, Simsbury, Farmington, and Granby, *Conn.* Woburn, Brighton, and Cambridge, *Mass.*

It is a valuable ore for the extraction of copper, and from it a great proportion of that used in commerce, is obtained.

Var. 1. PURPLE COPPER.

Cuivre Pyrteux Hepatique, H. Variegated Copper, J. Purple Copper, A P Variegated Pyritous Copper, C. Octohedral Copper-Pyrites, M.

Ext. Char.—Colors, blue, or yellow, sometimes intermediate between bronze-yellow, and copper red; irridescent; occurs massive, and crystallized in the form of cubes with curvilinear faces, and truncated angles; also in plates which are sometimes hexagonal; structure imperfectly lamellar; cleavage parallel to the planes of the regular octohedron; soft; easily frangible; lustre metallic; subject to tarnish: sp. gr. 5.

Chem. Char. Fusible into a globule which is magnetic. Effervesces with nitric acid.

Comp. Copper 58; iron 18; sulphur 19; oxygen 5.—*Klaproth.*

Dist Char. Its greater specific gravity, and its variegated colors, will distinguish it from ferruginous sulphuret of copper.

It is found in primitive and secondary rocks, with the other ores of copper.

Local. Arendal, Cornwall, Switzerland, Saxony, &c.

Species 4. GREY COPPER.

Cuivre Gris, H. Grey Copper, A P. C. Tetrahedral Copper Pyrites, J. Tetrahedral Copper-Glançe, M.

Ext. Char.—Color, steel grey, passing into iron black; streak brownish; occurs amorphous, disseminated, and crystallized in tetrahedrons, of which Hauy has ennumerated twelve modifications; lustre glistening and metallic; brittle; crystals small and grouped; sp. gr. about 5.

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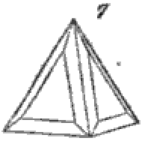

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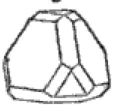

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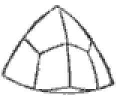


Fig. 7. The tetrahedron, with the edges bevelled or replaced by two planes.

Fig. 8. The same, with the edges, and solid angles truncated.

Fig. 9. The pyramidal dodecahedron, with curved faces.

Chem. Char. Fusible, but not easily reduced to the metallic state.

Comp. Copper 52; iron 23; sulphur 14.—*Chenevix.*

Dist. Char. Specular oxide of iron is magnetic; arsenical iron is harder than grey copper, and gives out arsenical fumes when heated.

It is found with the other ores of copper, and with those of iron in primitive and secondary rocks.

Local. Friberg, in Saxony. Gomor, in Hungary. Several places in the Tyrol. Spain, Scotland, England, &c.

Var. 1. ARSENICAL GREY COPPER.

Cuivre Gris Arsenifère, H. Arsenical Grey Copper, A. P. C.

Ext. Char.—Color, steel grey; occurs in tetrahedrons and amorphous; lustre metallic; possesses most of the characters of the species.

Chem. Char. Infusible, but diffuses the arsenical vapor.

Comp. Copper 41 to 48; iron 22.5 to 27.5; sulphur 10; arsenic 14 to 24; silver, a trace.—*Klaproth.*

Local. Various parts of Germany, Cornwall, *Eng.* Scotland, &c.

Var. 2. ANTIMONIAL GREY COPPER.

Cuivre Gris Antimonifere, H. Black Copper, J. Antimonial Grey Copper, P. C.

Ext. Char.—Color, dark lead grey, nearly black; occurs amorphous and crystallized, in tetrahedrons; lustre glimmering, and somewhat greasy; fracture uneven.

Chem. Char. Fusible into a metallic globule, which emits minute scintillations attended with little trains of smoke.

Comp. Copper 37 75; antimony 22; sulphur 28; silver 00.25; iron 03.25.—*Klaproth.*

Dist. Char. It is distinguished from other ores which it resembles, by the antimonial scintillations under the blowpipe.

Species 4. TENNANTITE.

Tennantite, J. P. C. M.

Ext. Char.—Color, lead grey, passing into blackish grey; occurs crystallized in the form of rhombic dodecahedrons; also in cubes and regular octohedrons; cleavage imperfect; structure foliated; lustre metallic; streak reddish grey; brittle: sp. gr. 4.37.

Chem. Char. Burns with a bluish flame, and then emits arsenical vapors, leaving a black magnetic scoria.

Comp. Copper 45.32; arsenic 11.84; iron 9.26; sulphur 28.74; silex 5.—*Phillips.*

Local. Cornwall, *Eng.* in several of the copper mines.

Var. 1. WHITE COPPER.

White Copper, J. C. A. P.

Ext. Char.—Colors, internally nearly silver white, sometimes with a tinge of yellow; soon tarnishes; lustre metallic and glistening; occurs massive and disseminated; yields to the knife; fracture fine grained, uneven; brittle: sp. gr. 4.5.

Chem. Char. Fusible, with arsenical vapors, into a dark slag.

Comp. Copper 40 ; the remainder being iron, arsenic and sulphur. —*Vauquelin.*

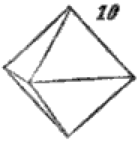
Local. Cornwall, with other copper ores.

U. S. Fairfield, *Conn.* in compact masses, color, metallic, sp. gr. 9. —*Silliman.*

Species 5. RED OXIDE OF COPPER.

Cuivre Oxidé Rouge, H. Octohedral Red Copper Ore, J. Red Copper Ore, A. Red Oxide of Copper, P. C. Octohedral Copper-Ore, M.

Ext. Char.—Color, red, of various shades, as deep cochineal red, greyish red, and pure cochineal red ; occurs amorphous and crystallized in regular octohedrons, and cubes, variously modified by truncation, and bevelment ; structure lamellar, but rarely visible ; cleavage parallel to the planes of the octohedron ; lustre metallic adamantine ; fracture conchoidal, uneven ; translucent ; yields to the knife ; brittle ; powder vermillion red : sp. gr. 4 to 5.9.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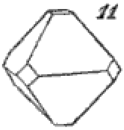
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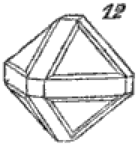
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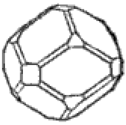
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Fig. 10. The regular octohedron, the primary form.

Fig. 11. The same, with all the solid angles truncated, producing quadrangular planes.

Fig. 12. The octohedron, with its edges and solid angles truncated, the angles produced by the truncation being slightly bevelled, forming three planes.

Fig. 13. The rhombic dodecahedron, with all its edges and solid angles slightly truncated.

Obs. According to Phillips, this mineral occurs under 100 secondary forms.

Chem. Char. Fusible, and easily reduced to the metallic state. Dissolves with effervescence, in nitric acid ; in muriatic acid, without effervescence.

Comp. Copper 91 ; oxygen 9.—*Klaproth.*

Copper 88.5 ; oxygen 11.5.—*Chenevix.*

Dist. Char. The red color of this species, and its effervescence in nitric acid, will distinguish it from red silver ore, which does not effervesce, and from the sulphurets of copper, which are not red. Cinnabar does not effervesce, and is volatile by the blowpipe.

Oxide of copper is found in primitive, and secondary rocks, associated with the other ores of copper.

It is found in small quantities, but its localities are numerous.

Var. 1. CAPILLARY RED OXIDE OF COPPER.

Capillary Red Copper Ore, J. Capillary Red Oxide of Copper, P. C.

Ext. Char.—Color, carmine red, often very beautiful; occurs in minute, long, slender crystals; translucent, or transparent; crystals generally aggregated, or cross each other at various angles.

Local. In the mines of Cornwall.

Var. 2. MASSIVE RED OXIDE OF COPPER.

Ext. Char.—Color, dark red; opake, or translucent; fracture granular; often intermingled with native copper.

Local. Cornwall.

Var. 3. FOLIATED RED OXIDE OF COPPER.

Foliated Red Copper Ore, J.

Ext. Char.—Color, red, often lively and rich; occurs massive and crystallized; structure foliated; lustre shining, metallic; fracture conchoidal, uneven; transparent, or translucent.

Local. It is found with the other varieties.

Var. 4. FERRUGINOUS RED OXIDE OF COPPER.

Tile Ore, P. A.

Ext. Char.—Color, brick red, passing into reddish brown; occurs massive; fracture earthy; lustre glimmering, or dull; yields to the knife, sometimes to the nail; opake.

Chem. Char. Infusible, turns black. Gives a dirty green to borax.

Comp. Supposed to consist of red oxide of copper, and iron.

Local. This species is found in small quantities, in most copper mines.

U. S. Perikomen lead mine, and near Lancaster, *Penn.* In the red sandstone formation, *N. J.* In the greenstone mountains, *Conn.*

Species 6. BLUE CARBONATE OF COPPER.

Cuivre Carbonaté bleu, H. Azure Copper Ore, J. Blue Carbonate of Copper, A. C. P.

Ext. Char.—Color, blue, of different shades, as azure or indigo blue; occurs massive, stalactical, encrusting, disseminated, and crystallized; primitive form, the ob-

Chem. Char. Infusible without addition; with borax, gives a green glass, and yields a metallic globule. Dissolves with effervescence in nitric acid.

Comp. Oxide of copper 70; carbonic acid 24; water 6.—*Klaproth.*

Dist. Char. The sulphate of copper which it may resemble, is soluble in water. Azure phosphate of iron becomes magnetic under the blowpipe.

Obs. Some specimens of implanted crystals present brilliant shining faces in every position, and being of an intense rich blue, are peculiarly striking and beautiful.

It is found in primitive and secondary mountains.

Local. Chili, Bohemia, the Hartz. Most of the copper mines in England. Chessy, in France. Uralian mountains, &c.

U. S. Perkiomen lead mine, *Penn.* Schuyler's mines, *N. J.* Hartford, *Conn.*

Jameson remarks, that this species is not only used as an ore of copper, but also as a pigment, called *mountain blue,* of which there is a manufactory in the Tyrol.

Species 7. GREEN CARBONATE OF COPPER.

Cuivre Carbonaté Verte, H. Green Carbonate of Copper, P. C. Hemi-Prismatic Habroneme-Malachite, M.

Ext. Char.—Color, emerald, grass, or apple green, also verdigris green; streak and powder, lighter green; occurs tuberose, globular, reniform, mammillary, and stalactical; also in fibres, and curved folia, and rarely in crystals; form four-sided prisms, generally very minute; and in rhombic prisms; lustre shining, or dull: sp. gr. about 4.

Chem. Char. Turns black, but does not melt alone; with borax, gives a dark greenish glass: effervesces with acids, and forms a blue color with ammonia.

Comp. Copper 58; oxygen 12.50; carbonic acid 18; water 11.50. —*Klaproth.*

Dist. Char. From the green oxide of uranium, the green phosphate of lead, and the green muriate of copper it is distinguished by its effervescence with acids. The green arseniate of copper gives out the garlic odor when heated.

Var. 1. FEBROUS MALACHITE.

Cuivre carbonaté vert aciculaire, H. Fibrous Malachite, J. P. C.

Ext. Char.—Color, green of various shades; occurs in delicate shining fibres, sometimes radiated, or fassiculated; lustre silky; translucent; very soft; brittle;

Obs. 1. It is found incrusting other minerals, particularly ores of copper in thin layers, composed of radiating delicate fibres of a glistening, silky lustre.

2. According to Jameson, these fibres are regular crystals, of which Estner determined, that some were six-sided prisms, with bevelled edges, others three-sided truncated prisms, &c.

It occurs in small quantities with other ores of copper.

Local. Silesia, Norway, Sweden, Russia, and the several mines in England.

U. S. Schuyler's mines, *N. J.* Perkiomen lead mine, *Penn.* Cheshire, *Conn.* in small, but good specimens.—*Silliman.*

Var. 2. COMPACT MALACHITE.

Cuivre carbonaté vert concrétionné, H. Massive Malachite, A. P. Compact Malachite, C.

Ext. Char.—Colors, green, emerald green, passing into apple, verdigris, or grass green; occurs in masses, composed of botryoidal, globular, or reniform concretions, of a fibrous radiating structure, closely compacted together. Sometimes the concretions are concentric lamellar, in one direction, and fibrous in another fracture conchoidal; opake; lustre glistening and silky; aspect often striped.

Comp. Oxide of copper, 72.2; carbonic acid, 18.5; water, 9.3.—*Phillips.*

It occurs with the blue carbonate of copper, and fibrous malachite.

Local. Bohemia, England, Russia, Saxony, Norway, and Siberia.

U. S. Blue Hills, *Md.* Near Nicholas Gap, *Penn.* Near Boundbrook, *N. J.* Greenfield, *Mass.*

Uses. It is ground, and employed as a paint, and is sometimes cut and polished for jewelry. Specimens are sometimes found of considerable size, and are sawn into thin plates, and polished as curiosities, for the covers of boxes, or are worked into vases, &c. These when polished, display the radiated structure, and silky, changeable lustre of the mineral to great advantage, and are often extremely beautiful.

Jameson remarks, that Patrin saw a slab of green malachite at St. Petersburg, which was thirty two inches long, and seventeen broad, and was valued at twenty thousand livres.

Species 8. CHRYSOCOLLA.

Cuivre carbonate terreux, H. Copper Green, C. Crysocolla, H. P. Uncleavable Staphyline-Malachite, M.

Ext. Char.—Color, verdigris green, passing into emerald, or leek green, also yellowish green, and sky blue; occurs massive, botryoidal, reniform, and sometimes coating malachite; fracture small conchoidal;

lustre shining, resinous ; yields to the knife, sometimes with difficulty ; sp. gr. 2. to 2.4 ; translucent : brittle.

Chem. Char. Infusible, but becomes black, and tinges the flame green. With borax forms a green glass, and yields a copper globule. Effervesces slightly with acids.

Comp. Oxide of copper 50 ; carbonic acid 7 ; water 17 ; silex 25. —*Klaproth.*

Dist. Char. Its translucency, and feeble effervescence will distinguish it from malachite.

Obs. 1. It appears to pass on the one side, into malachite, and on the other, into chalcedony, and hence it varies greatly in respect to hardness.—*Aiken.*

2. The same specimen often exhibits different external characters, being partly green and translucent, and partly brown and opake.—*Cleveland.*

Local. Cornwall, England ; Hungary, Bohemia, Norway, Siberia, Mexico, and Chili.

Species 9. DIOPTASE.

Cuivre Dioptase, H. Dioptase, J P. C. Emerald Copper, A. Rhombohedral Emerald-Malachite, M.

Ext. Char.—Color, emerald, verdigris, or blackish green ; occurs in six-sided prisms, terminated by three-sided pryamids ; structure lamellar ; cleavage in three directions, more or less perfect ; fracture conchoidal ; lustre vitreous, inclining to resinous ; transparent, or translucent ; sp. gr. 3.27. scratches glass.

Chem. Char. Infusible alone ; with borax, melts into a green glass. Soluble without effervescence in muriatic acid.

Comp. Oxide of copper 55 ; silex 33 ; water 12.—*Lowitz.*

Oxide of copper 25.57 ; carbonate of lime 42.85 ; silex 28.57.—*Vauquelin.*

Dist. Char. Emerald is much harder than dioptase, and is insoluble in acids. Its want of effervescence will distinguish it from chrysocolla.

Local. Siberia, where it is associated with carbonate of lime, and malachite.

Species 10. MURIATE OF COPPER.

Cuivre muriaté, H. Muriate of Copper, A. P. C. Atacamite, J. M.

Ext Char.—Color, emerald, verdigris, or leek green ; also blackish green ; streak, pale green ; occurs in minute octohedrons, either with wedge-shaped terminations, or variously truncated, or both ; also in lamellar masses, and in concretions composed of acicular crystals resembling malachite : structure lamellar : brittle :

lustre shining; translucent; crystals often transparent: sp. gr. 3.52. to 4.4.

Chem. Char. Communicates bright blue and green colors to the flame of a candle; before the blowpipe gives the muriatic odor, and melts into a globule of copper. Soluble in nitric acid, without effervescence.

Dist. Char. From arseniate of copper, it differs in emitting the muriatic, instead of the garlic odor. From malachite it is known by the same properties, as well as by the peculiar color it gives to the flame.

Local. Remolinos in Chili, with carbonate of copper. Peru, with the ores of silver. Vesuvius, in lava.

U. S. Woburn, Brighton, and Medford, *Mass.*

Species. 11. SULPHATE OF COPPER.

Cuivre sulfaté, H. Prismatic Vitrol, J. Sulphate of Copper, P. C. Tetarto-Prismatic-Vitrol-Salt, M.

Ext. Char.—Color, deep rich blue, and sky blue; artificial crystals, four, six, or eight-sided prisms, often terminated by dihedral summits; native crystals very rare; more commonly occurs stalactical, and pulverulent; taste styptic, and nauseous; when rubbed on moistened polished iron, leaves a coat of copper.

Obs. Sulphate of copper, or blue vitriol is sometimes found in solution, in the water proceeding from mines of the sulphuret of copper, and from the decomposition of which, it is produced.

Local. Anglesea in England, Wicklow in Ireland, Fahlun in Sweden, near Goslar in Hungary.

Obs. 1. At the copper mine of Anglesea, considerable quantities of the metal are obtained by throwing into the water which comes from the mine, waste iron, on which the metallic copper is precipitated.

2. The blue vitriol of commerce is obtained partly by crystallizing such natural solutions, and partly by lixiviating inferior ores of copper.

Uses. Its principal use is in dying. It is also employed in medicine.

Species 12. PHOSPHATE OF COPPER.

Cuivre Phosphaté, H. Phosphate of Copper, J. A. P. C. Prismatic Habroneme-Malachite, M.

Ext. Char.—Colors, emerald, verdigris, or blackish green, often darker on the surface; occurs crystallized in rhombic prisms with curvilinear faces, and in octohedrons, often elongated, and terminating in truncated pyramids; crystals very small, and fasciculated or grouped; also, it occurs in mammillary, or reniform concretions composed of radiating, or diverging delicate fibres, and in thin plates, opake; crystals often translucent; lustre resinous, or silky; structure foliated; cleaves in two directions: sp. gr. 4.

Chem. Char. Fusible into a brownish globule, which extends itself on the charcoal, and by the addition of a little tallow, is reduced to a small globule of copper. Dissolves without effervescence in nitric acid.

Comp. Oxide of copper 68.13; phosphoric acid 30.95.—*Klaproth.*

Dist. Char. Its solubility without effervescence, will distinguish it from malachite, and the effects of the blowpipe will distinguish it from arseniate of copper, chrysocolla, dioptase, and muriate of copper.

Local. Hungary, at several places. Cornwall, in England; and near Cologne, in Italy.

Species 13. HYDROUS PHOSPHATE OF COPPER.

Hydrous Phosphate of Copper, P. Prismatic Habroneme-Malachite, M.

Ext. Char—Color, emerald green, the massive, striated with blackish green; occurs massive and crystallized; crystals occur aggregated, or implanted, sometimes radiating or diverging; very minute, and so connected that their forms have not been precisely determined; powder, verdigris green; translucent: sp. gr. 4.2.

Chem. Char. Fusible with ease, into a reddish black slag, which with soda is reduced to a metallic globule.

Comp. Peroxide of copper 62.48; phosphoric acid 21.67; water 15.45.—*Lunn.*

Local. Bonn, on the Rhine, with native copper.

Species 14. ARSENIATE OF COPPER.

There are several varieties of this species, which differ considerably in their chemical characters, as well as external forms.

Var. 1. OCTOHEDRAL ARSENIATE OF COPPER.

Cuivre arseniate primitif, H. Lenticular Copper, J. Octohedral Arseniate of Copper, A. P. Obtuse Octohedral Arseniate of Copper, C. Prismatic Lirocone-Malachite, M.

Ext. Char.—Colors, sky blue, bluish white, greenish white, or verdigris green; streak pale; occurs in obtuse pyramidal octohedrons, composed of two four-sided pyramids joined base to base; crystals small; cleavage parallel to all the planes of an obtuse octohedron; lustre vitreous; translucent, semi-transparent; brittle; not so hard as fluor: sp. gr. 2.88.

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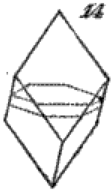

Fig. 14. An obtuse octohedron, or two four-sided pyramids set on a short common base; a form under which this mineral commonly occurs. The crystals are often flattened, so as to become nearly lenticular.

Chem. Char. Fusible into a black scoria; with borax, yields a metallic bead of copper. Gives the garlic odor when heated.

Comp. Oxide of copper 49; arsenic acid 14; water 35.—*Chenevix.*

Dist. Char. It differs from malachite, in not effervescing with acids, and in giving the odor of garlic. Green oxide of uranium, is not reduced by the blowpipe. Muriate of copper, exhales the muriatic vapor.

Local. Cornwall, in England, with many other varieties of copper ore.

Var. 2. RHOMBOIDAL ARSENIATE OF COPPER.

Cuivre arseniaté lamelliformé, H. Prismatic Copper Mica, J. Rhomboidal Arseniate of Copper, P. Hexahedral Arseniate of Copper, C. Rhombohedral Euchlore-Mica, M.

Ext. Char.—Colors, pure green, emerald green, grass green, rarely bluish green, or greenish white; occurs in six-sided tabular crystals, of which the lateral planes are trapeziums; cleavage parallel to all the planes of the rhomboid; structure foliated, with brilliant faces parallel to the broader planes; transparent, translucent; crystals sometimes arranged in rose-like forms, and sometimes form foliated, or tabular masses, which are divisible like those of mica; yields to the knife, or nail: sp. gr. 2.54.

Chem. Char. Fusible into a globule; with borax, yields a bead of copper.

Comp. Oxide of copper 58; arsenic acid 21; water 21.—*Chenevix*

Dist. Char. These are similar to those of the variety above, while it may be distinguished from that variety, by the forms of its crystals and foliated structure.

Local. Cornwall, in several of the copper mines.

Var. 3. OBLIQUE PRISMATIC ARSENIATE OF COPPER.

Cuivre arseniaté prismatique triangulaire, H. Trihedral Oliven Ore, J. Oblique Prismatic Arseniate, A. P. Prismatic Arseniate of Copper, C.

Ext. Char.—Color, bluish black, or deep black; occurs in curved lamellar concretions, and more rarely in minute oblique rhombic prisms; crystals fasciculated, or radiating, and often of a beautiful blue, by transmitted light; when massive, nearly black; translucent, or transparent; yields to the knife: sp. gr. 4.2.

Chem. Char. Before the blowpipe, flows like water, and in cooling, crystallizes in plates of a brown color.

Comp. Oxide of copper 54; arsenic acid 30; water 16.—*Chenevix.*

Dist. Char. Its peculiar chemical characters, and its crystallization on cooling, will distinguish it from substances it most resembles.

Local. Cornwall, with the other varieties of this species.

Var. 4. RIGHT PRISMATIC ARSENIATE OF COPPER.

Prismatic Oliven-Ore, J. Right Prismatic Arseniate, P. Prismatic Olive-Malachite, M.

Ext. Char.—Colors, various shades of olive green, passing into yellowish, brownish, or blackish green; occurs in prismatic crystals; cleavage parallel to the planes of a right rhombic prism; crystals often capillary; translucent; opake; shapes of the massive, globular, and reniform; surface drusy: brittle: sp. gr. 2.28.

Chem. Char. Fusible with a kind of deflagration, and by continuing the heat, is reduced, the globule of copper being covered with a coating of the red oxide. Soluble in nitric acid.

Comp. Oxide of copper 50; arsenic acid 29; water 21.—*Chenevix.*

Dist. Char. The difference between the chemical characters of this variety, and that above, will distinguish them from each other.

Local. Cornwall, and Cumberland, *Eng.*

Var. 5. FIBROUS ARSENIATE OF COPPER.

Cuivre arseniaté aciculaire, H. Fibrous Acicular Olivinite, J. Amianthiform, and Haematitic Arseniate, A. P. Fibrous Arseniate of Copper, C.

Ext. Char.—Colors, green, grass green, yellowish or brownish green, or greenish white; occurs in capillary crystals, parallel or diverging, extremely fine, like raw silk, and so closely connected as to resemble knots of wood; also it occurs loosely united, in short delicate fibrils, projecting from nodular, or reniform masses, and resembling the finest cotton; lustre silky; brittle; translucent; opake: sp. gr. 4.28.

Chem. Char. Fusible, with the odor of arsenic, into a cellular scoria. Soluble in acids.

Dist. Char. It resembles some varieties of amianthus, and byssolite, and also fibrous oxide of tin, but is easily distinguished from them by its chemical characters, and particularly the garlic odor.

Species 15. MARTIAL ARSENIATE OF COPPER.

Cuivre arseniaté ferrifère, H. Martial Arseniate of Copper, J. A. Ferruginous Arseniate of Copper, C. Scorodite, M.

Ext. Char.—Colors, leek green, olive green, passing into white; also, pale blue, and yellowish green; streak, white; occurs in reniform masses, composed of minute crystals, and in crystals, the forms of which are right rhombic prisms, terminated by four-sided pyramids; lustre vitreous; harder than calcareous spar; translucent, or transparent; fracture uneven; brittle: sp. gr. 3.16.

Chem. Char. Emits an arsenical odor, and melts into a brownish scoria, which acts on the magnet.

Comp. Oxide of copper 22.5; oxide of iron 27.5; arsenic acid 33.5; water 12; silex 3.—*Chenevix.*

Obs. The great copper mine of Fahlun, in Sweden, has been worked to the depth of 1200 feet, and one of the Cornwall copper mines, is 1800 feet deep. In both of these mines, the heat is so great that the miners carry on their labor with little or no clothing, in the coldest season. In the Fahlun mine, according to Dr. Clarke, the heat to a stranger is absolutely intolerable. This high temperature, is in part owing to the fires which are kindled to soften the rock, or break it in pieces, so as to lessen the labor of the miners, and in part to the great depth of the mines, the heat increasing, it is said, in proportion to the descent into the bowels of the earth.

Genus 6.—LEAD.

The color of pure lead, is bluish grey, approaching white, but it soon tarnishes on exposure to the air. Its specific gravity is 11. The ores of this metal are numerous, but with the exception of the sulphuret of lead, they are of no considerable importance to the arts.

Lead is found native, also combined with several of the other metals; with sulphur, with several of the acids, with oxygen, with several of the acidified metals, and with carbonic acid.

Uses. The uses to which this metal is applied, are numerous and important. In its metallic state, it is employed in the construction of aqueducts; for covering the roofs of houses; for the linings of boilers, for certain uses; in the composition of pewter, &c. Its oxides and salts, are employed as paints; in the composition of glass; in medicine, and in several of the more common arts.

This metal is inert on the living system, but its salts and oxides operate as slow, but certain poisons.

Species 1. NATIVE LEAD.

Plomb natif, H. Native Lead, A. P. C.

Ext. Char.—Color, bluish grey; occurs interspersed in galena; lustre metallic; malleable; soft; easily cut: sp. gr. 11.

Obs. 1. The existence of native lead has been doubted by Hauy, and others. That found on the Island of Madeira, in lava, was supposed to have been reduced to its metallic state, by volcanic heat.

2. The existence of native lead is, however, proved by the following extract of a letter to the present writer, from a gentleman of science, B F. Stickney, Esq. of Ohio.

"I have," says he, "a specimen of lead ore, from Auglaise River, (Ohio,) in which metallic lead is so interspersed with galena, as to prove incontestably the existence of native lead."

Species 2. SULPHURET OF LEAD. GALENA.

Plomb sulfuré, H. Hexahedral Galena, J. Sulphuret of Lead, P. C. Hexahedral Lead-Glance, M.

Ext. Char.—Color, bluish grey, lead grey, externally blackish grey, and sometimes irised; occurs crystallized, amorphous, and reticulated; form the cube, and regular octohedron, with many of their varieties; structure lamellated; cleavage, parallel to the planes of the cube, which is its primitive form; lustre of the cleaved surfaces, very brilliant; soft; brittle; opake; when massive, the structure is granular, and the fracture uneven, flat conchoidal: sp. gr. 7.5.

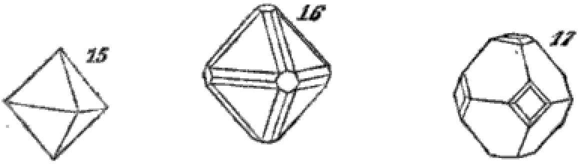

Fig. 15. The regular octohedron, a form next to the cube, under which the present species most commonly appears.

Fig. 16. The octohedron, with its edges bevelled, or replaced by two planes.

Fig. 17. The octohedron, with its solid angles deeply truncated, and the edges replaced.

Chem. Char. First decrepitates, and then melts with the odor of sulphur, into a globule of lead.

Comp. (A mean of 4 specimens.) Lead 67.5; sulphur 17; lime and silex 15.5.—*Vauquelin*.

Dist. Char. Between the sulphuret of lead, and the sulphuret of zinc, there are these distinctions. The lead is reduced to a metallic globule, by the blowpipe, and is fixed; while the zinc being reduced, is soon evaporated. Molybdena is infusible, as is the case with graphite.

Var. 1. GRANULAR GALENA.

Plomb sulfuré granulaire, H. Granular Sulphuret of Lead, C. Granular Galena, A. P.

Ext. Char.—Color, the same as in the species; occurs massive, composed of small crystalline grains, irregularly disposed; fracture granular; lustre shining; resembles steel; less apt to tarnish, than the other varieties.

In other respects, it does not differ from the species.

Var. 2. COMPACT GALENA.

Plomb sulfuré compacte, H. Compact Sulphuret of Lead, or Galena, C. Compact Galena, A. P.

Ext. Char.—Color, light lead grey; occurs in nodules, or small masses; fracture conchoidal; structure fine grained; texture close, and compact; lustre moderate; often contains silver.

Var. 3. SPECULAR GALENA.

Plomb sulfuré speculaire, H. Specular Galena, A. P. C.

Ext. Char.—Color, lead grey; occurs in extremely thin coatings, on quartz, and other subtances; lustre splendid, with an appearance of polish.

Obs. 1. This variety, from its high lustre, is called by the miners, *slickensides*, or *looking-glass lead ore*.

2. This variety is found chiefly in the Derbyshire lead mines, and Mr. Phillips states the curious circumstance, that when two veinstones meet, the surface of each being coated with this variety, there is a loud report, or explosion produced on separating them, the fragments at the same time being projected in various directions.

Var. 4. ANTIMONIAL SULPHURET OF LEAD.

Plomb sulfuré antimonifère, H. Triple Sulphuret of Lead, A. Antimoniated Galena, P. Antimonial Sulphuret of Lead, C. Di-Prismatic Copper-Glance, M.

Ext. Char.—Color, steel grey, passing into dark lead grey, or iron black; occurs amorphous and crystallized, in the form of rectangular prisms, variously modified; or in elongated cubes; crystals grouped; structure lamellar, affording brilliant faces parallel to the planes of a four-sided prism; brittle; lustre strongly metallic; crystals striated on certain faces; soft; yields to the nail: sp. gr. 5.7.

Chem. Char. Fusible, with the escape of white antimonial fumes, into a metallic globule, which contains a bead of copper at the centre.

Comp. Lead 42.62; antimony 24.23; sulphur 17; copper 12.8; iron 1.2.—*Hatchett.*

Dist. Char. The antimonial fumes, which it emits, and the globule of copper surrounded by a crust of lead which the blowpipe produces, will distinguish this variety.

Sulphuret of lead is found in primitive and secondary mountains, but most frequently in the latter, and particularly in limestone. In granite and limestone, it sometimes constitutes extensive beds, but more often occurs in veins of various dimensions and extent. It is commonly associated with the ores of zinc, copper, and iron, and often with those of silver, a portion of which, it generally contains.

Local. England, is a great repository of this ore. According to Phillips, the lead mines of Great Britain, produce annually from 45 to 48,000 tons of smelted lead. This is extracted almost entirely from the sulphuret, the largest proportion of which, is raised from the mines of England.

France, also contains its mines of this metal, as well as Saxony, Bohemia, and Spain.

U. S. Perkiomen Creek, 23 miles from Philadelphia, *Penn.* The shaft of this mine is 170 feet deep. Livingston's Manor, Columbia County. Ancram. Shawangunk Mountain, and Ulster County, *N. Y.* One ton from Livingston's mine, is said to have yielded 118 ounces of silver. Huntington, Southington, Middletown, and Bethlehem, *Conn.* None of these are wrought. Thetford, and Sunderland, *Vt.* Southampton, and Leverett, *Mass.* The mine at Southampton, has a horizontal entrance through the solid granite of nearly 1000 feet, and is expected ultimately to yield the best ore, in large quantities. Counties of Washington, St. Genivieve, Jefferson, and Madison, *Missouri.* The number of mines in these counties, according to Schoolcraft, are 45. The ore on an average, yields from 60 to 70 per cent. of metal, and is found in an alluvial deposit. The whole annual product of them, is about 3,000,000 of pounds. This ore is also found in *Illinois, Ohio, Indiana, Tennessee, Maryland, Virginia,* and in various places in the *North-Western Territory.—See Cleveland's Mineralogy, and Robinson's Localities.*

Species 3. NATIVE RED OXIDE OF LEAD.

Plomb oxide rouge, H. Native Minium, J. A. P. Oxide of Lead, C.

Ext. Char.—Color, scarlet red; occurs amorphous, in flakes, and in powder; when examined by a lens, it has a crystalline structure.

Chem. Char. On charcoal, it is converted into metallic lead.

Remark. It is supposed to arise from the decomposition of galena, with which it occurs.

Local. Yorkshire, *Eng.* Siberia, and Westphalia.

Var. 1. ALUMINOUS OXIDE OF LEAD.

Hydrous aluminate of Lead.—*Smithson.* P. Aluminous Oxide of Lead, C.

Ext. Char.—Color, yellow, or yellowish brown; occurs in masses composed of concentric layers; lustre pearly, on certain parts; on others irised; texture sometimes fibrous, and radiating; translucent on the edges; heavy; resembles hyalite in aspect.

Chem. Char. Decrepitates; when slowly heated, turns white and opake, but does not melt. With borax, melts into a colorless glass; with the addition of nitre, a globule of lead is obtained.

Comp. Lead 40.14; alumine 37; water 19.90; sulphuric acid 0.20; oxides of manganese and iron 1.80; silex 0.60.—*Berzelius.*

Local. Huelgoet, in Brittany.

Species 4. CARBONATE OF LEAD.

Plomb carbonaté, H. Di-Prismatic Lead-Spar, J. Carbonate of Lead, A. P. C. Di-Prismatic Lead-Baryte, M.

Ext. Char.—Colors, white, yellowish white, greyish white, and light brown; occurs in tabular crystals, in six-sided prisms, in cuneiform octohedrons, in four-sided prisms, and in double six-sided pyramids, each form being subject to various modifications, by truncation; also massive, compact, in spangles, and pulverulent; fracture uneven; transparent, or translucent; lustre adamantine, passing into resinous; brittle; sectile; refraction double: sp. gr. 6 to 7.23.

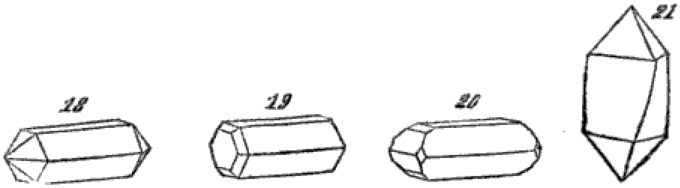

Fig. 18. A six-sided prism, terminated by six-sided pyramids.

Fig. 19 and 20. The same figures modified by truncation.

Fig. 21. A four-sided prism, with curved faces, terminated by four-sided pyramids, another common form.

Chem. Char. Decrepitates, becomes yellow, then red, and is immediately reduced to a globule of lead. Effervesces with muriatic acid.

Comp. Oxide of lead 82 ; carbonic acid 16 ; water 2.—*Klaproth.*

Dist. Char. Its high specific gravity, will distinguish it from carbonate of lime, and its effervescence from the sulphates of barytes and strontian. Its reduction to the metallic state, will indeed distinguish it from every mineral which it resembles.

Obs. 1. Crystals of the carbonate of lead, are generally grouped, or aggregated, or intersect each other in such a manner, as to make it difficult to determine their forms.

2. They are subject to decomposition, and in consequence, become grey and opake.

3. When recently exposed, some specimens are very beautiful.

Carbonate of lead, is found in primitive and secondary countries. It accompanies galena, and the other ores of lead ; also several of the ores of iron, zinc, and copper.

Jameson remarks, that next to galena, this is the most common ore of lead, but that it never occurs so abundantly, as to make it worth working by itself.

Local. Bohemia, Saxony, Siberia, Chili, Switzerland, and in many of the lead mines of England, and Scotland.

U. S. Mine à Burton, ***Missouri***, incrusting galena. Wythe County, *Vir.* Perkiomen lead mine, ***Penn.*** in double six-sided pyramids with truncated summits ; in six-sided prisms, and in oblique four-sided prisms.—***Wetherill.*** Also near Lancaster, ***Penn.***

Var. 1. ACICULAR CARBONATE OF LEAD.

Plomb carbonaté aciculaire, H. Acicular Carbonate of Lead, P. C.

Ext. Char.—Colors, white, greyish, or yellowish white, and brownish black ; occurs in minute fibres, or crystals, collected into groups, or tufts ; lustre silky and glistening ; often intermixed with malachite.

Remark. Some specimens of this variety, are remarkably beautiful.

Local. Cornwall, in several of the lead mines.

Var. 2. EARTHY CARBONATE OF LEAD.

Plomb carbonaté terreux, H. Earthy-Spar, J. Earthy Carbonate of Lead, A. P. C.

Ext. Char.—Color, grey, occasionally tinged with green, yellow, or red ; occurs in amorphous masses, in reniform concretions, and in crusts ; fracture and aspect, earthy ; lustre, a little glossy, or dull ; opake.

sometimes friable; soft and heavy: sp. gr. 4.16 to 5.78.

Comp. Oxide of lead 66; carbonic acid 12; water 2.2; silex 10.5; alumine 4.7; oxides of tin and manganese 2.2.—*John.*

Obs. This variety differs greatly in respect to its composition, owing to the foreign matter it is liable to contain. Sometimes it is nearly a pure carbonate of lead, while other specimens scarcely effervesce with acids, owing to admixture with foreign ingredients.

Local. Durham, and Derbyshire, in England, and in Scotland, with the other ores of lead.

Species 5. SULPHATE OF LEAD.

Plomb sulfaté, H. Sulphate of Lead, A. P. C. J. Prismatic Lead-Baryte, M.

Ext. Char.—Colors, white, greyish white, grey, red, brown, and green; occurs massive, and in small shining crystals; in the form of rhombic prisms with dihedral summits, the prisms often being so short as to give them an octohedral form; translucent; transparent in thin laminæ, lustre splendent, and resinous; streak white; easily scraped by the knife; brittle: sp. gr. 6.29.

Chem. Char. Fusible, and easily reduced to the metallic state. Insoluble in nitric acid.

Comp. Oxide of lead 72.47; sulphuric acid 26.9; the residue being water, iron, manganese, and silex.—*Stromeyer.*

Dist. Char. Carbonate of lead, which it resembles, effervesces with acids, and molybdate of lead which it also resembles, is not easily reduced to its metallic state, by the blowpipe.

It is found with sulphuret of lead, from the decomposition of which it may have been produced.

Local. Zellerfield, in the Hartz, with the ores of copper, iron, and lead. Andalusia, in Spain. Cornwall, Anglesea, and Scotland.

U. S. Perkiomen lead mine, *Penn.* in octohedrons.—*Wetherill.* Huntington, *Conn.* Southampton, *Mass.* in plates, or tables, on sulphuret of lead.—*Meade.*

Var. 1. SULPHATO-CARBONATE OF LEAD.

Rhomboidal carbonate of Lead, *Bournon.* Sulphato-Carbonate of Lead, *Brooke.* P. M.

Ext. Char.—Colors, greenish, yellowish, or greyish white; occurs in oblique angled, four-sided prisms, terminated by two planes set obliquely on the obtuse angles of the prism; crystals always minute, seldom distinct; and generally fasciculated, so as to present a fibrous aspect; lustre adamantine; structure foliated;

cleavage perfect, in two directions; translucent; sectile: sp. gr. 6.8 to 7.

Chem. Char. Fusible, but not easily reduced. Effervescence hardly perceptible, in nitric acid.

Comp. Sulphate of lead 53.1; carbonate of lead 46.9.—*Brooke.*

Local. Lead Hills, in Scotland.

Var. 2. CUPREOUS SULPHATO-CARBONATE OF LEAD.

Cupreous Sulphato-Carbonate of Lead, *Brooke.*

Ext. Char.—Color, deep verdigris green, or bluish green; occurs in minute prismatic crystals, which appear in small bunches, or bundles, radiating from a common point; form, broad rectangular prisms, terminated by dihedral summits; surface streaked; fracture uneven; translucent; brittle; soft; sp. gr. 6.4.

Comp. Sulphate of lead 55.8; carbonate of lead 32.8; carbonate of copper 11.4.—*Brooke.*

Local. Lead Hills, in Scotland.

Var 3. SULFATO-TRI-CARBONATE OF LEAD.

Rhomboidal Carbonate of Lead, *Bournon.* Sulphato-Tri-Carbonate of Lead, *Brooke.* M. P.

Ext Char.—Color, pale green, yellowish, and brownish; occurs in prismatic and rhomboidal crystals; primary form, the acute rhomboid, which passes by the replacement of all its solid angles into a six-sided prism; translucent; small crystals, transparent: sp. gr. 6.5.

Comp. Sulphate of lead 27.5; carbonate of lead 72.5.—*Brooke.*

Local. Lead Hills, Scotland, with the two preceding varieties.

Var. 4. CUPREOUS SULPHATE OF LEAD.

Cupreous Sulphate of Lead, *Brooke.* M. P.

Ext. Char.—Color, deep blue, and beautiful azure blue; occurs in crystals; primitive form, a right rhombic prism; occurs also in twin crystals; lustre adamantine; streak pale blue; faintly translucent; brittle; sp. gr. 5.3 to 5.43.

Comp. Sulphate of lead 74.4; oxide of copper 18; water 4.7.—*Brooke.*

Local. Lead Hills, Scotland. Linares, in Spain.

Species 6. MURIO-CARBONATE OF LEAD.

Corneous Lead-Ore, J. Murio-Carbonate of Lead, P. M. Carbonated Muriate of Lead, C.

Ext. Char.—Color, white, with tints of yellow, green, and grey; streak white; occurs in four-sided prisms, often so short as to become cubes; also in rectangular prisms, terminated by four-sided pyramids; both kinds variously modified by truncation; lustre adamantine; structure lamellar; cleavage, parallel to all the planes of a four-sided prism; cross fracture conchoidal; transparent, or translucent; rather sectile; brittle; sp. gr. 6.

Chem. Char. Fusible, into an orange colored globule, and on continuing the heat, the acid evaporates, and a minute globule of lead remains.

Comp. Oxide of lead 85.5; muriatic acid 8.5; carbonic acid 6.5. —*Klaproth.*

Dist Char. Its peculiar behavior under the blowpipe, will distinguish it from carbonate of lead.

Local. Hausbaden, in Germany, and Matlock, in Derbyshire.

U. S. Southampton lead mine, *Mass.* in groups of light green, nearly transparent, cubic crystals, with four-sided summits.—*Meade.*

Species 7. PHOSPHATE OF LEAD.

Plomb phosphaté, H. Rhomboidal Lead-Spar, J. Phosphate of Lead, A. P. C. Rhombohedral Lead-Baryte, M.

Ext. Char.—Colors, green, brown, grass green, olive, pistachio, and blackish green; sulphur yellow, greenish yellow, wax yellow; aurora red, hyacinth red; hair brown, clove brown; pearl grey, and ash grey; occurs amorphous, in crusts, in concretions, and in crystals; form, the six-sided prism, often truncated on the lateral or terminal edges; also the dodecahedron, or double six-sided pyramid; fracture small grained, or uneven, passing into splintery; lustre glistening, resinous, or adamantine; crystals sometimes acicular, and often glouped; translucent; yields easily to the knife; brittle; sp. gr. 6 to 7.

Chem. Char. Before the blowpipe on charcoal, it usually decripitates, then melts, and on cooling forms a polyhedral globule, the faces of which present concentric polygons; if this globule be pulverized, and mixed with borax, it melts into a milk-white enamel, which on continuing, the bead becomes transparent, the lower part being studded with globules of metallic lead.—*Aikin.*

Comp. Oxide of lead, 77.10; phosphoric acid, 19,0; muriatic, 1.54; oxide of iron, 0,10.—*Klaproth.*

Dist. Char. It differs from carbonate of lead, and carbonate of copper, in not effervescing with acids. Its peculiar behaviour under the blowpipe, will distinguish it from most, if not all other substances.

It is found in primitive and secondary rocks.

Local. Saxony, Bohemia, Siberia, Cornwall in several lead mines. Lead Hill in Scotland. Ireland.

U. S. Perkiomen lead mine, *Penn.* Southampton, *Mass.*

Var. 1. ARSENIATED PHOSPHATE OF LEAD.

Plomb phosphaté arsenifere, H. Arseniated phosphate of lead, P. C.

Ext. Char.—Colors, yellow, and greenish yellow, of various shades; occurs crystallized in the form of the species; also reniform and mammillated; fracture conchoidal; lustre resinous.

Chem. Char. Exhales the arsenical vapor, and yields a globule of lead.

Comp. Oxide of lead 76; phosphoric acid 13; arsenic acid 7; muriatic acid 1,75; water 5.—*Klaproth.*

Local. Saxony, and Rosiers in France.

Var. 2. BLUE LEAD.

Plomb sulfuré epigene prismatique, H. Blue Lead, J. A. P. C.
Hexahedral Lead-Glance, M.

Ext. Char.—Color, between lead grey, and indigo blue; occurs massive, and in six-sided prisms, often somewhat bulging, or with convex faces; fracture conchoidal, or fine grained; uneven; lustre glimmering metallic; fragments indeterminate; soft; easily frangible; opake; sp. gr. 5.46.

Chem. Char. Fusible, with the emission of sulphureous vapors, a part of the globule being reduced, while the other part, on cooling crystallizes in dodecahedrons.

Obs. Prof. Silliman supposes this to be a mixture of the sulphuret, and the phosphate of lead, in which opinion he is followed by Prof. Mohs.

Local. Huelgoet, in France, and in Saxony.

Species 7. ARSENIATE OF LEAD.

Plomb arsenié, H. Arseniate of Lead, J. A. P. C.

Ext. Char.—Colors, grass green, wine yellow, hair brown, and yellowish white; occurs in small slender six-sided crystals, either perfect or with truncated edges, and in minute crystals, gathered into bundles, and so arranged as to assume the general appearance of six-sided prisms; translucent, rarely transparent; when transparent scratches glass; lustre resinous; brittle; also occurs in mammillary concretions, and in filaments, with a silken lustre. sp. gr. 5 to 6.4.

Chem. Char. Gives out arsenical vapors, and is reduced to metallic lead. It does not effervesce with acids.

Comp. Oxide of lead 69.76 ; arsenic acid 26.4 ; muriatic acid 1. 58.—*Gregor.*

Local. Cornwall, and Devonshire, in several of the lead mines. St. Prix, in the department of Saone, in France.

Var. 1. RENIFORM ARSENIATE OF LEAD.

Reniform Arseniate of Lead, P. A. C.

Ext. Char.—Color, brownish red, passing into straw yellow ; occurs in reniform masses ; fracture conchoidal ; lustre glistening, resinous ; opake ; soft ; brittle : sp. gr. 3.9.

Chem. Char. Fusible, with arsenical vapor, into a black globule, out of which oozes little globules of metallic lead.

Comp. Lead 25 : oxide of iron 14 ; silver 1,15 ; arsenic acid 25 ; silex 7 ; alumine 2 ; water 10.—*Bindheim.*

Dist. Char. Arseniate of lead differs from the carbonate, the molibdate, and the phosphate of lead, by the emission of the garlic odor, when heated ; also, the carbonate effervesces, the molybdate is with difficulty reduced, and the phosphate crystallizes in polyhedrons on cooling.

Local. Nertschinsk, in Siberia.

Species. 8. MOLYBDATE OF LEAD.

Plomb molybdaté, H. Yellow Lead Spar, J. Molybdate of Lead, A. P. C. Pyramidal Lead-Baryte, M.

Ext. Char.—Colors, wax, or honey yellow, passing into lemon, or orange yellow, and brownish yellow ; occurs in crystals, and rarely massive ; form, the octohedron, variously modified ; sometimes it is truncated on all its angles, or on the solid angles of the summits only : sometimes it is found in four-sided tables, or nearly in the form of a cube, or parallelopiped, or eight-sided table, either truncated or bevelled ; sometimes these table so intersect each other, as to give the mass a cellular structure : fracture imperfectly conchoidal ; soft ; brittle ; yields to the knife ; lustre waxy ; sp. gr. 5.9.

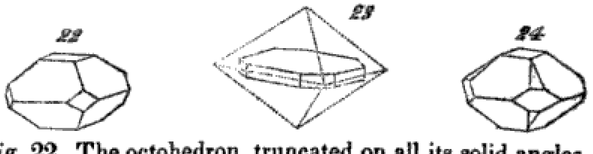

Fig. 22. The octohedron, truncated on all its solid angles.

Fig. 23. An eight-sided table, produced by the deep truncation of all the angles of an octohedron, forming the table; and the truncation of the common base, producing the eight-sides.

Fig. 24. Another secondary form, in which the solid angles are truncated, with the truncation of the edges of the common base, in form of a scalene triangle.

Chem. Char. Fusible into a dark grey mass, which by the utmost effort of the blowpipe, yields globules of lead. Soluble, without effervescence, in hot nitric acid.

Comp. Oxide of lead 64.42; molybdic acid 34.25.—*Klaproth.*

Dist. Char. It differs from the carbonate, and sulphate of lead, in the difficulty of its reduction. The arseniate of lead, emits the garlic odor; the phosphate is not reduced without a flux, and the muriate of lead, emits the smell of muriatic acid. Its sp. gr. will distinguish it from the earthy minerals.

Local. Bleyberg, in Carinthia, Zimapan in Mexico. Annaberg in Austria, and in the Tyrol.

U. S. Perkiomen lead mine, *Penn.* where it occurs in quadrangular tables, variously modified.—*Conrad.* Southampton lead mine, *Mass.* in small tabular crystals, of a dark wax yellow.—*Meade.*

Species 9. CHROMATE OF LEAD.

Plomb chromaté, H. Red Lead-Spar, J. Chromate of Lead, A. P. C. Hemi-Prismatic Lead-Baryte, M.

Ext. Char.—Colors, orange, or aurora red, or hyacinth red, always rich and beautiful; occurs crystallized, and rarely massive; form, the rectangular four-sided prism, variously modified; also the compressed eight-sided prism, with two, three, or four-sided terminations; crystals often broad and flat; sometimes striated, and generally incomplete, their geometrical characters being difficult to determine; lustre resinous; translucent; yields to the knife; brittle; sp. gr. 6.

Chem. Char. Fusible, with crackling, into a greyish slag; tinges borax green,

Comp. Oxide of lead 63.96. chromic acid 36.40.—*Klaproth.*

Dist. Char. It differs from the sulphuret of arsenic, from red antimonial silver, and from cinnabar, in this respect, that all these are more or less volatile under the blowpipe, while the present species is fixed.

Local. Beresof, in Siberia, in a gold mine, Cocaes, in Brazil, and Zimapan in Mexico.

Obs. The native chromate of lead, is a rare, and scarce mineral. The artificial chromate is of a beautiful bright yellow, and is employed with oil, in the finer kinds of painting.

The chromic acid, used in the manufacture of this article, is extracted by a chemical process, from the chromate of iron.

This paint is manufactured at Philadelphia, the chromic acid being obtained from the chromate of iron, which is found near Baltimore.

Var. 1. CUPREOUS CHROMATE OF LEAD.

Vaquelinite. Chromate of lead and Copper, P. Cupreous Chromate of lead, C. Vauquelinite. Malachite, M.

Ext. Char.—Colors, olive green, and blackish green; occurs in minute six-sided crystals, irregularly aggregated, and frequently constituting thin crusts, and sometimes in botryoidal, or stalactical masses; lustre adamantine; faintly translucent; rather brittle; sometimes is interspersed with chromate of lead.

Chem. Char. Intumesces, and melts into a greyish globule, surrounded with little globules of metallic lead.

Comp. Oxide of lead 60.78; oxide of copper 10.80; chromic acid 28.33.—*Berzelius.*

Local. Siberia, and Brazil, with the chromate of lead.

Genus 7.—BISMUTH.

Color, when pure, reddish white; lustre brilliant; texture foliated; softer than copper; breaks when struck smartly with a hammer; melts at 476, Fah.; and if the heat be increased, evaporates in the form of yellow oxide: may be distilled in a close vessel; sp. gr 9.82.

Uses. It enters into the composition of printing types. Its oxides are employed as paints, and in medicine.

The ores of Bismuth are few, and rarely met with.

Species 1. NATIVE BISMUTH.

Bismuth natif, H. Octohedral Bismuth, J. M. Native Bismuth, A. P. C.

Ext. Char.—Color, silver white, with a tinge of copper red; occurs amorphous, plumose, and reticulated; also crystallized in the form of octohedrons and cubes; structure lamellar, with joints parallel to the planes of an octohedron; soft; lustre brilliant; subject to tarnish; sp. gr. 9.

Chem. Char. Easily fusible, and by continuing the heat, evaporates in the form of a yellow oxide. Soluble in nitric acid, but is precipitated on dilution with water.

Dist. Char. Native bismuth differs from the sulphuret of bismuth, in not giving out the sulphureous odor when heated; the sulphuret is also of a pale lead grey color, instead of reddish white; its want of malleability, and easy fusion will distinguish it from native silver, and native copper, and its color will distinguish it from native antimony.

It is found in primitive rocks, and particularly in quartz, gneiss, and mica slate, where it is generally associated with cobalt, arsenic, and silver.

Local. Saxony, Bohemia, Swabia, Norway, and England, each contain localities of this metal.

U S. Huntington, *Conn.* in broad plates disseminated in a vein of quartz.—*Silliman.* Also Trumbull, *Conn.* in tabular masses, with the sulphurets of iron, and lead.—*Phillips.*

Species. 2. SULPHURET OF BISMUTH.

Bismuth sulfuré, H. Prismatic Bismuth-Glance, J. M. Sulphuretted Bismuth, A. Sulphuret of Bismuth, P. C.

Ext. Char.—Color, between lead grey, and tin white; occurs amorphous, lamelliform, and acicular; structure foliated, or fibrous; cleavage of the foliated, parallel to the sides, and shorter diagonal of a rhombic prism; sometimes occurs in fibrous radiating masses; lustre shining, metallic; soft; brittle; streak unchanged: sp.gr. 6.

Chem. Char. Fusible by the flame of a candle; under the blowpipe, gives the flame and odor of sulphur, and is chiefly volatilized, the residue being with difficulty reduced to its metallic state.

Comp. Bismuth 60; sulphur 40.—*Sage.*

Dist. Char. It differs from native bismuth, in color, and in giving the fumes of sulphur, under the blow pipe. Sulphuret of lead is easily reduced to a metallic globule; sulphuret of antimony disappears entirely before the blowpipe.

Local. These are much the same with those of native bismuth, with which it is commonly found.

Var. 1. CUPREOUS SULPHURET OF BISMUTH.

Cupreous Bismuth, J. Cupriferous Sulphuret of Bismuth, A. P. Cupreous Sulphuret of Bismuth, C.

Ext. Char.—Colors, lead grey, or steel grey, passing into tin white, with a reddish, or yellowish tarnish; occurs massive, disseminated, and acicular; fracture uneven; streak black; opake; sectile.

Comp. Bismuth 47.24; copper 34.66; sulphur 12.58—*Klaproth.*

Local. Near Wittichen, in Furstenburg, with native bismuth, and pyritous copper.

Var. 2. PLUMBO-CUPREOUS SULPHURET OF BISMUTH.

Bismuth sulfuré plumbo-cupriferé, H. Plumbo-Cupreous Sulphuret of Bismuth, C.

Ext. Char—Color, steel grey, with a yellowish tarnish; occurs amorphous, disseminated, and in acicular prisms, striated longitudinally; structure lamellar;

lustre, shining, metallic; yields easily to the knife: sp. gr. 6.

Chem. Char. Fusible, with sulphureous vapor, after which it emits sparkling metallic globules, and on continuing the heat, there remains a mixture of copper and lead, which tinges borax green. Effervesces in acids.

Comp. Bismuth 43.2; lead 24.3; copper 12.1; nickel 1.5; tellurium 1.3; sulphur 11.5.—*John.*

Local. Near Beresof, in Siberia, imbedded in quartz.

Species 3. OXIDE OF BISMUTH.

Bismuth oxidé, H. Bismuth Ochre, J. A. P. Oxide of Bismuth, C.

Ext. Char.—Color, greenish, or yellowish grey; occurs massive, and pulverulent; fracture earthy; structure imperfectly lamellar; opake; soft; dull; and brittle: sp. gr. about 4.37.

Chem. Char. Easily reduced, on charcoal, to the metallic state. Soluble in nitric acid.

Comp. Oxide of bismuth 86.3; oxide of iron 5.2; carbonic acid 4.1; water 3.4.—*Lampidius.*

Genus 3.—NICKEL.

Pure nickel is of a brilliant white color, resembling silver. It is malleable, both hot and cold. It is not so hard as wrought iron, and like it, is magnetic. It fuses at 160°, Wedgewood. In nitric acid, it gives a greenish solution; tarnishes by heat, and runs through nearly the same changes that heated steel does: sp. gr. 9.

Nickel is not an abundant metal. Its ores are few in number, and rarely found.

Species 1. NATIVE NICKEL.

Nickel natif, H. Native Nickel, J. A. P. C. M.

Ext. Char.—Color, when fresh broken, pale yellow, with a tinge of grey; occurs in slightly flexible needles, or filaments, or in tables placed on each other; not magnetic.

Chem. Char. Partially melts, and becomes magnetic and malleable.

Comp. Nickel, with a small portion of arsenic, and cobalt, which seems to destroy its magnetism.

Local. Hartz, Saxony, Bohemia, near Salzburg, and Cornwall.

It is also found in nearly every meteoric stone, which has been analyzed.

Species 2. ARSENICAL NICKEL.

Nickel arsenical, H. Prismatic Nickel Pyrites, J. Copper Nickel, A. P. Arsenical Nickel, C. Prismatic Nickel-Pyrites, M.

Ext. Char.—Colors, copper red, or yellowish red; acquires a dark tarnish by exposure; occurs reticulated, botryoidal, and massive; fracture imperfectly conchoidal; lustre, shining metallic; yields with difficulty to the knife; sometimes gives sparks with steel; said to occur in four, or six-sided prisms: sp. gr. 6.60 to 7.70.

Chem. Char. Gives out arsenical vapors, and melts with difficulty into a scoria, interspersed with metallic globules. Forms a green solution in warm nitric acid.

Comp. Nickel 44.2; arsenic 54.7; iron, lead, and sulphur, in small portions.—*Stromeyer.*

Dist. Char. It has a strong resemblance to native copper, but copper is malleable, and does not emit arsenical vapors. From pyritous copper, it may be known by its garlic odor, and its difficult reduction.

It is found in primitive rocks, with the ores of cobalt, copper, and silver.

Local. Saxony, Bohemia, France, Spain, and Cornwall.

U. S. Chatham, *Conn.* in a hornblende rock, associated with cobalt.—*Torrey.* Frederic County, *Md.*

Species 3. ARSENITE OF NICKEL.

Nickel oxidé, H. Nickel Ochre. Arseniate of Nickel, P. Nickel-ochre, A. Arsenite of Nickel, C.

Ext. Char.—Color, apple, or grass green, and greenish white; occurs in the state of a powder adhering to, and coating other minerals, and particularly arsenical nickel; also, more or less compact, and of a fine apple green color; opake, or feebly translucent.

Chem. Char. Fusible, and reducible with borax, to the metallic state, exhaling a strong odor of arsenic. Dissolves in acids without effervescence.

Comp. Oxide of nickel 37.4; arsenious acid 37; water 24.3; oxide of iron 1.1; sulphuric acid 0.2.—*Stromeyer.*

Dist. Char. The carbonate of copper, which it sometimes resembles, effervesces with acids, and turns black when heated. The oxide of bismuth is easily reduced, and soon evaporated, by the blowpipe.

Species 4. PIMELITE.

Pimelit, W. Nickel oxydé, Bt. Pimelite, J. P. C.

Ext. Char.—Colors, apple green, or greenish yellow;

occurs in crusts, or small indurated masses ; fracture, and texture, earthy ; lustre glimmering, or dull ; soft ; unctuous to the touch.

Chem. Char. Infusible, but turns dark grey, and loses a part of its weight.

Comp. Oxide of nickel 15.62 ; silex 35 ; alumine 5.10 ; lime 0.40 ; magnesia 1.25 ; water 37.91.—*Klaproth.*

Local. Silesia, in several places, where it is associated with chrysoprase, in veins traversing serpentine.

U. S. New Fane, *N. H.* color apple green ; envelopes chrysoprase. Discovered by Mr. Field.

Genus 9.—COBALT.

Color, when pure, greyish white, with a tinge of copper red ; lustre, approaching brilliant ; melting point, 130° Wedgewood ; brittle, and reducible to powder in a mortar ; not liable to oxidate on exposure to the air, or if kept under water : sp. gr. 8.7.

Obs. Cobalt has not been found in the native state.

Uses. Cobalt, in its metallic state, has not been applied to any use ; but in the state of an oxide, it is an article of considerable consequence in the arts. *Zaffree* is an impure oxide of cobalt, which when fused with a certain quantity of glass, forms *smalt.* Smalt, is of a deep and rich blue color, and is the substance which gives the blue color to china-ware, to enamel, glass, porcelain, &c. Paper, and linen, also receive their bluish tinge from smalt.

Remark. The name, *cobalt,* according to Beckmann, comes from *cobalus*, a title which the German miners gave to an imaginary spirit, which they formerly believed haunted certain mines. This name was given to the ores of cobalt, because, like an evil spirit, they thwarted the hopes of the miners, by raising great expectations when nothing in fact was to be realized, the uses of cobalt being then entirely unknown. It was once customary, therefore, says the same author, to introduce into the church service, a prayer, " that God would protect miners, and their works, from *kobalts,* and spirits."

Its uses as a coloring matter, were discovered in about 1640.

Species 1. ARSENICAL COBALT.

Cobalt Arsenical, H. Octohedral Cobalt Pyrites, J. M. Arsenical Cobalt, A. C. Tin White Cobalt, P.

Ext. Char.—Color, tin, or silver white, tarnished externally greyish, or reddish ; occurs amorphous, arborescent, reticulated, stalactical, and crystallized in the form of cubes, and octohedrons with their varieties ; crystals often exhibit cracks, and convex surfaces ; lustre, glistening and metallic ; yields with difficulty to the knife ; brittle : sp. gr. 7.3.

Chem. Char. Before the blowpipe, it gives out a copious arsenical vapor, on the first impression of the heat; it melts only partially, and that with great difficulty, and is not attractable by the magnet; on the addition of borax, it immediately melts into a grey metallic globule, coloring the borax of a deep blue.—*Aikin.* In the flame of a candle, it emits arsenical vapors.

Dist. Char. The present species, differs from grey cobalt, in being of a more compact, or granular texture, instead of being lamellar; and in emitting the odor of arsenic, when exposed to the flame of a candle. From arsenical iron, it differs, in giving a blue color to borax, and from antimonial silver by the same test, and also by its garlic odor, which the silver does not emit.

Comp. Cobalt 44; arsenic 55; sulphur 0.50.—*Klaproth.*

Var. 1. GREY ARSENICAL COBALT.

Cobalt gris, H. Hexahedral Cobalt Pyrites, J. M. Bright White Cobalt, A. P. Grey Cobalt, C.

Ext. Char.—Color, tin white, with a tinge of copper red; occurs dentritic, botryoidal, and crystallized in cubes and octohedrons, variously truncated, and perfectly similar to those of the sulphuret of iron; structure lamellar; cleavage, parallel to the planes of the cube; yields with difficulty to the knife; not brittle; lustre metallic, shining: sp. gr. 6.33 to 6.45.

Chem. Char. Turns black, and as it grows red hot, emits arsenical fumes, and is finally reduced to a metallic globule, which is magnetic.—*Phillips.*

Comp. Cobalt 33.1; arsenic 43.5; sulphur 20.1; iron 3.2.—*Stromeyer.*

Dist. Char. The marks of distinction, between this variety and the species, has already been pointed out. All the ores of cobalt are easily distinguished from other minerals, by the deep blue they give to borax.

Obs. The present species and its variety, are the ores chiefly wrought for the purpose of obtaining cobalt, for commercial purposes.

Arsenical cobalt occurs in veins, traversing primitive rocks, associated with nickel, bismuth, silver, arsenic, and copper.

Local. Cornwall, and near Dartmoor, in England. Tunaberg, in Sweden. Queerback, in Silesia. Norway, Sweden. Friberg, Marienberg, and Annaberg, in Saxony.

U. S Chatham, *Conn.* in a hornblende, and mica-slate rock. This mine was wrought 50 years since, and abandoned. Another attempt has also been made within a few years, but the ore was found too poor to make it profitable, and it is again abandoned.

Obs. Nearly all the zaffree and smalt, used in commerce, come from Saxony, where the cobalt mines have been long wrought, with great profit.

Species 2. SULPHURET OF COBALT AND COPPER.

Cobalt sulfuré, *Lucas*. Cobalt Kies, J. M. Sulphuret of Cobalt, P. C.

Ext. Char.—Color, white, yellowish white, or greyish; occurs massive and botryoidal; fracture uneven, conchoidal; presenting a granular surface; lustre brilliant; cleavage indistinct; semi-hard.

Chem. Char. Emits a sulphureous odor, and melts into a metallic globule, which gives the blue color to borax

Comp. Cobalt 43.29; copper 14.40; iron 3.53; sulphur 38. 50.—*Hisinger*.

Local. Riddarhyttan, in Sweden.

Species 3. EARTHY COBALT.

Cobalt oxidē noir, H. Black Cobalt-ochre, J. M. Earthy Cobalt, A. P. Oxide of Cobalt, C.

Ext. Char.—Color, bluish, and brownish black, blackish brown, and yellowish grey; occurs botryoidal, stalactic, and massive; structure impalpable; sometimes friable; fracture, earthy; lustre, none; acquires a resinous lustre by rubbing; soils a little; sp. gr. 2.2.

Chem. Char. Gives out the arsenical smell, and tinges borax smalt blue.

Comp. It consists of the oxides of cobalt and manganese.—*Mohs*.

It occurs only in small quantities, and is found in secondary rocks.

Local. Schneeberg in Saxony; Saalfield in Thuringia; in Hessia, and at Alderly Edge, in England.

Uses. It is employed in the preparation of smalt, and is sometimes a valuable ore.

Species 4. ARSENIATE OF COBALT.

Cobalt arseniatè, H. Prismatic Red Cobalt, J. Red Cobalt, Cobalt Bloom, A P. Prismatic Cobalt-Mica, M. Arseniate of Cobalt, C.

Ext. Char.—Colors, crimson red, peach blossom red, cochineal red, and somtimes pearl grey, or greenish grey; occurs in botryoidal, and reniform masses, also investing, earthy, slaggy, and in acicular, radiating, or diverging crystals; crystals translucent; massive, opake and dull; soft; yields to the knife, and sometimes to the nail; thin laminæ, flexible; sp. gr. 2.9.

Chem. Char. Emits copious arsenical fumes, and tinges borax smalt blue.

Comp. Oxide of cobalt 39; arsenic acid 37; water 22.—*Bucholz.*

Dist. Char. The blue color it gives to borax will distinguish it from red oxide of copper, the red oxide of iron, and the sulphuret of mercury.

It occurs in veins, traversing rocks of various ages, and in beds. It may be considered a common ore of cobalt, and sometimes occurs in sufficient quantities for the manufacture of smalt.

Local. Schneeberg and Annaberg in Saxony, Thuringia, Bieber, in Hessia.

U. S. Chatham *Conn.* of a peach blossom red, in crusts, disseminated in felspar.—*Torrey.*

Species 5. SULPHATE OF COBALT.

Red Vitriol, Sulphate of Cobalt, J. A. P. M. Sulphate of Cobalt, C.

Ext. Char.—Color, pale rose red; occurs in small masses of a crystalline appearance, and sometimes stalactical; translucent; taste styptic, friable.

Chem. Char. Tinges borax pale blue.

Comp. Cobalt 38.71; sulphuric acid 19.74; water 41.55.—*Koppe.*

Local. Bieber in Hessia, and in Hungary.

Genus 10.—IRON.

Of all the metals, this is the most universally diffused, and of the greatest use to man.

Its ores are very numerous, and many of them very beautiful and highly interesting. The color, and many of the properties of pure iron are too generally known to require any description. In its soft state, it is one of the most ductile of all the metals, and in the form of steel it is the hardest of all metallic bodies.

In general the ores of iron are easily detected by their magnetic property. Many of them, as the oxides and sulphurets, which are not magnetic, in their original state, become so on being submitted to the blowpipe on charcoal, with the addition of a little tallow.

The specific gravity of pure iron is 7.7.

Species 1. NATIVE IRON.

Fer natif, H. Native Iron, A. P. C. Octohedral Iron, J. M.

Ext. Char.—Color, pale steel grey, approaching that of platina; occurs massive, reticulated and cellular; fracture hackly; malleable; magnetic; not easily oxidated; has rarely occurred in octohedral crystals; sp. gr. 7.7.

Chem. Char. Dissolves with effervescence in all the strong acids Its solutions strike a black color, with tincture of nut-galls.

Comp. (From Saxony.) Iron 92.50; lead 6; copper 1.5.—*Klaproth.*

Local. Near Grenoble in France, mingled with quartz and clay. Near Steinback in Saxony, in a gangue of garnets.

Var. 1. METEORIC NATIVE IRON.

Fer natif meteorique. Meteoric Native Iron, J. A. P. C.

Ext. Char.—Color, pale steel grey, usually covered with a coat of what appears to be brown oxide of iron; occurs massive, globular, and rarely in octohedral crystals; lustre metallic; texture compact, or porous; malleable; sp. gr. 6.48, to 7.57.

Comp. (Siberian) Metallic iron 98.5; nickel 1.5.

Obs. 1. Nearly every specimen of native meteoric iron which has been examined, has been found to contain nickel, in small proportions, as from 1.5. to 10 per cent.

2. Masses of meteoric iron, have been found in various parts of the world.

3. Profe ssor Pallas in his travels, states that he found on the top of a mountain in Siberia, a mass of native iron weighing 1680 pounds. It was malleable and flexible. The inhabitants reported to him, that it fell from the sky.

4. A mass, now in the imperial cabinet of Vienna, came from Agram, in Croatia. It was seen by the inhabitants to fall from the air, and is said to have appeared like a globe of fire. This event happened in 1751.

5. In the province of Tucuman, in South America, in the midst of a large plain, Don Rubin de Celis describes a mass of native iron, weighing about 30,000 pounds. It had an irregular indented surface, and internally presented many cavities. It contains 10 per cent. of nickel.

6. A mass found in Prussia, is said to have weighed 1,600 pounds.

7. A mass found at Bithborg in France, is mentioned by Col. Gibbs. It weighed, by estimation, about 2.500 pounds. In some parts it is so hard as to give fire with steel.

8. A mass, now in the Cabinet, at New-Haven, was found near Red River in Louisiana. Its surface is covered by a dark brown crust, and is deeply indented. It is very compact and malleable. This mass weighs upwards of 3000 pounds. In its interior, Col. Gibbs discovered octohedral crystals of iron, the largest of which is half an inch long.

9. Capt. Ross mentions a mass of native iron which exists in West Greenland. The Esquimaux have made knives of it. It contains 3 per cent of nickel.

10. Other masses of the same metal have been discovered in varous parts of the globe. That of Croatia, however, seems to be the only one concerning which there is any direct proof of its having fallen from the atmosphere. But the similarity of composition, and the

circumstances under which most, if not all of these masses have been found, as their insulation, peculiar composition, and their situation on the surface of the earth, seems to indicate that they owe their origin to a common cause, and that they must have fallen from the atmosphere at various and uncertain periods.

Species 2. ARSENICAL IRON.

Fer arsenical, H. Arsenical Pyrites, J. Prismatic Arsenical Pyrites, M. Mispickel, A. Arsenical Iron, P. C.

Ext. Char.—Color, tin white, with a shade of yellow; occurs massive, disseminated, and crystallized; form the right rhombic prism, either simple, or terminated by dihedral summits; also modified by truncation, on the edges of the summits—on each of the obtuse angles, or otherwise; lustre shining, metallic; fracture granular; hard; brittle; gives fire with steel, the sparks being attended with a little train of white smoke; when struck, gives the odor of garlic; sp. gr. 6.5.

Chem. Char. Fusible, with volumes of white arsenical smoke, the residue being magnetic iron.

Comp. Arsenic 54.55; iron 45.46.—*Berzelius.*

Dist. Char. It resembles arsenical, and grey cobalt, but these both tinge borax smalt blue. It also may resemble sulphuret of iron, and antimonial silver, but neither of these emit the garlic fumes.

It is found chiefly in primitive rocks, as gneiss, mica-slate, and granite; where it occurs in veins, or is disseminated.

Local. Its foreign localities are numerous.

U. S. Warwick, Orange County, *N. Y.* Near Boston, *Mass.* Chatham, *Conn.* Paris, *Maine.*

Var. 1. ARGENTIFEROUS ARSENICAL IRON.

Fer arsenical argentifére, H. Argentiferous Arsenical Pyrites, J. Argentiferous Mispickel, A. Argentiferous Arsenical Iron, P. C.

Ext. Char.—Color, whiter than in the species; lustre silvery; usually tarnished with a shade of yellow; sometimes occurs in acicular crystals; otherwise its characters agree with those of arsenical iron.

Comp. (That of Andreasberg;) Iron 44; arsenic 35; silver 13; antimony 5.—*Klaproth.*

Remark. This variety contains from 1 to 15 per cent of silver.

Local. Freyberg, aud Braunsdorf, in Saxony. It is a rare ore.

Species 3. SULPHURET OF IRON.

Fer sulfuré, H. Hexahedral Iron Pyrites, J. M. Common Pyrites, A. P. Sulphuret of Iron, C.

Ext. Char.—Color, bronze yellow, passing into brass yellow, and steel grey; occurs crystallized, capillary, cellular. massive, and disseminated; form the cube, octohedron, dodecahedron with pentagonal faces, and the icosahedron, with trapezoidal faces, with their modifications and varieties; cleavage parallel to the sides of an hexahedron and octohedron; fracture conchoidal; lustre brilliant, metallic; crystals embedded, and implanted; hard, brittle, sp. gr. 4.8.

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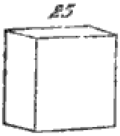
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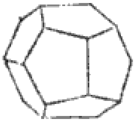
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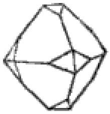
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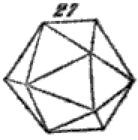

Fig. 25. A cube, the primitive form, and one of the most common figures under which it occurs. This is often truncated on all its solid angles.

Fig. 26. The dodecahedron, with pentagonal faces.

Fig. 27. The octohedron, truncated on all its solid angles.

Fig. 28. A solid, bounded by twenty triangular faces.

Hauy has enumerated a great variety of other modifications, some by truncation, others by bevelment.

Obs. Sulphuret of iron is often a very beautiful mineral, the crystals being as perfect in shape, as could be formed by the most skilful lapidary, and the truncations perfectly symmetrical, together with a surface that resembles burnished gold. They are of all sizes, from that of a mustard seed, to two inches, or even more, in diameter.

Chem. Char Fusible, with a strong odor of sulphur, into a globule, which is magnetic.

Comp. Iron 47.85; sulphur 52.15—*Hatchett.*

Dist. Char. It has often been taken for gold, but gold is malleable; iron pyrites is brittle. It differs from sulphuret of copper in being so hard as not to yield to the knife; pyritous copper yields to the knife, and does not yield a magnetic globule. Arsenical iron emits arsenical fumes, while iron pyrites emits those of sulphur.

Var. 1. RADIATED SULPHURET OF IRON.

Fer sulfuré radié, H. Radiated Pyrites, J. Radiated Iron Pyrites, P. White Pyrites, A. Radiated Sulphuret of Iron, C.

Ext. Char.—Color, bronze yellow, passing into steel grey, often variegated; occurs in masses, of a globular, botryoidal, or reniform shape, composed of fibrous crystals, radiating from the centre, and terminating on the surface of the mass; fracture fibrous; lustre brilliant.

Obs. These masses, commonly fall into a state of decomposition, if exposed to the air, as in cabinets; in which case they crack in various directions, and become covered with a white efflorescence, which will be found on touching it with the tongue to be sulphate of iron, or copperas.

Var. 2. HEPATIC SULPHURET OF IRON.*

Fer sulfuré epigene, H. Hepatic Pyrites, J. A. P. Hepatic Sulphuret of Iron, C.

Ext. Char.—Color, liver brown; internally pale brass yellow, inclining to steel grey; occurs in hexahedral, and octohedral crystals, also stalactical, botryoidal, and amorphous; lustre glimmering.

Obs. 1. This variety presents most of the forms of iron pyrites.

2. Its color seems to arise from a peculiar kind of decomposition, the nature of which is not well understood, and by which its color is changed, and its lustre disappears, without any change of form.

It is found in veins in primitive rocks.

U. S. Near Sparta, *N. J.* Staten Island, and at Anthony's nose, *N. Y.*

Arsenical Sulphuret of Iron.—Color, steel grey, paler than common pyrites; it yields arsenical, as well as sulphureous vapors.

Auriferous Sulphuret of Iron.—Color, deep yellow; occurs in grains and cubic crystals; contains a small quantity of gold, which seems to be in a state of simple mixture with the pyrites.

Seleniferous Sulphuret of Iron.—Color, pale yellow; occurs in granular masses.

Pseudomorphous Sulphuret of Iron.—It occurs in the crevices of wood, and minerals, and also in the cavities of organic remains, and takes its form from that of the cavity, in which it is found.

Uses. Sulphuret of iron, is a very abundant, and universally distributed ore. It however is seldom, if ever employed for the making of iron, but is chiefly used for the extraction of the sulphate of iron or *copperas*, by decomposition.

For this purpose, the ore, being raised from the earth, it is exposed to the air, and moistened. By a natural process, the sulphur absorbs oxygen from the atmosphere, and is converted into sulphuric acid. The acid then unites to the iron, and forms a sulphate, which appears in the form of a greenish white crust on the decomposing pyrites. The copperas is then obtained by washing, or lixiviation, and subsequent crystallization.

In the *United States*, manufactories of the sulphate of iron have been established in *Tennessee.* In *Maryland*, about twenty miles from Baltimore. In *Ohio*, near Zanesville, and on the Muskingum river, and at Steubenville. In *Vermont*, at Strafford, and Shrewsbury. At Strafford, about one thousand persons are employed in the several departments of this manufactory, and during the last year, (1825,) seven hundred tons of copperas have been produced.

Species 4. MAGNETIC SULPHURET OF IRON.

Fer sulfurè magnetique, H. Magnetic Iron Pyrites, P. Magnetic Pyrites, J. A. C. Rhombohedral Iron, Pyrites, M.

Ext. Char.—Color, between bronze yellow and cop-

* From *hepar* Lat. *liver*; because it is of a liver color.

per red; occurs massive; rarely in six-sided prisms; structure lamellar; turns brown by exposure; obedient to the magnet.

Chem. Char. Fusible with the sulphureous odor, into a magnetic globule.

Comp. Iron 63.5; sulphur 36.5.—*Hatchett.*

Obs. This variety contains less iron and more sulphur than the other species. Its magnetic property, Hauy supposes, may depend on its containing a portion of iron in its pure state, and not united to the sulphur. In the opinion of Hatchett, iron combined with less than 37 per cent of sulphur may not only affect the needle, but become a permanent magnet, which is the case with the present species.

Local. Hartz. Galloway, in Scotland, and various other places.

U. S. Brookfield and Huntington, *Conn.* Near Boston, *Mass.* Brunswick, *Maine.*

Species 5. MAGNETIC OXIDE OF IRON.

Fer oxidulè, H. Octohedral Iron ore, J. M. Oxidulated Iron, P. Magnetic Iron Ore, A. Magnetic Oxide of Iron, C.

Ext. Char.—Color, iron black; occurs crystallized, lamelliform, and massive; form the regular octohedron, dodecahedron with rhombic faces, cube and four-sided prism terminated by four-sided pyramids; all subject to a variety of truncations; structure imperfectly lamellar; fracture uneven; lustre shining or glimmering; faces often striated; occurs also in thin plates and in the state of sand; sp. gr. 4.4.

Chem. Char. Becomes brown but is infusible. Insoluble in nitric acid.

Comp. Peroxide of iron 71.86; protoxide of iron 28.14—*Berzelius.*

Obs. 1 This species is always attracted by the magnet, and sometimes attracts iron, which has not been magnetized; it then is called *native magnet*, or *loadstone.*

2. In other instances iron is said to be magnetic when it disturbs the polarility of the magnetic needle, without possessing the power of imparting the same quality; but the native magnetic iron, not only attracts its own particles, but those of iron, which before were not magnetic, and has the power of imparting this property, thus forming the artificial magnet.

3. The loadstone is chiefly found in primitive countries, and sometimes constitutes large masses, or even beds.

4. According to Patrin, there occurs in Sweden, and Switzerland, whole mountains composed of magnetic iron, immense masses of which are found to be native magnets. Blocks of 40lbs. weight, he

says, would carry 200lbs. of iron, and sometimes pieces were found which would lift 25 times their own weight of iron.

5. The celebrated Bergman also describes a hill of the same kind of iron ore, which he saw at Talberg in Swedish Lapland. It is a league in circuit, and 400 feet high, and consists to appearance, solely of black iron ore, cemented into a hard and solid mass with quartz. —*Pinkerton's Petrology.*

6. From its external appearance, the native magnet does not differ from common magnetic oxide of iron, but on trial it will be found to attract iron filings, and to possess polarity.

U. S. Goshen, *Penn.* On the river Wachitta, *Arkansas Territory.* Topsham, *Maine.*

Var. 1. EARTHY MAGNETIC OXIDE OF IRON.

Fer oxydulè fuligineux, H. Earthy Oxydulated Magnetic Iron, P. Earthy Magnetic Iron Ore, J. A.

Ext. Char.—Color, bluish black; occurs massive; fracture fine grained, earthy; lustre dull; yields to the knife; sometimes friable; gives the odor of clay, when breathed on.

Local. Arundal in Norway.

Var. 2. SANDY MAGNETIC OXIDE OF IRON.

Fer oxydulè titanifere, H. Sandy Magnetic Iron Ore, A. Titaniferous Oxydulated Iron, P. Iron Sand, J. C.

Ext. Char—Color, iron black; occurs in small dodecahedral, and octohedral crystals, and in minute grains constituting iron sand; strongly magnetic; pow der black.

Chem. Char. Infusible, and unalterable by the blowpipe.

Comp. Oxide of iron 85.50; oxide of titanium 14; oxide of manganese 0.50.—*Klaproth.*

Obs. This variety being sifted, is in common use for desk, or writing sand.

Local. U. S West-Haven, *Conn.* on the beach of the sea shore. It very obviously proceeds from the disintegration of the chlorite slate contiguous to the beach.—*Silliman.* On Block Island, *R. I.* Gill, *Mass.* Also in Maryland, Ohio, and Virginia.

Magnetic oxide of iron is found very abundantly in foreign countries, and is known under the name of *mountain ore.* It furnishes the best bar iron, and is that, from which, the Swedish steel is made. It yields from 50 to 90 per cent of metallic iron.

Local. U. S. Franconia, Grafton county *N. H.* The bed is from 5 to 8 feet thick, and is contained in gneiss. Beautiful octohedral, and dodecahedral crystals are common. It also yields the compact variety. This bed is explored for smelting. Topsham, Lincoln county, *Maine.* Some of the crystals are two inches in diameter.—*Cleveland.* Suckasunny, *N J.* where the bed has been worked to the depth of 100 feet. The ore from the lowest part is not magnetic until it has been exposed to the light and air.—*Gibbs.* Near Lake Champlain, *N. Y.* Also in the Highlands, and at Crown Point.—

Gibbs. Williamstown, Middlefield, and Woburn, *Mass.* Somerset *Ver.* In various places in Pennsylvania, &c.

Species 6. SPECULAR OXIDE OF IRON.

Fer oligiste, H. Specular Iron, P. Rhomboidal Iron Ore, J. Rhombohedral Iron Ore, M. Specular Oxide of Iron, C.

Ext. Char.—Color, steel grey. with the surface highly polished, and often tarnished azure blue, green, or red, sometimes resembling tempered steel, and sometimes passing into blackish blue ; streak cherry red, or reddish brown ; occurs crystallized in a great variety of forms, among which are the pyramidal octohedron, with its modifications ; the pyramidal dodecahedron, with its summits replaced ; the hexahedral table, with the edges replaced, &c. ; primary, the slightly acute rhomb ; structure lamellar ; cross fracture conchoidal ; lustre brilliant, metallic ; faces of the crystals often striated ; slightly attracted by the magnet ; sp. gr. 5. 52.

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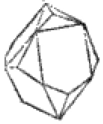

Fig. 29. A figure bounded by 24 faces, of which six are isoceles triangles, twelve scalene triangles, and six pentagons.

Obs. 1. The beautiful irridescent specimens, which come from the Isle of Elba, are frequently crystallized in the above form.

2. The present species, often occurs in groups of tabular or lenticular crystals, implanted edgewise, or intersecting each other so as to form cells of various shapes. Sometimes the edges only appear distinct, forming groups resembling the lancets of a *scarificator.*

Chem Char Infusible, but becomes reddish. Insoluble in acids.

Comp. Iron 69 ; oxygen 31.—*Hassenfraz.*

Dist. Char It differs from the magnetic oxide, in yielding a red powder, that of the magnetic being black. Grey copper and galena, are reduced by the blowpipe, and are not at all magnetic.

Remark. Some of the most splendid specimens, seen in cabinets, belong to this species. It occurs chiefly in primitive mountains, associated with magnetic iron, red oxide of iron, and quartz.

Local. Elba, affords the finest specimens, where it is very abundant, and is said to have been worked as a mine, for 3000 years. Saxony, Bavaria, Bohemia, and in most other countries.

U. S. Near Baltimore, *Md.* Near Lake Champlain, *N. Y.* Brighton, and Montague, *Mass.* Jamaica, *Ver.*

Var. 1. *Volcanic Specular Oxide of Iron.*—It is found in lava, and possibly also, in the stones used in smelting furnaces, when they become porous and partially disintegrated by the heat. The writer has seen some beautiful crystals of specular iron, contained in a micaceous sandstone, which had been used for the above purpose, and which to all appearance, had been formed by particles of iron from the furnace.

Var. 2. MICACEOUS OXIDE OF IRON.

Fer oligiste ecailleux, H. Micaceous Specular Iron, J. P. A. Micaceous Oxide of Iron, C. Rhombohedral Iron-Ore, M.

Ext. Char.—Color, iron black, passing into steel-grey; when turned in a particular direction towards the light it has a tinge of red; streak and powder cherry red; translucent, in thin laminæ, when it appears blood red; occurs massive, composed of thin laminæ, easily separable; splits into broad pieces, of a slaty aspect; also occurs in distinct tabular crystals; sometimes a little unctuous to the touch; brittle; sp. gr. nearly 4.

Dist. Char. From earthy minerals, it is sufficiently distinguished by its weight, color, and lustre, and from the other ores of iron, by its micaceous structure.

Specular and micaceous iron, are found in primitive rocks, among the other ores of iron. Sometimes they are disseminated in the other ores, and sometimes they form considerable beds alone.

Local. Near Baltimore, *Vir.* Near the Raritan, *N. J.* Fort Lee, *N. Y.* Hawley, Brighton, and Charlestown, *Mass.* New Stratford, *Conn.* Near Belfast, *Maine.* Madison County, and Washington County, *Missouri.* In the latter County, micaceous iron forms a ridge from 500 to 600 feet high, and half a mile long.—*Schoolcraft.*

Species 7. BROWN OXIDE OF IRON.

Fer oxidé rubigineux, H. Brown Iron Ore, A. P. Brown Oxide of Iron, C.

Ext. Char.—Colors, brown, blackish brown, or yellowish brown; occurs stalactical, nodular, fibrous, and amorphous; and according to Mohs, in cubical crystals; powder, yellowish brown; seldom magnetic; sp. gr. 3.44.

Chem. Char. Infusible, but turns reddish, and acquires the magnetic property.

Comp. Oxide of iron 85; water 15.—*Daubisson.*

Var. 1. FIBROUS BROWN OXIDE OF IRON.

Fer oxidé haematite, H. Fibrous Brown Iron Ore. Brown Hæmatite, A. P. C.

Ext. Char.—Color, brown, yellowish, or blackish brown; on the outside, often varnished or glossed, precisely resembling black glazed earthen ware; occurs stalactical, tuberose, nodular and amorphous; structure fibrous, sometimes parallel, but more often radiating, or diverging from a centre; lustre, silky, or resinous; yields to the knife.

Obs. This variety often presents very curious imitative forms; as of cylinders of the size of a pipe stem, many inches long, and interwoven into a sort of net-work; also of the branches of trees, or of coral, or bunches of grapes, &c.

This ore, is found in primitive, and secondary rocks.

Local. It is found in every country of Europe.

U. S. Messersburg, Jenkintown, and Lancaster, *Penn.* Gallatin County, *Illinois.* Lawrence County, *Arkansas Territory.* Burlington County, *N. J.* Staten Island, *N. Y.* Stalactical and mammillary, often with a shining surface.—*Pierce and Torrey.* Salisbury, *Conn.* specimens often covered with a jet black shining gloss, like the black glazed tea-pots of former times. Some very beautiful specimens come from this locality. Bennington, and Monkton, *Ver.* That of Bennington yields 33 per cent. of iron.—*Hall.*

Uses. It is employed as an iron ore, and yields from 30 to 60 per cent. of the metal.

Var. 2. COMPACT BROWN OXIDE OF IRON.

Compact Brown Iron Ore, J. P. A. Compact Brown Oxide of Iron, C.

Ext. Char.—Color, olive brown, passing into blackish brown; occurs massive, stalactical, cellular and amorphous; streak and powder yellowish brown; lustre none; structure compact, sometimes slaty, but never fibrous; fracture conchoidal, or earthy, yields to the knife; sp. gr. 3.5. to 3.7.

Comp. Iron 82; water 11.3; oxide of manganese 0.3; silex 2.6. —*Daubisson.*

Dist. Char. It is distinguished from the hæmatite, by its compact structure.

It usually occurs with the fibrous variety, into which it gradually passes.

Local. Blue Ridge, *Md.* It occurs in stalagmites, or very beautifully dentritic, resembling in large masses, a grove of trees.—*Hayden.*

Uses. It is explored as an iron mine, and is said to yield about 50 per cent. of metal.

Var. 3. SCALY BROWN OXIDE OF IRON.

Scaly Brown Iron Ore, A. P.

Ext. Char.—Color, brown, passing into steel grey; occurs in the form of scales, often encrusting the other varieties; lustre glistening, metallic; unctuous to the touch; soils the fingers.

Var. 4. OCHERY BROWN OXIDE OF IRON.

Fer oxidé pulverulent, H. Ochery Brown Iron Ore, P. Yellow Ochre.

Ext. Char.—Color, pale brown, or yellowish; occurs massive, of an earthy aspect; soils the fingers; friable.

Comp. Iron 83; water 12; silex 5.—*Daubisson.*

It is found among bog iron ore.

Var. 5. UMBER.

Ext. Char.—Color, olive brown, blackish or yellowish brown; occurs massive; lustre, none; fracture conchoidal; texture earthy; soils very much; easily broken; adheres strongly to the tongue; falls to pieces in water; sp. gr. 2.

Comp. Oxide of iron 48; oxide of manganese 20; silex 13; alumine 5; water 14.—*Phillips.*

Local. Cyprus. It is used as a paint.

Species 8. RED OXIDE OF IRON.

Fer oxidé rouge, H. Rhomboidal Iron Ore, J. Rhombohedral Iron Ore, M. Red Iron Ore, P. Red Oxide of Iron, C.

Ext Char.—Color, reddish brown, streak and powder, blood red, or brownish red; sometimes slightly magnetic; yields to the knife; aspect rather earthy, than metallic; rarely found crystallized; opake; texture fibrous, or compact; sp. gr. 3. to 5.

Var. 1. FIBROUS RED OXIDE OF IRON. RED HÆMATITE.

Fibrous Red Iron Ore, J. P. Red Hæmatite, A. C.

Ext. Char.—Colors, yellowish brown, and brownish red, or steel grey; lustre somewhat metallic; receives a polish; streak and powder, nearly blood red; occurs amorphous, stalactical, botryoidal, and in concretions; structure distinctly fibrous; fibres, particularly of the stalactical, radiate from the centre, or run parallel, resembling the grain of wood; fracture conchoidal in one direction; sp. gr. 4.75.

Chem. Char. Infusible, but turns dark, and becomes magnetic.

Comp. Oxide of iron 90; silex 2; lime 1; water 3;—*Daubisson.*

It is found chiefly in primitive, but sometimes in secondary mountains.

Local. It is found in several European countries, as England, Bohemia, Saxony, &c.

U. S. Perkiomen lead mine, *Penn.* Kent, *Conn.*

Uses. It is said to yield the best of iron, particularly for drawing and rolling. It is also used for polishing buttons, under the name of *blood-stone*, and during our late war, was in great demand, and sold at exceedingly exorbitant prices, for this purpose.

Var. 2. COMPACT RED OXIDE OF IRON.

Fer-oligiste compact, H. Compact Red Iron Ore, J. A. P. Compact Red Oxide of Iron, C.

Ext. Char.—Color, brownish red, with a mixture of steel grey; surface, sometimes steel grey; streak, and powder, blood red; fracture conchoidal or uneven; lustre a little metallic; occurs massive, slaty, globular, and reniform; also in pseudomorphous crystals, generally cubic, with truncated angles; sp. gr. 3.5 to 5.

It is found in primitive, and secondary rocks, with red hæmatite, and other iron ores.

Local. U. S. On Elk river, *Tenn.* very hard, and compact.—*Schoolcraft.* Canton, *N. Y.*—*Hall.* At the head of Gasconade river, *Missouri.*

Var. 3. SCALY RED OXIDE OF IRON.

Fer-oligiste luisant, H. Scaly Red Iron Ore, J. A. P. Scaly Red Oxide of Iron, C.

Ext. Char.—Color, reddish brown; occurs in masses and crusts, composed of minute scales, slightly cohering; lustre somewhat metallic; unctuous to the touch; soils the fingers.

Chem. Char. Iron 66; oxygen 28.50; silex 4.25; alumine 1.25. —*Hauy.*

It occurs with the preceding varieties, but is more rare.

Local. Perkiomen lead mine, *Penn.* Kent, *Conn.*

Var. 4. OCHERY RED OXIDE OF IRON. RED OCHRE.

Fer oligiste terreux, H. Red Ochre, J. A. P. Ochery Red Oxide of Iron. Red Ochre, C.

Ext. Char.—Color, dark blood red, passing into yellowish, or brownish red; occurs massive; texture compact, earthy; soils the fingers, but is not unctuous; friable; sp. gr. about 3.

It is found with the preceding varieties, and occurs in many places in this country.

Uses. It is sometimes employed as a pigment, under the name of *Indian Red;* but more commonly it is believed, under that of Spanish Brown.

Species 9. ARGILLACEOUS OXIDE OF IRON.

Fer oxidé massif and geodique, H. Argillaceous or Clay Iron Stone, P. Argillaceous Oxide of Iron, C.

Ext. Char.—Colors, ash grey, bluish, brown, and reddish brown; occurs amorphous, and in flat tabular masses; also reniform, globular, and pulverulent; fracture uneven, and earthy, or flat conchoidal; yields easily to the knife; adheres to the tongue; sp. gr. 3.37.

Chem. Char. Infusible, but turns black, and becomes magnetic.

Comp. Protoxide of iron, with a trace of manganese 43.26; alumine and silex 20.78; carbonic acid 29.30; carbonaceous matter 2.67; lime 1.87; moisture 1.—*Phillips.*

It occurs in secondary rocks, and is found in most countries.

Var. 1. COLUMNAR ARGILLACEOUS OXIDE OF IRON.

Fer ogiliste bacillaire-conjoint, H. Columnar Clay-Iron-Stone, A. P. Columnar Argillaceous Oxide of Iron. C.

Ext. Char.—Color, red, brownish, or blackish red, and yellowish red; occurs in masses, composed of columnar pieces, fitting each other like grain, tin or starch, and sometimes with interstices filled with bitumen, or calcareous spar; texture fine grained, earthy; brittle; adheres to the tongue; sometimes magnetic; sp. gr. 3. to 4.4.

Comp. Oxide of iron 50; water 13; silex 30.5; alumine 7;—*Brocchi.*

Local. U. S. Navesink hills, *N. J.* Long Island, *N. Y.* Martha's Vineyard, *Mass.*

It is not common, but is sometimes explored as an iron mine.

Var. 3. PISIFORM ARGILLACEOUS OXIDE OF IRON.

Fer oxidé rubigeneux globuliforme, H. Pisiform Clay-Iron-stone, A. P. Granular Argillaceous oxide of Iron, C. Pea Iron ore.*

Ext. Char.—Colors, brown, yellowish brown, or blackish brown; occurs in small globular masses, consisting of concentric layers of the size of a pea, or larger; brittle; fracture conchoidal; lustre, resinous at the circumference, but dull and earthy at the centre.

Comp. Oxide of iron 48; alumine 31; silex 15; water 6.—*Daubisson.*

It is found in clay, and soft calcareous deposites, with the bog-ore.

Local. It is abundant in France, and in several parts of Switzerland. It is also found in England, Franconia, and Swabia.

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* From its resemblance to peas.

U. S. Pompton plain, and other places, *N. J.* Staten Island, *N. Y.* Salisbury, Windsor, and Hartford, *Conn.*

Uses. It is explored in France, and Switzerland, but is said not to yield good iron.

Var. 3. LENTICULAR ARGILLACEOUS OXIDE OF IRON.

Lenticular Clay Iron-Stone, A. P.

Ext. Char.—Color, brownish red, yellowish brown, or greyish black; occurs in lenticular or oblong flattened masses, of various sizes, from that of an apple seed to that of a butternut; lustre of the fracture, somewhat metallic; easily broken; sp. gr. 3. to 3.8.

Chem. Char. Becomes magnetic, but does not easily melt alone; with borax, melts into a yellowish green glass.

Comp. Oxide of iron 64; water 5; alumine 23; silex 7.5.—*Lampidius.*

Local. Franconia, Bavaria, Saltzburg, Switzerland, France. &c.

U. S. Ontario, *N. Y.* in an alluvial deposite, which also contains fossil shells.—*Eaton.*

Uses. It is sometimes explored as an iron mine, and is said to yield from 30 to 60 per cent.

Var. 4. NODULAR ARGILLACEOUS OXIDE OF IRON.

Fer oxidé geodique, H. Reniform Brown Clay-Iron-Stone, P. Nodular Argillaceous Oxide of Iron, C.

Ext. Char.—Color, yellowish brown, or yellow, internally, when fresh fractured; occurs in nodules of various sizes, from that of a nut, to that of a man's head; sometimes hollow internally, and sometimes contains a pulverulent nucleus; fracture, even, earthy, or flat conchoidal, generally earthy towards the centre; texture earthy, or compact, towards the circumference; appears to be composed of concentric layers; sp. gr. about 3; in the hardest parts scarcely yields to the knife.

It is found in clay-slate, and in alluvial deposites.

Obs. Sometimes there is a cavity in the centre of these nodules, containing some small loose stones, or sand, which rattles on being shook. The ancients supposed, but on what grounds, we do not know, that the eagles, had a habit of transporting those balls to their nests, for the purpose of facilitating the laying of their eggs; hence they were called, *Eagle stones.*

Local. U. S. Near Baltimore, *Md* it forms extensive beds. The nodules are composed of concentric layers, and frequently contain minute crystals of sparry iron.—*Gilmor.* Also at Bomb-shell hill near Bladensburg, in nodules from two to eight inches in diameter. When exposed to a strong heat they burst with an explosion.—*Hayden.* Near Plymouth, *Mass.* Nodules, of a reddish grey color, externally, with a soft, or friable, yellowish nucleus, occur at Northington, *Conn.* They appear to be formed of fine sand-stone.

Var. 5. JASPERY OXIDE OF IRON.

Jaspery Clay Iron-stone, J. Jaspery Argillaceous oxide of Iron, C.

Ext. Char.—Color, reddish, or yellowish brown; occurs massive, having the aspect of jasper; fracture conchoidal, passing into even; lustre glimmering; opake; scarcely yields to the knife; sp. gr. 3.19.

Local. Cornwall, in England. Fischau, in Austria.

Var. 7. COMPACT BLACK IRON ORE.

Compact Black Iron Ore, P.

Ext. Char.—Color, bluish black, passing into steel grey; occurs massive, and in distinct concretions, consisting of concentric lamillæ; fracture conchoidal, or uneven; texture fine grained; opake; brittle.

Var. 8. FIBROUS BLACK IRON ORE.

Fibrous Black Iron ore, P.

Ext. Char.—Color, bluish black, passing into steel grey; occurs reniform, and globular; structure finely fibrous, and divergent; lustre somewhat metallic; gives a shining streak on paper; scarcely yields to tke knife; sp. gr. 4.7.

Chem. Char. Infusible alone; with borax yields a violet colored glass.

Obs. According to Phillips the two last varieties occur in only small quantities, and are found in the veins of primitive, and secondary mountains, with the brown and red hæmatites.

They probably contain a portion of manganese.

Species 10. BOG IRON ORE.

Bog Iron Ore, J. A. P. Bog Ore, C.

Ext. Char.—Colors, yellowish, brown, brownish yellow, and reddish grey; occur amorphous, tuberous, and cellular; fracture earthy, or uneven; lustre resinous, or dull; often friable; sometimes resembles scoria, and sometimes ochre; soils the fingers; sp. gr. 2 to 3.

Var. 1. FRIABLE BOG ORE.

It occurs in masses, sometimes corroded or sinuous; soils the fingers; dull; appears earthy, or ochery.

Var. 2. COMPACT BOG ORE.

It occurs amorphous, tuberous, and in crusts; fracture, conchoidal; lustre resinous; soft; yields to the knife; soils the fingers.

Remarks. These varieties, to which some add *Indurated*, occur together, commonly in the same specimen. They are fouud in low swampy ground, in almost every section of country.

Obs. Bog ore is considered of the most recent formation, indeed it is supposed to be deposited every day, from waters containing oxide of iron, and therefore is constantly forming.

Uses. It is employed for the extraction of iron, and yields, from 30, to 60 per cent of metal.

Species 11 FRANKLINITE.*

Franklinite, *Berthier.* P. C.

Ext. Char.—Color, iron black, powder deep red, or reddish brown; occurs in granular masses, composed of imperfect crystals, or small grains, which sometimes exhibit the planes of the octohedron; structure lamellar; aspect similar to octohedral iron; sp. gr. 4.87; magnetic.

Chem. Char. Soluble without effervescence in hot muratic acid, exhaling a slight odor of chlorine. Before the blow pipe, the zinc is volatilized, leaving a hard magnetic alloy of iron and manganese, susceptible of a polish.

Comp. Oxide of iron 66; oxide of zinc 17; oxide of manganese 16—*Berthier.*

Local. U. S. New-Jersey, accompanied by the red oxide of zinc, and yellowish green garnet. It is mostly embedded in the red oxide of zinc.

Species 12. HYDROUS OXIDE OF IRON.

Fer hydro-oxide, *Bournon.* Hydrous Oxide of Iron P.

Ext. Char.—Color, iron black, internally blackish brown; occurs massive, and crystallized; structure of theri massive, fibrous and radiating: crystals very minute, the terminations, sometimes appearing like velvet; also occurs in slender stalactites, composed of fibres radiating from the centre to the circumference; scratches glass.

Comp. Oxide of iron 80.25; water 15; silex 3.75.—*Vauquelin.*

Local. Clifton, near Bristol, in quartose geodes, also near Botallack, Cornwall, Siberia, and France.

Var. 1. CRONSTEDITE.

Cronstedit, *Leonhard.* Cronstedite, P.

Ext. Char.—Color, black; occurs massive, composed

*In honor of *Dr. Franklin.*

of opake fibres; lustre brilliant; also, in separate six-sided prisms, sometimes adhering laterally; soft; powder and streak, leek green; sp. gr. 3.34.

Chem. Char. Intumesces, but does not melt; with borax, yields a black, opake enamel.

Comp. Oxide of iron 58.85, of manganese 2.88; magnesia 5.07; water 10.70; silex 22.45.—*Phillips.*

Local. Near Przibram, in Bohemia, with carbonate of iron.

Species. 13. HYDROUS SULPHURIC OXIDE OF IRON.

Fer oxide resinite H. Iron Sinter J. Pitchy Bog Iron Ore A. Pitchy Iron Ore P. C.

Ext. Char.—Colors, greyish black, blackish, or yellowish brown; occurs in crusts, in stalactical, or reniform masses, and in lamellar concretions; fracture conchoidal, or fine grained; lustre shining, or glistening; translucent on the edges; streak yellowish; yields to the knife; said also to occur in rectangular prisms; sp. gr. 2.4.

Chem. Char. Melts in the flame of a candle, and becomes magnetic.

Comp. Oxide of iron 67; sulphuric acid 8; water 25.—*Klaproth.*

Dist. Char. Its easy fusibility, will distinguish it from the other ores of iron.

Local. Pless, in upper Silesia, and in Brittany.

Species 14. NATIVE MURIATE OF IRON.

Fer muriaté H. Pyrosmalite J. P. Muriate of Iron C.

Ext. Char.—Color, liver brown, passing into pistachio green, and greenish grey; occurs in six-sided prisms, or tables, with the terminal edges often replaced; lustre shining; that of the terminal planes pearly; structure lamellar; translucent; cleavage, most distinct, parallel to the terminal planes; cross fracture splintery; yields to the knife with difficulty. sp. gr. about 3; translucent on the edges.

Chem. Char. Fusible, with the escape of chlorine into a magnetic globule.

Comp. Submuriate of iron 14.10; protoxide of iron 21.81; oxide of manganese 21.14; silex 35.85; lime 1.21; loss 5.89 *Hisinger.*

Local. Nordmark in Sweden, in a bed of magnetic iron.

Species 15. CARBONATE OF IRON.

Fer oxidè carbonaté H. Sparry Iron J. Sparry Iron. K. A. Spathose Iron, Carbonate of Iron P. Carbonate of Iron C. Brachytypous Parachrose—Baryte M.

Ext. Char.—Colors, wine yellow, yellowish brown, or greyish yellow; becomes brownish black. by exposure; occurs massive; composed of crystalline, foliated plates, often curved; structure foliated or lamellar; lustre shining vitreous; streak white; translucent when recently broken; occurs also in acute rhomboids, sometimes with truncated terminal angles, in six-sided crystals, in octohedrons, and in lenticular crystals; crystals often adhere by thin edges to other minerals, or are found in groups, or druses; yields to the knife; cleavage parallel to the planes of an obtuse rhomboid, which is the primitive form; sp. gr. about 4.

Chem. Char. Infusible, blackens and becomes magnetic. Dissolves slowly in nitric acid, with slight effervescence.

Comp. Oxide of iron 58; carbonic acid 35; oxide of manganese 4.25; magnesia 0.75; lime 0.5.—*Klaproth.*

Dist. Char. From the earthy minerals which it resembles, it is distinguished by its great weight; from other ores of iron by its crystalline, foliated cleavage, or fracture; and from blende which it often very nearly resembles, by its yielding magnetic iron, by the blowpipe.

Obs. On being exposed to the air, it is gradually decomposod; first the color of the surface becomes brown, or black; afterwards, also the streak is changed into red or brown, its hardness and specific gravity are diminished, and even the chemical constitution is altered, the whole being converted into hydrate of iron. *(Mohs.)*

It occurs abundantly in some countries, in veins and beds, chiefly in primitive rocks, but sometimes in secondary ones. It is associated with the other ores of iron, also with those of copper, and lead, and with calcareous spar, brown spar, &c.

Local. Hesse, Hartz, and Westphalia, where it is worked as an ore of iron. France, Germany and Spain in abundance. England sparingly.

U. S. Near Baltimore, *Md.* in lenticular crystals. New-Milford, *Conn.* chiefly in foliated masses, but sometimes in obtuse rhombs.—"This appears to be the only locality in the U. States where carbonate of iron occurs in quantity."—*Silliman.*

Species 16. PHOSPHATE OF IRON.

Fer phosphaté H. Blue Iron Ore A. Phosphate of Iron P. C. Prismatic Blue Iron J. Prismatic Iron-Mica M.

Ext. Char.—Color, indigo blue, sometimes nearly black, and sometimes greenish blue; occurs crystallized, massive and amorphous; form of the primitive, an oblong four-sided prism, which is also the form under which it often appears; crystals subject to truncation. It also occurs in six, eight, or twelve sided prisms, and in rounded, flattened, or lenticular crystals; structure fibrous, resembling hornblende; crystals grouped, or intersect each other, leaving interstices or cells; lustre shining; the massive is laminated, or consists of shining plates, adhering together; the indurated occurs in friable crusts, or in small masses, with an earthy texture; sp. gr. 2.69.

Chem. Char. Fusible into a steel colored globule, which is magnetic.

Comp. Oxide of iron 41.25; phosphoric acid 19.25; water 31.25; alumine 5.—*Laugier.*

Dist. Char. A little attention to color will distinguish it from hornblende; from the blue carbonate of copper, it differs in being of darker color; and from this, and indicolite, it differs in yielding a magnetic globule.

Local. Isle of France. Allier in France, Cornwall, and Devonshire in England. Siberia. Bodenmais in Bavaria. Stavern in Norway.

U. S. New-Jersey. It is transparent when first taken from the earth, but becomes deep indigo blue by exposure, or by a moderate heat.—*Woodbridge.* Also, on Crosswick's creek, color, externally blue, but greenish internally, and soft like talc.

Var. 1. EARTHY PHOSPHATE OF IRON.

Fer phosphaté terreux, H. Earthy Blue Iron, J. Earthy Blue Iron Ore, A. Earthy Phosphate of Iron, P. C.

Ext. Char.—Colors, on its first exposure, greyish, yellowish, or greenish white, but soon changes to indigo blue of various shades; occurs massive, disseminated, and investing other minerals; soft; often very slightly cohering; dull; soils the fingers; sp. gr. about 2.

Chem. Char. Becomes brown, and then melts into a magnetic globule.

Comp. Oxide of iron 47.50; phosphoric acid 32; water 20.—*Klaproth.*

This variety is found in alluvial soils, as in mud and clay, supposed to be more or less intermingled with animal matter, and from whence it is probable, the phosphoric acid has been derived. Indeed, it has been found penetrating the organic remains of various animals.

Local. Isle of Dogs, Isle of Man, and in the Shetland Islands, in England.

U. S. Allentown, and other places, *N. J.* Near Plymouth, and at Hopkinton, *Mass.* York, in *Maine.* At Allentown, it occurs in masses which weigh 30lbs. or more.—*Conrad.*

Uses. Phosphate of iron, is sometimes ground and employed as a pigment.

Species 17. SULPHATE OF IRON.

Fer sulphaté, H. Rhomboidal Vitriol, J. Hemi-Prismatic Vitriol-Salt, M. Green Vitriol, A. Sulphate of Iron, P. C.

Ext. Char.—Colors, green, or yellowish, or brownish green; occurs in stalactical concretions, in efflorescences, massive, and crystallized in the form of right oblique angled prisms; taste astringent and metallic; soluble in water.

Chem. Char. Its solution strikes a black color with tincture of nut galls.

Comp. Oxide of iron 25.7; sulphuric acid 28.9; water 45.4.—*Berzelius.*

It occurs in small quantities, in mines of the sulphuret of iron, from the decomposition of which, it proceeds.

Species 18. CHROMATE OF IRON.

Fer chromaté, H. Prismatic Chrome-Ore. J. Octohedral Chrome-Ore, M. Chromated Iron, A. Chromate of Iron, P. C.

Ext. Char.—Color, blackish brown, or nearly black; occurs massive, disseminated, granular and crystallized in regular octohedrons, or double four-sided pyramids, sometimes flattened; powder and streak brownish; lustre imperfect metallic; opake; brittle; crystals sometimes so minute as to resemble a tuft of hair, and sometimes of considerable size; fracture conchoidal, or uneven; sp. gr. 4. to 4.50; sometimes magnetic.

Chem. Char. Infusible alone, but with borax, yields a rich and lively grass green bead.

Comp. Oxide of iron 34.7; chromic acid 43; alumine 20.3; silex 2.—*Vauquelin.*

Dist. Char. The green tinge it gives to borax, will distinguish it from octohedral iron, which it most resembles, and from the dark varieties of blende.

This species is usually found embedded in serpentine, steatite, or talc.

Local. Near Grassin, department of Var, in France, in nodules and veins, in serpentine. Uralian Mountains, in Siberia. Shetland Islands. In Bohemia, Silesia, and Piedmont.

U. S. Loudon County, *Va.* Bare Hills, near Baltimore, *Md.* in great abundance, in serpentine. From this locality, according to Hayden, it extends through Pennsylvania, New Jersey, and New York, to Milford, in Connecticut. From 10 to 14 miles from Philadelphia, on the West Chester and Lancaster roads it occurs in detached masses, weighing from a few ounces to 20 pounds, and in one instance 500 pounds.—*Cooper*. Hoboken, *N. J* in octohedral crystals. On Staten Island, *N. Y.* Milford, *Conn.* disseminated in serpentine. Cummington, *Mass.*

Uses. Chromate of iron is employed to furnish the *chromic acid*, which being united with oxide of lead, forms the chromate of lead, or *chrome yellow*, a yellow pigment in great demand.

The chromate of iron is worth from 40 to 60 dolls. a ton in market. The chromate of lead sells in large quantities for $1,00 a pound, and in smaller quantities, or by the single pound $1,25 to $1,50. It is stated that in 1819, about 3,000 pounds of the chromate of lead were manufactured in Philadelphia.—*Cleveland.*

Species 19. ARSENIATE OF IRON.

Fer arseniaté, H. Hexahedral Olivenite, J. Arseniate of Iron, A. P. C. Hexahedral Lirocone-Malachite, M.

Ext. Char.—Color, olive green, passing into bottle green and brownish green; also yellowish brown, and yellowish red; streak, and powder, pale brown; occurs in small, and often very perfect cubes, sometimes truncated on the alternate angles, or on the edges and angles; crystals longitudinally striated; lustre adamantine; sometimes occurs stalactical, and studded with crystals; fracture imperfectly conchoidal; transparent, translucent, or opake; yields to the knife; sp. gr. 3.

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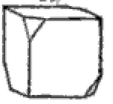

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Fig. 30. A cube, with a triangular face on each alternate, solid angle, formed by truncation.

Fig. 31. A cube, with the alternate solid angles replaced by four planes, of which the middle one is a hexagon, and the others, triangles.

Chem. Char. Melts in the flame of a candle. On charcoal, before the blowpipe, emits the arsenical odor, and leaves a magnetic scoria.

Comp. Oxide of iron 48; arsenic acid 18; water 32; carbonate of lime 2.—*Vauquelin.*

Local. St. Leonard, in France. Cornwall, and near St. Day, in England, with the other ores of iron.

It is a rare mineral.

Species 20. OXALATE OF IRON.

Oxalate of Iron. Humboldtine, P.

Ext. Char.—Color, bright yellow ; occurs in crystalline, flattish masses, of indeterminate forms ; yields to the nail ; acquires electricity by friction ; sp. gr. 1.3.

Chem. Char. Decomposes easily by heat, giving out a vegetable odor, and leaving a residue, which is at first yellow, then black, and finally becomes red. Insoluble in boiling water, or alcohol.

Comp. Protoxide of iron 53.56 ; oxalic acid 46.14.—*Rivero.*

Local. Near Berlin, in Bohemia, in friable lignite. The oxalic acid, is supposed to proceed from the decomposition of succulent plants, many varieties of which contain it.

Genus 11.—URANIUM.

This metal is reduced to its pure state with great difficulty, even in the laboratory of the chemist. According to Klaproth, uranium is of a dark grey color, with a metallic lustre and granular texture. It is soluble in nitric acid ; fuses with great difficulty, and affords a deep orange color to porcelain enamel : sp. gr. 8 to 9.

Species 1. BLACK OXIDE OF URANIUM.

Urane oxidulé, H. Uran-Ochre. Pitch Blende, A. P. Indivisible Uranium, J. Uncleavable Uranium-Ore, M. Black Oxide of Uranium, C.

Ext. Char.—Colors, greyish black, bluish black, brownish black, and iron black ; occurs globular, reniform, and amorphous ; fracture imperfectly conchoidal ; structure granular or slaty ; lustre imperfectly metallic ; translucent, opake ; brittle ; scratches glass, but yields to the knife ; sp. gr. 7.5.

Chem. Char. Infusible alone ; with borax, yields a grey slag. Soluble in nitric acid, with the emission of nitrous gas.

Comp. Oxide of uranium 86.5 ; galena 6 ; oxide of iron 2.5 ; silex 5.—*Klaproth.*

Dist. Char. From the dark varieties of the sulphuret of zinc, it is distinguished by its greater specific gravity, and its want of the foliated structure which the zinc possesses. The chromate of iron gives a green globule with borax, and the ferruginous oxide of tungsten, is fusible alone.

This rare species is found in primitive rocks, commonly in small masses. It is associated with the ores of copper, cobalt, arsenic, silver, &c.

Local. Konsberg, in Norway. Joachimsthal, in Bohemia, and in Cornwall, England.

Species 2. GREEN OXIDE OF URANIUM.

Uran oxidé, H. Micaceous Uranitic Ore, K. Uranite, A. P. Green Oxide of Uranium, C. Pyramidal Uranite, J. Pyramidal Euchlore-Mica, M.

Ext. Char.—Color, emerald, or grass green, often very beautiful; also, yellowish green, leek green, and lemon yellow; streak pale; occurs crystallized in quadrangular prisms, in four, six, and eight-sided tables, and rarely, in obtuse octohedrons; all the varieties subject to truncation; crystals variously grouped, sometimes resembling a fan, and sometimes a sheaf; sometimes it appears like a scale of mica, attached to some other mineral; structure foliated; cleavage, easy in certain directions; lustre glistening, and sometimes pearly; transparent, translucent; yields to the knife; sp. gr. 3.10.

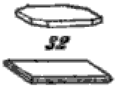
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Fig. 32. An eight-sided tabular crystal, one of the common forms.

Fig. 33. An octohedron, with truncated summits, and truncated angles.

Chem. Char. Decrepitates, but does not melt. Dissolves in nitric acid, yielding when the solution is saturated, a lemon yellow solution; with borax, yields a yellowish green glass.

Comp. Oxide of uranium 72.15; water 15.70; lime 6.87; oxides of tin and manganese 1.55; gangue 2.50.—*Berzelius.*

Obs. According to the analysis of Phillips, a specimen from Cornwall, yielded oxide of uranium 60; oxide of copper 9; phosphoric acid 15.3; water 13.8; silex 0.5.

If this is the composition of the present species, it is a phosphate of uranium, probably colored by phosphate of copper.

Dist. Char. It resembles green mica, but the mica is elastic, while the uranium is easily broken, and is inelastic; mica is also more easily cleaved. It may resemble some of the green ores of copper, but copper when dissolved in nitric acid, yields a blue color with ammonia, which the uranium does not.

It is found in primitive rocks, and particularly in granite.

Local. Cornwall, where it is found in granite, with the ores of copper, arseniate of iron, wavellite, &c. Bodenmais, in Bavaria, with felspar and beryl. Near Autun, and near Limoges, in France.

U. S. Near Baltimore, *Md*—*Gilmor.*

Var. 1. EARTHY OXIDE OF URANIUM.

Urane oxidé terreux, H. Uran Ochre, J Pulverulent Uranite, A. Earthy Green Oxide of Uranium, C.

Ext. Char.—Color, yellow, of various shades, also greenish yellow; occurs in a pulverulent state, forming crusts on other minerals; also in small indurated masses, with little lustre, and an earthy aspect.

It is found with the present species.

U. S. Near Baltimore, *Md.*

Genus 12.—TIN.

Tin is a white metal of considerable lustre, and not easily oxidated by exposure. It is easily cut with a knife, but is not so soft as lead. When bent, it makes a peculiar crackling noise, probably owing to the separation of some of its particles. It is very malleable, and is readily reduced into thin sheets. It melts at 442° Fah. sp. gr. 7.29.

Uses Tin is employed for various, and very important purposes. Thin sheets of iron, being dipped into melted tin, receive a coat of the metal, and are thus prevented from rusting. This is commonly called *sheet tin*, and is the article of which the common tin ware is made. Tin foil with mercury, forms the amalgam on the backs of looking-glasses. Tin also forms a part of prince's metal, Brittania metal, pewter speculum metal, &c.

Obs. It was formerly supposed that tin was sometimes found in its native state, but Mr. Phillips observes, that this error arose from there having been found pieces of the metal at the scites of old smelting places, and which had been reduced by the heat, long before.

The ores of tin, are only two, an oxide, and a sulphuret.

Species 1. OXIDE OF TIN.

Etain oxidé, H. Tinstone, K. A. Pyramidal Tin-Ore, J. M. Oxide of Tin, P. C.

Ext. Char.—Colors, yellowish brown, brownish black, greyish yellow, hair brown, and nearly colorless, and transparent; the light brown, translucent, and the darker colors, opake; occurs in crystals, and in masses, from the size of grains to that of the fist; primitive form, the octohedron, with square bases; secondary forms very numerous, but difficult to ascertain, on account of the imperfections, or grouping of the crystals; lustre resinous, or adamantine; structure lamellar; cleavage parallel to the axis of the octohedron, and also to the diagonals of the common base; fracture uneven and imperfectly conchoidal ; gives sparks with steel ; brittle ; sp. gr. 6. 7 to 7.

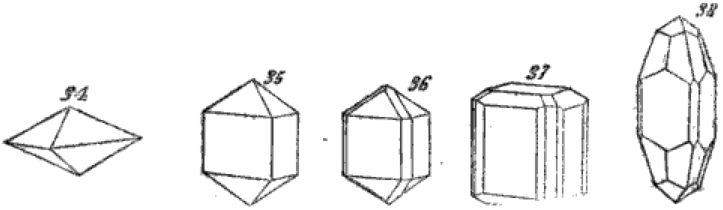


Fig. 34. An obtuse octohedron, or double four-sided pyramid, the primitive form.

Fig. 35. A four-sided prism, terminated by four-sided pyramids. This is one of the most common forms.

Fig. 36. The same as 35 with the angles truncated.

Fig. 37. A macled, or twin crystal, composed of two four-sided prisms, with truncated edges joined together.

Fig. 38. A four-sided prism, surmounted by eight-sided pyramids, which are terminated by four-sided summits.

A great variety of other secondary forms are ennumerated.

Chem. Char. It decrepitates strongly, but in fine powder, may be reduced to the metallic state on charcoal.

Comp. Tin 77.5 ; oxygen 21.5 ; oxide of iron 0.25 ; silex 0.75.—*Klaproth.*

Dist. Char. Carbonate of iron, which it most resembles, leaves a magnetic globule under the blowpipe. Sulphuret of zinc is infusible, and not so hard as oxide of tin ; and ferruginous oxide of tungsten, yields readily to the knife, and melts into a black scoria.

Tin occurs only in primitive rocks. Its localities are few, but Jameson observes, that when it does occur,it is generally in considerable quantities.

Local. Cornwall, in England. Gallacia, in Spain. Bohemia, and Saxony. Sumatra, Siam, and Pegu. Mexico and Chili.

Obs. 1. The greatest known deposite of tin, is at Cornwall, where it occurs in veins, traversing granite, and other primitive rocks, and is associated with chlorite, iron pyrites, topaz, quartz, fluor, &c. The ore from the Cornwall mines is most commonly found in the state of crystals, variously grouped or aggregated, and according to Phillips the different veins yield different varieties of form. It is also found in alluvial deposites, in the same district, and is called *Stream Tin,* because the ore is separated from the rocks and brought down, by streams of water.

Some of the Cornwall mines extend many hundred feet under the sea, and it is said that in one of them the noisé of the waves, and the rolling of the pebbles can be distinctly heard, so near has the excavation been carried to the bottom of the ocean.

2. The *Block Tin* of commerce is extracted from the ore taken from the excavated mines. *Grain tin,* which is said to be of a purer qualily, is extracted from stream tin.

Var. 1. FIBROUS OXIDE OF TIN. WOOD TIN.

Etain oxydé concretionné, H. Wood Tin J. A. Fibrous oxide of Tin P. C.

Ext. Char.—Color, brown of several shades; occurs amorphous, reniform, globular, and wedge shaped; surface generally water-worn; structure fibrous in one direction and concentric lamellar in the other; fibres radiate, or diverge, sometimes intersect each other; lustre feebly resinous; colors, sometimes arranged in bands; sp. gr. 6·4.

Chem. Char. Decrepitates, and becomes reddish, but does not melt.
Comp. Oxide of tin 91; oxide of iron 9.—*Vauquelin.*

Var. 2. TOAD'S EYE WOOD TIN.

Toad's Eye Wood Tin P.

Ext. Char.—Colors, hair brown, and yellowish white, arranged in concentric layers; occurs in minute spherical masses, composed of fibres radiating from the centre.

Obs. Wood Tin, so called, from its fibrous structure, resembling that of wood, is found chiefly in the alluvial mining districts of Cornwall. It is commonly found in small masses, but a mass found near St. Austle weighs 15 lb. and for which 100 dollars has been offered.

The toad's eye variety, is found in small masses embedded in an aggregate of schorl and quartz.

Var. 3. COLUMBIFEROUS OXIDE OF TIN.

Columbiferous Oxide of Tin P.

Ext. Char.—Color, reddish black, or reddish grey; occurs in small octohedrons, or crystalline grains; lustre metallic; fracture uneven; opake; scratches glass; sp. gr. 6.55.

Chem. Char. It does not alter before the blowpipe.
Comp. Oxide of tin 63.6; oxide of columbium 2.4; oxide of iron 1.4; of manganese 0.8; Another variety yielded 12 per cent of the oxide of columbium.—*Berzelius.*
Local. Finbo in Sweden.

Species 2. SULPHURET OF TIN AND COPPER.

Etain sulphuré H. Tin Pyrites, A. P. Pyritous Tin, C.

Ext. Char.—Color, steel grey, yellowish white, and yellow; occurs amorphous, with the colors intermixed, giving it the appearance of bell metal, whence it is sometimes called bell metal ore; fracture granular and uneven; lustre metallic; brittle; yields to the knife; sp. gr. 4.3 to 4.78.

Chem. Char. Fusible with the odor of sulphur, into a black scoria, but is not reduced to the metallic state.

Comp. Tin 34; copper 36; sulphur 25; iron 2.—*Klaproth.*

Remark. The analysis does not shew whether these constituents exist in a state of chemical combination, or in the state of simple mixture.

Local. Cornwall, only, where it is associated with pyritous copper and blende.

Genus 13.—ZINC.

Zinc when pure is of a brilliant white color, with a tinge of blue; fracture uneven, striated, or foliated, presenting the result of a confused crystallization; when rubded on the fingers, zinc imparts to them a peculiar taste and smell. When cold it is not malleable, but when heated to a little above 212 deg. it becomes malleable, and may be hammered into thin plates, or drawn under rollers. If heated to about 400 deg. it becomes so brittle as to be easily reduced to powder in a mortar.—*Thomson.*

Zinc melts at 680 deg. and if the temperature be increased, it burns with a bluish white flame; sp. gr. 7.29.

Uses. When mixed with copper it forms *brass*, one of the most useful and common of alloys. In chemistry it is employed to obtain hydrogen, by solution with sulphuric acid and water. Its salts and oxides are employed in medicine, and the pure metal, when reduced to thin sheets, is used to cover the roofs of buildings.

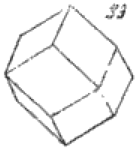
Zinc never occurs in the native state, but is found mineralized by sulphur, oxygen, or carbonic acid.

Its ores are few in number, and not common.

Species 1. SULPHURET OF ZINC.

Zinc sulphuré, H. Blende, K. A. P. Sulphuret of Zinc, C. Dodecahedral Zinc Blende, J. Dodecahedral Garnet-Blende, M.

Ext. Char.—Colors, yellowish, greenish, reddish, or blackish brown; streak corresponding with the color, but paler; occurs crystallized, amorphous, and lamelliform; primitive form, the rhombic dodecahedron; secondary forms, the octohedron, and tetrahedron, with their varieties, often modified by truncation and bevelment; opake, or translucent; yields to the knife; brittle; crystals commonly grouped so as to make it difficult to determine their forms; lustre shining, or splendent; sometimes metallic, or adamantine; structure foliated; sp. gr. 3.7 to 4.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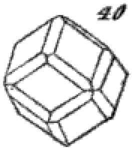
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Fig. 39. The rhombic dodecahedron, the primitive form.

Fig. 40. The same with all the edges truncated.

Remark. These simple forms are subject to deep and various truncations; so that in many instances, the forms are very difficult to determine or understand. One complex form, having the general appearance of fig. 39, is so modified by truncation, as to present 24 faces, of which 12 are nearly equilateral, and 12 isoceles triangles.

Chem. Char. Decrepitates, but is commonly infusible. When pulverized and thrown into sulphuric acid, it gives the odor of sulphuretted hydrogen.

Comp. (Brown variety.) Zinc 58.8; sulphur 23.5; iron 8.4; silex 7.0.—*Thomson.*

(Yellow variety.) Zinc 64; sulphur 20; water 6; iron 5; fluoric acid 4; silex 1.—*Bergman.*

Dist. Char. Sulphuret of lead is easily reduced to the metallic state by the blowpipe, while the zinc is infusible. Oxide of tin is of a darker color than the present species, and wants its foliated structure, Chromate of iron tinges borax green, and the carbonate of iron yields a magnetic globule, neither of which characters belong to zinc.

Zinc is found in primitive and secondary rocks, and is associated with sulphuret of lead, with iron and copper.

Local. Cornwall, and Derbyshire, England, Perthshire, Cumberland, and in the lead hills near Edinburgh.

U S. Near Baltimore, *Md.* Perkiomen lead mine, *Penn.* Hamburg and Sparta, *N. J.* Near Hamilton College, *N. Y.* color, wax yellow and translucent.—*Torrey.* At Shawangunk Mountain, and in the Highlands, *N. Y.* Berlin, *Conn.* color yellow. Southampton lead mine, *Mass.* Also at Leverett.

Obs. This ore commonly occurs too widely disseminated in its gangue to make it profitable for working. It is however sometimes, after roasting, used in the preparation of brass.

Var. 1. PHOSPHORESCENT BLENDE.

Yellow Zinc Blende, J. Yellow Sulphuret of Zinc, C. Phosphorescent Blende, P.

Ext. Char.—Color, yellowish, sometimes lemon yellow; occasionally mixed with green, and red; translucent; lustre adamantine; phosphorescent by friction.

Local. Perthshire, and Flintshire. The Hartz. In Saxony, and Bohemia.

It is one of the rarest varieties of zinc ore.

Var. 2. FIBROUS BLENDE.

Zinc sulfuré strié, H. Fibrous Brown Zinc-Blende, J. Fibrous Sulphuret of Zinc, C. Fibrous Blende, A. P.

Ext. Char.—Colors, reddish brown, yellowish brown and iron black; occurs reniform, and massive; opake, or translucent; structure fibrous, often radiating, or diverging.

Chem. Char. Gives the odor of sulphur, and sometimes even burns with a bluish flame, but is not reduced to its metallic state.

Local. Cornwall, *Eng.* Brisgaw, and Reabel, in Carinthia.

It is a rare variety.

Var. 3. MAMMILLATED BLENDE.

Mammillated Blende, P.

Ext. Char.—Color, externally, brown, or blackish brown; internally, hair brown, passing into yellowish white; occurs in mammillated, and botryoidal masses; structure concentric lamellar; fracture in one direction, flat conchoidal; translucent on the edges.

Comp. Oxide of zinc 66; sulphur 33.—*Kidd.*

Remark. In the other varieties, the zinc is not in the state of an oxide. Possibly there may be a mistake in this analysis.

Var. 4. CADMIFEROUS BLENDE.

Cadmiferous Blende, P.

Ext. Char.—Color, brown; lustre metallic, when fresh fractured; structure radiated; occurs embedded in common massive blende; sp. gr. 4.

Obs. The presence of cadmium in this variety, was first discovered by Stromeyer, and according to Phillips, has since been found in the radiated siliciferous oxides of zinc, from Freyberg, and Derbyshire.

Var. 5. BLACK BLENDE.

Zinc sufuré noir, H. Black Zinc-Blende, J. Black Sulphuret of Zinc, C.

Ext. Char.—Colors, black, reddish, greyish, or brownish black, often irised; occurs massive and crystallized fracture foliated; nearly opake; transmits a blood red light; lustre more or less shining, and metallic.

Obs. 1. According to Jameson, the different colored varieties of zinc, characterize different formations, the yellow being the oldest, the black the newest, and the brown of an intermediate age.

2. Sulphuret of zinc, is not extensively worked for the purpose of obtaining the metal, its reduction being much more difficult than that of *calamine*, the ore from which zinc is commonly obtained. The miners know this species under the name of *black jack*.

Species 2. RED OXIDE OF ZINC.

Red Oxide of Zinc, *Bruce*. A. P. C. Zinc-Ore, M.

Ext. Char.—Colors, ruby, blood, or aurora red, sometimes yellowish red; occurs massive, and disseminated; fracture foliated in one direction, and flat conchoidal in the other; lustre shining, and somewhat micaceous; cleavage, (according to Phillips) parallel to all the planes of a regular six-sided prism; translucent on the edges; by exposure, becomes dull, and covered with a whitish pearly crust; structure foliated; brittle, and easily reduced to powder; yields to the knife; sp. gr. 6.22.

Chem. Char. Infusible alone, but with borax yields a yellowish transparent bead. Soluble with effervescence, in all the minerals acids; with potash, melts into an emerald green glass, which communicates to water, the same color, but is changed to rose red, on the addition of a few drops of acid.—*Bruce.*

Comp. Zinc 76; oxygen 16; oxides of manganese, and iron 8.—*Bruce.*

Oxide of zinc 88; red oxide of manganese 12.—*Berthier.*

Dist. Char. It differs from red sulphuretted antimonial silver, and from the chromate of lead, by its infusibility before the blowpipe; from the red oxide of copper by its greater specific gravity, and by its colorless solution in nitric acid; from the red oxide of titanium, by its solubility in acids; and is not like the red sulphuret of arsenic, volalized by the blowpipe, with the garlic odor.—*Cleveland*

Local. In the Franklin, Stirling, and Rutger's iron mines, in Sussex County, *N. J.* At Franklin, it is embedded in a whitish oxide of zinc. Sometimes the Franklinite is embedded in it, forming an aggregate of a singular aspect, a red ground, with black spots.

Obs. Cleveland remarks, that this ore is well adapted to the manufacture of brass.

Species 3. SILICIOUS OXIDE OF ZINC.

Zinc oxidé, H. Silicious Oxide of Zinc, P. C. Prismatic Calamine, or Electric Calamine, J. Prismatic Zinc-Baryte, M.

Ext. Char.—Colors, yellowish or greyish white, and light brown, sometimes with a tinge of green; occurs stalactical, botryoidal, massive, and crystallized; primary form the right rhombic prism; secondary forms the six-sided prism, and the four sided table, variously modified by truncation; also the octohedron; crystals commonly collected into groups; translucent or transparent; becomes electric by heat; sometimes gives fire with steel, but may more commonly be scratched by the knife; texture, foliated, fibrous, or earthy; sp. gr. 3.4.

Chem. Char. Whitens, and becomes friable, but does not melt. Dissolves in nitric acid, without effervescence, forming a gelatinous solution.

Comp. Oxide of zinc 66; silex 33.—*Klaproth.*

Oxide of zinc 38; silex 50; water 12.—*Pelletier.*

Dist. Char. The zeolites, which it sometimes resembles, melt into a spongy mass. From stilbite, and the varieties of carbonate and sulphate of lime, it is distinguished by the effects of acids, and the result of the blowpipe, as also by its electric property.

This species is found in primitive, transition, and secondary rocks, but most frequently in limestone.

Local. Wanlockhead, in Scotland. Leicestershire, and Derbyshire, *Eng.* Flintshire, in Wales. Bleiberg, in Carinthia, and Friberg, in the Brisgau.

U. S. Perkiomen lead mine, and at Conestoga Creek, *Penn.* Near the falls of the Hockhocking, *Ohio.*

Species 4. CARBONATE OF ZINC.

Zinc carbonaté, H. Rhomboidal Calamine, J. Carbonate of Zinc, P. C. Rhombohedral Zinc-Baryte, M.

Ext. Char.—Color, grey, greenish, or brown, and sometimes nearly white; occurs crystallized, compact, amorphous, pseudo-morphous, and cupriferous; translucent, or opake; yields to the knife; not electric by heat; sp. gr. 3.35 to 4.44.

Chem. Char. Infusible, but loses about 34 per cent. by ignition. Soluble with effervescence, in cold sulphuric, or warm nitric acid. Cleveland says, if paper, which has been immersed in a solution of this salt, in nitric acid, be dried, and then held at the distance of a few inches from burning coals, it spontaneously kindles.

Dist. Char. It is distinguished from the silicious oxide, by its effervescence with acids, and by its not forming a gelatinous solution.

Var. 1. CRYSTALLIZED CARBONATE OF ZINC.

Crystallized Calamine, P.

Ext. Char.—Colors, yellowish, greyish, or various shades of green and brown; occurs in obtuse and acute rhomboids, and in long quadralateral tables, variously modified; structure lamellar; cleavage parallel to all the planes of the rhomboid; lustre vitreous; translucent; yields to the knife; crystals small.

Comp. Oxide of zinc 65.2; carbonic acid 34.8.—***Smithson.***

Var. 2. COMPACT CARBONATE OF ZINC.

Compact Carbonate of Zinc, or Calamine, C.

Ext. Char.—Colors, greyish, yellowish, greenish, or brownish; colors dull; occurs stalactical, reniform, and cellular; structure imperfectly fibrous, or compact; fracture uneven, or splintery; lustre feebly glistening; translucent, or opake.

Comp. Oxide of zinc 64.8; carbonic acid 35.2.—***Smithson.***

Var. 3. PSEUDO-MORPHOUS CARBONATE OF ZINC.

Pseudo-morphous Calamine, P.

Ext. Char.—Color, as in the above varieties; occurs in the form of that variety of crystallized carbonate of lime, called *Dog's-tooth spar.*

Obs. These crystals, instead of being solid, are hollow, the carbonate of zinc having been deposited on the dog's-tooth-spar, after which the spar has been decomposed and washed away.

Var. 4. EARTHY CARBONATE OF ZINC.

Earthy Calamine, P.

Ext. Char.—Colors, white, greyish, or yellowish white; occurs massive, disseminated, and investing; yields to the nail; fracture and texture earthy; adheres to the tongue; sp. gr. 3.36.

Comp. Oxide of zinc 71.4; carbonic acid 13.5; water 15.1.—***Smithson.***

Var. 5. CUPREOUS CARBONATE OF ZINC.

Cupriferous Calamine, P.

Ext. Char.—Color, pale green; occurs in thin lamellæ, composed of crystalline, diverging fibres, closely aggregated; lustre silky.

Obs. It contains a portion of carbonate of copper, to which its color is owing.

The present species is found in secondary rocks, and most often, in limestone. It is associated with the ores of lead, and copper, and with the silicious oxide of zinc.

Local. Medship Hills, in Somersetshire. Holywell, in Flintshire, where it occurs in obtuse rhomboids. Near Castleton, in Derbyshire. Also in Bristol.

U. S Perkiomen lead mine, *Penn.* in reniform concretions, radiated and compact.—***Wetherill.***

Uses. When melted with copper, it forms *brass.*

Obs. 1. Both of these species were anciently known under the name of *calamine.*

2. The ancients highly esteemed an earth under the above name, which had the quality of converting copper into a golden yellow metal, and at the same time, of increasing its weight.

3. It is most probable, that at first, brass was formed by the natural occurrence of the ores of copper and zinc together, as is said to be the case in some of the Hungarian mines.

4. Brass had been made and employed in the arts, for many centuries, before it was known, that calamine, which was considered an earth, contained a metal.

5. At present, most of the brass used in commerce and the arts, is made, more or less after the ancient manner. The oxide, or carbonate of zinc, being previously roasted, is mixed with granulated copper and charcoal, and then exposed to a proper degree of heat. The zinc is reduced to its metallic state, and unites with the copper to form the alloy in question.

6. The mode of obtaining metallic zinc, is by first roasting the calamine to drive off the carbonic acid, and other volatile matters, and then by distilling, in earthen retorts, the beaks of which are placed under water. The metal passes by distillation, into the vessels of water. This process is said to have been obtained from the Chinese, by a person who went out for that purpose.

Species 5. SULPHATE OF ZINC.

Zinc sulphaté, H. White Vitriol, A. Pyramidal Vitriol, J. Sulphate of Zinc, P. C. Prismatic Vitriol-Salt, M.

Ext. Char.—Colors, white, greyish, or reddish white occurs in concretions, in efflorescences, stalactical, reniform, and investing; also crystallized in minute rectangular, four-sided prisms; structure of the massive fibrous, and radiated; lustre shining; translucent; soft; brittle; soluble in water; taste, styptic and nauseous; sp. gr. 2.

Chem. Char. Before the blowpipe it fuses, and gives off a large quantity of water and sulphuric acid, leaving a grey scoria. Its solutions in water, are precipitated into the carbonated alkalies.

Comp. Oxide of zinc 27.5; sulphuric acid 22; water 50.

It is found in mines, containing the sulphuret of zinc, from the decomposition of which, it is supposed to arise.

Obs. The sulphate of zinc, or *white vitriol* of commerce, is produced by the same kind of process, already described, for making green vitriol, or sulphate of copper. The sulphuret of zinc, being first roasted, is exposed to the action of the air and moisture, by which means the sulphur is converted into sulphuric acid, by the absorption of oxygen from the atmosphere. As the acid forms, it combines with the zinc, forming a sulphate, which is obtained by lixiviation, or washing, and subsequent evaporation and crystallization.

Genus 14.—MANGANESE.

Manganese, in its metallic state, has not been converted to any use; it is therefore never reduced, except in the laboratory of the chemist, in small quantities, by way of experiment.

When pure it is of a greyish white color like cast iron, and of a brilliant lustre; melts at 160 deg. Wedgewood, and has neither taste, nor smell. Exposed to the air, it soon loses its lustre, and again becomes an oxide; sp. gr. 8.

Uses. The black oxide of manganese is employed, with muriate of soda, and sulphuric acid to produce chlorine, a gas used in bleaching cotton and linen cloth, paper, &c. It is also used with sulphuric acid, to furnish oxygen gas, for chemical purposes; and in small quantities, it enters into the composition of glass. It is also employed to give a purple tinge to enamel.

Remark. The best test of the presence of manganese, is the purple color which all its ores give, when fused with borax.

The ores of this metal are not very numerous, but they are widely disseminated, and quite common.

Species 1. BLACK OXIDE OF MANGANESE.

Manganese oxidé metalloide, H. Grey oxide of Manganese, P. Grey Manganese, A. Oxide of Manganese, C. Uncleavable Manganese-Ore, M.

Ext. Char—Colors, greyish black, dark violet, or iron black; occurs massive, acicular, and crystallized; primitive form, the rhombic prism, with various modifications; also, in acicular crystals, longitudinally striated, and diverging, or confusedly intersecting each other; lustre earthy, sometimes metallic, and shining; soils the fingers; sp. gr. 4.14 to 4.80.

Var. 1. RADIATED AND FIBROUS BLACK OXIDE OF MANGANESE.

Radiated and Fibrous Grey Manganese, J. Radiated oxide of Manganese, C.

Ext. Char.—Color, dark steel grey, passing into iron black; occurs in fibres, or in acicular crystals, sometimes radiating from a point, and sometimes intersecting each other in various directions, and resembling a bunch of the finest steel needles, after having been in the fire; lustre metallic; often presenting specimens of singular beauty.

Chem. Char. Infusible alone, but with borax dissolves, giving the globule a dark violet, or purple tinge. When a grain or two of its powder is mixed with a little common salt, and moistened with sulphuric acid, and heated, the suffocating smell of chlorine is emitted.

Comp. Manganese 44; oxygen 42; oxide of iron 3; silex 5; carbon 1.5.—*Cordier*.

Oxide of Manganese 99.25; water 0.25.—*Klaproth*.

Dist. Char. It resembles sulphuret of antimony, but this is easily fusible, while the manganese is infusible. It may be confounded with brown hæmatite, but this becomes magnetic under the blowpipe, and tinges borax brown, while the manganese tinges borax purple.

Var. 2. COMPACT BLACK OXIDE OF MANGANESE.

Manganese oxidé compacté, H. Compact grey oxide of Manganese, P. Compact grey Manganese, A. Compact oxide of Manganese, C.

Ext. Char.—Colors, dark steel grey, passing into iron black, violet brown, or brownish black; occurs massive, stalactical, and botryoidal; lustre a little metallic, or dull; fracture conchoidal, or uneven; texture compact; yields to the knife, but sometimes scratches glass; soils the fingers; sp. gr. 3.70.

Chem. Char. Infusible alone; with borax gives the purple globule.

Comp. It is an impure mineral, containing about 60 or 80 per cent of the oxide of manganese, 20 per cent of iron, and often a portion of silex, barytes, carbon, &c.

Var. 3. EARTHY OXIDE OF MANGANESE.

Earthy grey Manganese ore, J. Earthy grey oxide of Manganese, P. Earthy oxide of Manganese, C.

Ext. Char.—Colors, greyish brown, and blackish brown; occurs massive, amorphous and botryoidal; texture and fracture earthy; more or less friable, and sometimes pulverulent; soils the fingers strongly; sp. gr. 2 to 3.

Comp. It sometimes contains nearly one half oxide of iron, or other foreign substances.

Obs. This variety is known to miners under the name of *Wad*.—Jameson says, that when it is dry, and mixed with one fourth of its weight of linseed oil, and moderately heated, it inflames.

Var. 4. SILVERY OXIDE OF MANGANESE.

Manganese oxidé argentin, H. Argentine oxide of Manganese, C.

Ext. Char.—Color, yellowish white, or greyish yellow; occurs in delicate tufts, or filaments, sometimes united into small masses, or it is found incrusting other minerals, in thin layers; lustre silvery, hence the name; brittle; crumbles between the fingers.

Oxide of Manganese is found chiefly in primitive rocks, and most frequently among the ores of iron. It is very extensively diffused, and is often the coloring matter of other minerals. It however does not very often occur in large quantities at a place.

Local. Cornwall, Devonshire and Aberdeen. In Germany, France, Siberia, and indeed in almost every country.

U. S. Lawrence County, *Arkansas Territory*. Near Greenburg, and near Big Sandy river, *Ken* Shenandoah County, and Albemarle County, *Virg.* Near Wilkesbarre; also near Lancaster, and in Northumberland County, *Penn.* Near Hamburg, *N. J.* Near Troy and near Ancram, and on the Island of New-York. *N. Y.* Monkton, *Ver.* crystalized and earthy. Also at Bennington, from whence large quantities are drawn for use.—*Hall.* Lebanon, *Conn.* Milton, Lynn, Deerfield, and Leverett, *Mass.* Also at Dorchester, Adams, Richmond and Plainfield, *Mass.*

Species 2. SILICIOUS OXIDE OF MANGANESE

Manganese oxide silicifere, H. Rhomboidal red Manganese, J. Siliciferous oxide of Manganese, P. White Manganese, A. Siliceous oxide of Manganese, C.

Ext. Char.—Colors, pale red, rose red, reddish brown, and yellowish white; occurs massive, composed of granular concretions; also earthy, and it is said in lenticular crystals; fracture conchoidal; lustre, shining, or nearly dull; scratches glass, when compact; sp. gr. 3.2.

Chem. Char. Fusible on the edges; with borax, gives a violet colored, translucent glass.

Comp. Oxide of manganese 52.6; silex 39.6; oxide of iron 4.6; lime 1.5; volatile matter, 2 75.—*Berzelius.*

Local. Kapnic, in Transylvania, with magnetic oxide of iron, and garnets. Near Tavistock, in Devonshire, with the grey oxide of manganese. Also in Sweden, Siberia, &c.

U. S. Middlebury, *Ver.* Cummington, *Mass.*

Species 3. CARBONATE OF MANGANESE.

Manganese oxidé carbonatée, H. Carbonate of Manganese, P. C.

Ext. Char.—Colors, rose red, reddish white, and brownish; occurs massive, composed of small shining crystalline grains, of a foliated structure; also globular, and reniform; yields a little to the knife; translucent on the edges; fracture conchoidal, and splintery; sp. gr. 3.20.

It is said also to occur in lenticular crystals.

Chem. Char Infusible, but becomes brown; with borax, gives a reddish violet bead.

Comp. Oxide of manganese 48; carbonic acid 49; oxide of iron 2.1; silex 0.9 —*Lampidius.*

Local. Nagyag, and Kapnic in Transylvania, in a vein of native auriferous tellurium.

Var. 1. ALLAGITE.

Allagit. *Leonhard.* Allagite, P. M.

Ext. Char.—Colors, brown, and green, changing by exposure, to pink brown, and pearl grey, and finally to dark grey, and black; scratches glass; but does not give sparks with steel.

Chem. Char. The green is fusible, with difficulty into a black pearly glass; the brown, with borax, into a violet blue glass.

Comp. Oxide of manganese 75; silex 16; carbonic acid 7.50.—*Du-Menil*

Local. The Hartz, in Switzerland.

Var. 2. RHODONITE.

Rhodonit. *Leonhard.* Rhodonite, P. M.

Ext. Char.—Colors, red, rose red, pink, or yellowish white; occurs compact, and in fibrous masses; fracture of the compact, splintery; individuals of the fibrous variety, easily separable; slightly translucent; lustre shining, scratches glass, and gives sparks with steel; sp. gr. 3.6.

Comp. (The fibrous) Protoxide of manganese 49.87; silex 39; carbonic acid 4; alumine 0.12; water 6; oxide of iron 0.25.—*Brandes.*

Local. Stahlberg, in Switzerland.

Var. 3. HORN MANGAN.

Horn Mangan. *Leonhard,* P.

Ext. Char.—Colors, white, grey, and brown, of various shades: also greenish blue; occurs compact; fracture somewhat conchoidal, and occasionally splintery; translucent on the edges; lustre glistening, but becomes brilliant on exposure; scratches glass faintly; gives no sparks with steel; sp. gr. 3. to 3.89.

Chem. Char. Fusible on the edges, with phosphorescence: With borax yields a bead of a hyacinth red color.

Comp. Protoxide of manganese 54.58; silex 34; carbonic acid 8; water 2; oxide of iron 0.5.—*Brandes.*

Local. It occurs with the above varieties.

Species 3. SULPHURET OF MANGANESE.

Manganese sulfuré, H. Sulphuret of Manganese, A. P. C. Prismatic Manganese-Blende, J. Hexahedral Glance-Blende, M.

Ext. Char.—Color, of the fresh fracture, steel grey, but becomes brownish black, by exposure; occurs massive, reniform, and botryoidal; lustre shining, metallic; texture fine grained, or sometimes foliated; fracture uneven; yields to the knife; opake; sp. gr. 3.95.

Chem. Char. Infusible alone, but dissolves with borax, giving a violet blue glass. With nitrous acid, its powder yields sulphuretted hydrogen.

Comp. Manganese slightly oxidated 85; sulphur 15.—*Vauquelin.*

Local. Nagyag, in Transylvania, with tellurium, blende, and the other ores of manganese. Also in Cornwall.

Species 4. PHOSPHATE OF MANGANESE.

Manganese phosphate ferrifere, H. Phosphate of Manganese, A. P. C. J. M.

Ext. Char.—Colors, reddish, or blackish brown; powder brown, or reddish; occurs massive; structure lamellar; fracture uneven; translucent on the edges; lustre resinous, and somewhat chatoyant; mechanical division, tends to a rectangular prism; scratches glass; brittle; sp. gr. 3.4. to 3.95.

Chem. Char. Fusible, with intumescence into a black enamel, which is magnetic; soluble in nitric acid, without effervescence.

Comp. Protoxide of manganese 32.6; phosphoric acid 32.8; protoxide of iron 31.9; phosphate of lime 3.2.—*Berzelius.*

Local. Limoges in France, in a coarse grained granite. It is said also to occur in *Pennsylvania and Massachusetts.*

Species 5. CUPREOUS MANGANESE.

Cupreous Manganese, J. M.

Ext. Char.—Color, bluish black, streak unchanged; occurs massive, reniform, and in botryoidal groups; texture compact; fracture imperfect conchoidal; lustre resinous; opake; not very brittle; yields to the knife; sp. gr. 3.19 to 3.21.

Chem. Char. Becomes brown, but is infusible alone., To borax and salt of phosphorus, gives a mixture of purple and green colors.

Comp. Black oxide of manganese 82; brown oxide of copper 13.50. —*Lampidius.*

Local. In the tin mines of Schlaggenwald, in Bohemia.

Genus 15. MOLYBDENA.

The pure metal, which is obtained with great difficulty, is of a white color, tinged with yellow. On exposure to the air, it soon oxidates, but remains unaltered under water; on exposure to continued heat, it is converted into a white oxide. By the action of sulphuric and nitric acid, it is converted into *Molybdic acid,* which has the form of a yellowish white powder. Sp. gr. of the pure metal 8.6.

The ores of this metal are few, and though not uncommon, they rarely occur in any considerable quantities.

Species 1. SULPHURET OF MOLYBDENA.

Molybdene sulfurè, H. Sulphuret of Molybdena, P. C.

Ext. Char.—Color, nearly that of fresh cut, metallic lead; occurs massive, or crystallized, in short hexahedral prisms; structure lamellar, or foliated; cleavage perfect in one direction; lustre brilliant, and not subject to tarnish; folia easily separable, and somewhat flexible; unctuous to the touch; leaves a metallic streak on paper; opake; sp. gr. 4.5 to 4.7; often appears, in spots, or dots, in other minerals, as in limestone.

Chem. Char. Infusible, but sometimes gives out the odor of sulphur, and if the heat be urged, emits white fumes. Soluble with effervescence in carbonate of soda. It is converted into molybdic acid by the action of nitric acid.

Comp. Molybdena 60; sulphur 40.—*Bucholz.*

Dist Char. It resembles plumbago, but may be readily, and certainly distinguished from it, by the blowpipe with borax. The molybdena, in small scales will adhere to the surface of the globule of fused borax, without any change; but the plumbago, dissolves, or separates into minute particles, coating the surface of the borax, with a lead grey crust. Micaceous iron becomes magnetic before the blowpipe, which will always distinguish it from molybdena.

This mineral belongs to primitive rocks, as granite, gneiss, and primitive limestone.

Local. Near Mont Blanc. Near Norberg, in Sweden, in a white steatite. Abo, in Finland, with hornblende. Chessy, in France, in scienite. Cornwall, with tin and copper. Cumberland, with apatite, and iron ore.

U. S. Chester County, and Delaware County, *Penn.* Near Baltimore, in granite. Near Philadelphia, in gneiss. On the Island of New York, and in the Highlands, *N. Y.* Also in West Chester, and Putnam Counties, and at Crownpoint. East Haddam, Saybrook, and Brookfield, *Conn.* Shaftsbury, *Mass.* in six-sided tables or plates.—*Silliman.* Also at Brimfield. Brunswick, *Maine*, in six-sided tables, and in foliated masses.—*Cleveland.*

Species 2. OXIDE OF MOLYBDENA.

Molybdena ochre, J. Oxide of Molybdena, P. C.

Ext. Char.—Color, straw, or sulphur yellow; occurs pulverulent, and in friable crusts.

Chem. Char. When heated, by the compound blowpipe, a snow-white oxide is sublimed.—*Cleveland.*

Obs. It has not been analyzed, but according to the observation of Berzelius, it behaves under the blowpipe, like pure molybdic acid.

Local. Nummedalen, in Norway, on sulphuret of molybdena. And at Coryburg, in Scotland.

U. S. Brunswick, in *Maine*, with sulphuret of molybdena.

Genus 16—ANTIMONY.

Color of the pure metal, white; occurs in foliated or lamellar masses, the lamellæ being placed in irregular directions, often with broad shining faces, sometimes curved; brittle, and easily reduced to a powder; melting point, 800 deg. Fah. and at a higher heat, evaporates in form of a grey smoke; soluble in the acids; sp. gr. 6.8.

Uses. It enters into the composition of printing types, of speculum metal, of Britannia ware, &c. In medicine it is universally employed, when united to tartaric acid, under the name of *tartar emetic.*

Its ores are few, and its localities not very numerous.

Species 1. NATIVE ANTIMONY.

Antimoiné natif, H. Dodecahedral Antimony, J. Native Antimony, A. P. C. Rhombohedral Antimony, M.

Ext. Char.—Color, tin white, but on exposure, becomes yellowish, or brownish; occurs reniform, amorphous, and in thin plates; also crystallized in octohedrons, and dodecahedrons; lustre brilliant; structure lamellar; cleavage easily effected, in certain directions; brittle; sp. gr. 6.7.

Chem Char. Easily fusible with a grey inodorous vapor. With borax, it separates into small individual globules, and continues to emit white fumes from its own combustion, after the heat is removed; on cooling, the globule becomes covered with minute crystals of the oxide of antimony.

Comp. Antimony 98; silver 1; iron 0.25.—*Klaproth.*

Obs. It often contains a little arsenic, and some specimens leave a small globule of silver on the charcoal, after the antimony has escaped.

Dist. Char. It resembles antimonial silver, but this always yields a globule of silver, under the blowpipe. The sulphuret of antimony, gives the odor of sulphur, which the native does not. It may also be taken for arsenical iron, and native bismuth. But the first emits the arsenical odor, and leaves a magnetic globule, and the bismuth has a tinge of copper-red.

It is found in primitive rocks, and is a rare ore.

Local Sahlberg, in Sweden. Dauphiny, in France. Andreasberg, in the Hartz. Allemont, near Grenoble.

U. S. Harwinton, *Conn.* in broad plates, associated with sulphuret of antimony.—*Silliman.*

Species 2. SULPHURET OF ANTIMONY.

Antimoine sulfuré, H. Prismatic Antimony-Glance, J. Sulphuret of Antimony, A. P. C. Prismatoidal Antimony-Glance, M.

Ext. Char.—Color, lead grey, passing into steel grey; streak unchanged; often irridescent, from external tarnish; occurs massive, composed of delicate threads, or needles, closely aggregated, and sometimes so fine as to resemble wool; also, crystallized in rhombic prisms, variously modified, and variously terminated; lustre splendent; fracture, and texture fibrous; yields to the knife; brittle, and easily reduced to powder; sp. gr. 4 to 4.80.

Chem. Char. Melts in a candle. Before the blowpipe, emits the odor of sulphur, and is mostly volatalized, in the form of a white smoke.

Comp. Antimony 74; sulphur 26.—*Bergman.*

Dist. Char. The easy fusibility of this species, will easily distinguish it from the minerals it most resembles, particularly, from the oxide of manganese. It differs from native antimony, in emitting the sulphureous odor when heated, and in being of a darker color.

Var. 1. RADIATED SULPHURET OF ANTIMONY.

Antimoine sulfuré aciculaire, H. Acicular Sulphuret of Antimony, P. Radiated Sulphuret of Antimony, C.

Ext. Char.—Color, lead grey, passing into steel grey; occurs in masses, composed of acicular, compressed, cylindrical crystals, radiating from a centre, or intersecting each other, in various directions; longitudinal fracture, fibrous; lustre of the faces very brilliant.

Obs. This variety is much more common than the above.

Var. 2. PLUMOSE SULPHURET OF ANTIMONY.

Antimoine sulfuré capillaire, H. Plumoze Sulphuret of Antimony, P. C.

Ext. Char.----Color, dark steel grey, or lead grey, often tarnished purple, or blue; occurs in very minute capillary crystals, investing the surfaces of other minerals, giving them a feathery, or downy appearance; brittle; soft; opake.

Chem. Char. Fusible, with a white vapor, into a black slag.

Local. Huel Boys mine, in Cornwall. It is rare.

Var. 3. COMPACT SULPHURET OF ANTIMONY.

Antimoine sulfuré compact, H. Sulphuret of Antimony, P. C.

Ext. Char.—Color, light lead grey; fracture uneven; texture fine grained; lustre glimmering; occurs massive, and disseminated; brittle; yields to the knife; sp. gr. 4.3.

Dist. Char. Easily distinguished from the steel-grained sulphuret of lead, by the white fumes it emits under the blowpipe.

It is a rare variety.

Sulphuret of antimony, is the ore, from which the antimony of commerce is obtained. It is found in primitive and secondary rocks, associated with the sulphurets of lead, and zinc, and with ores of iron, copper, and arsenic.

Local. Andreasberg, in the Hartz. Friberg, in Saxony. Schemnitz, in Hungary. Nagyag, in Transylvania. Mexico. England. Scotland. Ireland. Spain, &c.

U. S. Near Richmond, in *Virg.* Near Zanesville, *Ohio.* Harwinton, *Conn.* with native antimony. Near South Hadley, *Mass.* On Saco river, *Maine.*

Var. 4. NICKELIFEROUS GREY ANTIMONY.

Antimoine sulfuré nickelifere, H. Nickeliferous Sulphuret of Antimony, C.

Ext. Char.—Color, steel grey, inclining to silver white; occurs in compact, or in broad plates; cleavage, parallel to the planes of the hexahedron, perfect; lustre metallic; brittle; sp. gr. 6.56.

Chem. Char. It is partly volatalized before the blowpipe, during which the supporting charcoal is covered with a white coating; at last it melts into a metallic globule, which communicates a blue color to the glass of borax.—*Mohs.*

Comp. Antimony 43.80; sulphur 17.71; nickel 36.60; iron and manganese 1.89.—*Stromeyer.*

Local. Near Treusburg, in Nassau, with galena, and copper.

Obs. Sulphuret of antimony, sometimes contains various proportions of silver, or copper. One variety, found in the Pyrenees, is said to contain 20 per cent of copper.

Species 3. SULPHURETTED OXIDE OF ANTIMONY.

Antimoine oxidé sulfuré, H. Red Antimony, J. A. P. Prismatic Purple-Blende, M. Sulphuretted oxide of Antimony, C.

Ext. Char.—Color, cherry red, or brownish red, streak unchanged; surface, often irridescent, from tarnish; occurs in acicular prisms, radiating, or interlacing; feebly translucent; also, occurs massive, with a fibrous, or granular structure; lustre metallic adamantine; brittle; sp. gr. 4 to 4.6.

Chem. Char. Melts easily, and is entirely volatalized, by continuing the heat. In nitric acid, it becomes covered with a white coating, but does not entirely dissolve.

Comp. Antimony 67.50; oxygen 10.80; sulphur 19.70.—*Klaproth.*

Obs. It occurs with the sulphuret of antimony, which has induced a belief, that it arises from the decomposition of that ore.

Dist. Char. Cinnibar is of a deeper, or scarlet-red color, and is volatalized with a blue flame. Red oxide of copper, leaves a globule of the metal on the charcoal, and the red oxide of tin is infusible.

Local. Kapnic, in Transylvania. Allemont, in France. Hungary. Saxony. Tuscany, &c.

U. S. Mear Leesburg, *Vir.* in detached masses, in the soil; it has a deep ruby color.—*Hayden.*

Species 4. OXIDE OF ANTIMONY.

Antimoine oxydé, H. Oxide of Antimony, A. P. C. Prismatic White Antimony, J. Prismatic Antimony-Baryte, M.

Ext. Char.—Colors, white, yellowish white, or greyish, occurs massive, in acicular prisms, and in tabular crystals; crystals commonly occur in radiated, or facicular groups; structure foliated, or fibrous; translucent; lustre, shining pearly; sp. gr. about 5.

Chem. Char. Fusible, with ease, and volatile by the heat; but it is sometimes volatile without fusion.

Comp. Oxide of antimony 86; oxide of iron 3; silex 8.—*Vauquelin.*

Dist. Char. Its volatility and weight, will distinguish it from zeolite and stilbite. Carbonate of lead, is not volatile by the blowpipe. It is found with the other ores of antimony.

Local. Malazka, in Bohemia. Allemont, in France, &c.

Genus 17.—CHROME.

Color of the pure metal, between tin white, and steel grey. It is obtained from the native chromate of iron, with difficulty, and only in small quantities; when this metal is oxidated to its fullest extent, it constitutes chromic acid, a crystalline salt of a beautiful aurora red color. The metal has a radiated, crystalline texture, and is hard, and brittle. sp. gr. about 6.

Uses. The oxides of chrome, or chromic acid, form very beautiful, and useful colors, when combined with other metals, as iron, cobalt, lead, or mercury. Green, yellow, and red colors, are produced in this way, and are employed as pigments, and for the coloring of porcelain ware. The emerald, actinolite, and several other green minerals, owe their colors to oxide of chrome.

Species 1. OXIDE OF CHROME.

Oxide of Chrome, *Mac Culloch,* P. C.

Ext. Char.—Colors, bright grass green, and pale yellow; occurs pulverulent, or compact; translucent, when compact, and of a green color, bearing the marks of crystalline structure; lustre, and appearance, like that of compact crystalline limestone.

Chem. Char. The green, changes to yellow, by heat. Gives a green color to borax, and also to boiling alkali; but the color is precipitated by further boiling.

Local. Unst, one of the Shetland Isles, where it fills the cavities of the chromate of iron.—*Mac Culloch.*

Genus 18.—ARSENIC.

Color of the metal, bluish white, like that of steel; lustre brilliant; brittle; soft; may be reduced to powder, in a mortar; when heated it emits the odour of garlic, and flies off in white fumes; sublimes without melting; oxidates, and turns dark, on exposure, but retains its brilliancy for years, if closely sealed in a glass tube; Sp. gr. 5.7.

Uses. It enters into the composition of some metallic alloys, and its oxides are employed in the preparation of certain paints; in the coloring of glass, and in medicine, it is used under the name of *Fowler's Solution* It is a violent poison, in all its modes of existence, except in that of a pure metal.

Obs. No mines are wrought for the purpose of obtaining this metal. That used in commerce, which is the white oxide, is chiefly scraped, by condemned criminals, from the long chimnies of the cobalt smelting furnaces in Saxony.

Species 1. NATIVE ARSENIC.

Arsenic natif, H. Native Arsenic, A. P.C.

Ext. Char.—Color, tin white, inclining to steel grey, or lead grey; externally, tarnished nearly black; occurs reniform, botryoidal, in plates, and in concretions; fracture uneven; structure imperfectly foliated; or sometimes, concentric lamellar, and sometimes, with impressions of crystals; yields to the knife; brittle; lustre metallic; sp. gr. 5.7.

Chem. Char. Burns with a blue flame, yielding a dense white smoke, attended with the odor of garlic, and leaves on the charcoal, a minute portion of iron, silver, or gold.

Dist. Char. From other native metals, it may readily be distinguished, by its beginning to evaporate before it melts. Arsenical pyrites leaves a magnetic globule; and arsenical antimonial silver, leaves a silver globule, both of which will shew that they are not the present species.

It occurs chiefly in primitive rocks, with the ores of cobalt, silver, copper, &c.

Local. Konigsberg in Norway. In the Hartz. Bohemia. France. England, &c.
U. S. Martha's vineyard.

Species 2. OXIDE OF ARSENIC.

Arsenic oxidé, H. Oxide of Arsenic, J. P. C. Octohedral Arsenic Acid, M.

Ext. Char.—Color, snow white, or yellowish, reddish, or greenish white; occurs earthy, capillary, and investing; also crystallized in octohedrons, and in quadrangular tables; cleavage parallel to the planes of the octohedron; lustre vitreous; texture fibrous, or granular; crystals often minute, and delicate; translucent; opake.

Chem. Char. Gives out the smell of garlic, and finally evaporates.—Soluble in about 80 parts of water.

Dist. Char. Its solubility in water will distinguish it from pharmacolite, and other minerals which it resembles.

Local. Andreasberg in the Hartz, with the ores of arsenic and lead, also in the Pyrenees.

Obs. This is a very rare mineral, and perhaps, with the exception of the carbonate of barytes, which is also rare, the only instance, where nature has furnished, ready prepared, a violent poison in the mineral kingdom.

Species 3. SULPHURET OF ARSENIC.

Arsenic sulfuré, H. Sulphuret of Arsenic, P. C.

Of this species, there are two varieties, which differ chiefly in respect to color. They are both composed of metallic arsenic, and sulphur, though probably in different proportions.

Var. 1. RED SULPHURET OF ARSENIC.

Realgar Kirwan, P. Arsenic sulfuré rouge, H. Red Orpiment, J. Realger, P. C. Hemi Prismatic Sulphur, M.

Ext. Char.—Color, aurora red, scarlet, or blood red; occurs amorphous, in concretions, and in flakes, or crusts; also crystallized in the form of a four-sided prism, with the terminal planes set obliquely on the lateral planes, and in six-sided prisms, both forms being subject to a variety of modifications, from truncation, and bevelment; lustre shining, vitreous, or waxy; streak, lemon yellow; fracture of the compact, conchoidal; semi-transparent, or opake; soft; often yields to the nail; brittle; sp. gr. 3.30; becomes electric, by friction.

Chem. Char. Melts easily, and burns with a blue flame, and white smoke, attended with the odors of sulphur and garlic. In nitric acid it becomes whitish.

Comp. Arsenic 69; sulphur 31.—*Klaproth.*

Dist. Char. Its color resembles that of chromate of lead, but the chromate is much heavier, and tinges borax green. The red ores of silver and mercury give a red streak, and seldom give the odor of arsenic, like the present variety. They are also heavier than the present species.

Uses. It is employed as a paint, and the Chinese form vessels, and images of it.

Var. 2. YELLOW SULPHURET OF ARSENIC.

Arsenic sulfuré jaune, H. Orpiment, A. P. C. Yellow Orpiment or Prismatoidal Sulphur, J. Prismatoidal Sulphur, M.

Ext. Char.—Color, lemon, or golden yellow; occurs reniform, disseminated, and in plates; also, it is said, in minute crystals; lustre shining, sometimes brilliant, and metallic; structure foliated, or laminated, the laminæ often curved, and easily separable, like those of mica; flexible, but not elastic; translucent; by friction, acquires negative electricity; sp. gr. 3.4.

Chem. Char. Burns, emitting the fumes of sulphur and arsenic.

Comp. Arsenic 57; sulphur 43.—*Thenard.*

Dist. Char. It most resembles yellow mica, but the layers of mica are flexible and elastic; those of orpiment being easily broken. Mica also gives no fumes when heated. Native sulphur has not a foliated structure, like orpiment, and is not so heavy.

Uses. Orpiment is employed as a paint, but for this purpose it is mostly prepared by art.

Both varieties are found, chiefly in secondary, but sometimes in primitive rocks. Sometimes realger occurs among the products of volcanoes.

Local. Realgar is found in the Hartz, in the mines of Saxony, Bohemia, and Hungary, and on the North West coast of America. Also, among the volcanic matter of Etna, Vesuvius and Guadaloupe.

Orpiment is also found in Suabia, in Piedmont, at Moldavia in Hungary, in China and in Nova Scotia, in America.

Genus 19. COLUMBIUM.*

Columbium, in the purest state, in which it has been obtained, is a metal of a dark iron grey color, which when rubbed against a fine whetstone, or is scratched with a knife, puts on the metallic lustre. It scratches glass, is brittle, and is not acted on by any of the acids, or by any mixture of them: sp. gr. 6.

*From its being first discovered in America.

The ores of Columbium are few, and occur but rarely, and in small quantities.

Species 1. FERRUGINOUS OXIDE OF COLUMBIUM.

Tantale oxydé ferro-manganèsifere, H. Prismatic Tantalium-ore, M. J. Columbite, P. Ferruginous oxide of Columbium, C.

Ext. Char.—Colors, greyish, and brownish, or bluish black; occurs amorphous, and in small crystalline masses, the forms of which are imperfect, four, and six-sided prisms, sometimes flattened, and variously modified by truncation; structure imperfectly foliated; brittle; lustre a little shining, but not metallic; opake; sp. gr. 6 to 7.

Chem. Char. Infusible, and suffers no change by the blowpipe alone. Partly soluble in heated sulphuric acid, *(Mohs.)* If fused with potash, mixed with a little borax, the mass spreads on the charcoal, and passes from a brownish to a greenish color. With borax it dissolves with difficulty, and forms a bottle green glass.

Comp. (From New-London) Oxide of columbium 87; oxide of iron 21.—*Hatchett.*

(From Sweden) Oxide of columbium 85; oxide of iron 12; oxide of manganese 8.—*Vauquelin.*

Obs. Columbium was first discovered by Mr. Hatchett in a specimen of unexamined ore, said to have been sent from Gov. Winthrop, of Connecticut, to Sir Hans Sloane. It was deposited in the British Museum, and analysed by Mr. Hatchett in 1801, who found that it was the ore of a new metal, to which he gave the name of *Columbium* in honor of this country.

2. After the discovery of Mr. Hatchett, Mr. Ekeberg, a Swedish chemist, discovered the oxide of a new metal, in a specimen of ore, from Findland, and to which he gave the name of *Tantalum.* The ore itself he called *Tantalite.*

3. In the year 1809, Dr. Wollaston, having obtained specimens of the ores of the two new metals from America, and from Finland, discovered that they differed, only in respect to localities, and that they were ores of the same metal.

Local. Kemito, in Finland. Bodenmais, in Bavaria.

U. S. New-London and Haddam, *Ct.* At Haddam, it is embeded in granite, with garnet, chrysoberyl, and beryl.—*Silliman.* Warwick, *N. Y*—*Robinson.*

Species 2. ITTRIOUS OXIDE OF COLUMBIUM.

Tantale oxidé yttrifere, H. Yttro-Columbite, P. Yttro-Tantalite, J. M. Yttrious oxide of Columbium, C.

Ext. Char.—Colors, iron black, yellowish brown, and blackish brown; powder paler; occurs in grains, in small masses, and in thin plates; it is said also to occur in rhombic prisms; lustre shining, metallic; opake; scratches glass a little; sp gr. 5.8 to 5.3.

Var. 1. BLACK ITTRIOUS OXIDE OF COLUMBIUM.
Black Yttro-tantalite, M.

Ext. Char.—Color, black, occurs disseminated, and in grains, seldom of the size of a hazlenut; traces of crystallization indistinct; fracture lamellar, in one direction, and coarse granular, in another; lustre imperfect, metallic; opake; streak grey; brittle; scratches glass; sp. gr. 5.3.

Var. 2. YELLOW ITTRIOUS OXIDE OF COLUMBIUM.
Yellow Yttro-tantalite, M.

Ext. Char.—Color, yellowish brown, sometimes with green spots, or stripes; streak white; occurs between felspar, in a state of laminæ, seldom in grains, not exceeding the size of a pepper corn; longitudinal fracture foliated; cross fracture, fine grained; lustre resinous, on the surface, vitreous, on the fracture; no trace of crystallization; distinctly scratched by glass; sp. gr. 5.8.

Chem. Char. Infusible alone; with borax, both varieties are fusible into a yellowish glass. The black, froths and melts with soda, the yellow not. They are not acted upon by acids.

Comp. (Black) Oxide of columbium 57; ittria 20.25; lime 6.25; oxide of uranium 0.50; tungstic acid and tin 8.25; oxide of iron 3.50.—*Berzelius.*

(Yellow) oxide of columbium 59 50; ittria 24.90; lime 3.29; oxide of uranium 8 23; tungstic acid and tin, 1.25; oxide of iron, 2.72. *Berzelius.*

Local. These varieties are found at Ytterby in Sweden, imbedded in felspar. Also at Abo, and in Greenland.

Genus 20.—CERIUM.*

The characters of this substance, as a pure metal, are little known. The chemists have demonstrated, that such a metal exists, but its refractory nature is such, as to defy every means, heretofore used, to reduce it to the state of a pure metal.

Its ores are various, but most of them are rare, and have been found in only small quantities.

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* From the planet Ceres.

Species 1. SILICIOUS OXIDE OF CERIUM.

Cerium oxydé silicifère, H. Cerite, A. P. Indivisible Cerium-Ore, J. Uncleavable Cerium-Ore, M.

Ext. Char.—Colors, rose red, brownish red, and flesh red, passing into grey; streak nearly white; occurs massive, and disseminated; fracture compact; splintery; translucent, or opake; brittle; texture granular; lustre shining; scratches glass; yields with difficulty to the knife; sp. gr. 4.9.

Chem. Char. Infusible alone; with borax, dissolves into an orange colored globule, which grows pale on cooling.

Comp. Oxide of cerium 68.59; silex 18; oxide of iron 2; lime 1.25; water and carbonic acid 9.60.—*Hisinger.*

Local. Westmoreland, in Sweden, with bismuth, mica, hornblende and molybdena.

Species 2. ALLANITE.

Allanite,* *Thomson.* Allanite, J. A. P. C.

Ext. Char.—Colors, brownish, and greenish black; powder greenish grey; occurs massive, and crystallized in four, and six-sided prisms, variously terminated; fracture imperfect conchoidal; lustre shining resino-metallic; scratches glass, and gives sparks with steel; opake; sp. gr. 3.5 to 4.

Chem. Char. Becomes greenish yellow, and sometimes intumesces, and melts into a slag.

Comp. Oxide of cerium 33; oxide of iron 25.40; silex 35.40; lime 9.20; alumine 4.10—*Thomson.*

Dist. Char. It resembles gadonolite, but according to Bournon, gadonolite, in thin pieces, is translucent, and of a fine green color, while the present species is commonly opake, but when translucent, is of a yellowish brown color.

Local. West Greenland, in a granite rock.

Var. 1. ORTHITE.

Orthite, *Berzelius.* P. C.

Ext. Char.—Colors, ash grey, or brownish, from decomposition; occurs in long straight seams, or layers; texture impalpable; fracture conchoidal; lustre vitreous; streak, brownish grey; opake; scratches glass with difficulty; sp. gr. 3.28.

Chem. Char. Melts, with effervescence, into a black vescicular globule; with borax, into a transparent glass.

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* In honor of Thomas Allen, Esq. of Edinburgh.

Comp. Oxide of cerium 19.44; silex 32; lime 7.84; alumine 14.80; protoxide of iron 12.44; oxide of manganese 3.40; ittria 3.44; water 5.36.—*Berzelius.*

Local. Finbo, in Sweden, along with albite in a gneiss rock.

Species 3. ITTRIO-CALCAREOUS OXIDE OF CERIUM.

Yttro-cerite, J. P. C. M.

Ext. Char.—Colors, greyish white, greyish red, and violet blue; colors, sometimes mingled in the same specimen; occurs amorphous, and in crusts; texture granular; structure lamellar; lustre glistening; fracture uneven; yields to the knife; sp. gr. 3.44.

Chem. Char. Becomes white, but is infusible alone. On adding a little gypsum, it fuses into a bead, which becomes white on cooling. In fine powder, soluble in muriatic acid, forming a yellow solution.

Comp. Oxide of cerium 18.22; ittria 9.11; lime 47.63; fluoric acid 25.—*Berzelius.*

Local. Finbo, in Sweden, disseminated in quartz.

U. S. Franklin, *N. J.* discovered by Col. Gibbs.—*Silliman.*

Species 4. FLUATE OF CERIUM.

Fluate of Cerium, *Berzelius.* Fluate of Cerium, P. C. M.

Ext. Char.—Colors, yellow, pale red, or deep red; occurs in small masses, in plates, and in six-sided prisms; soft, some of the varieties, yielding to the nail.

Obs. This is not quite a pure fluate, but contains a little ittria, or thorina.

Var. 1. NEUTRAL FLUATE OF CERIUM.

Neutral Fluate of Cerium, P. C. M.

Ext. Char.—Color, reddish; occurs amorphous, in plates, and in six-sided prisms.

Chem. Char. Color, changes to brown, but does not fuse alone; with borax, and salt of phosphorus, gives a red or orange colored globule, which becomes pale on cooling.—*Mohs.* It corrodes glass when heated in it.

Comp. Fluate of protoxide of cerium 30.43; fluate of peroxide of cerium 68, with a trace of ittria.—*Berzelius.*

Var. 2. SUB-FLUATE OF CERIUM.

Sub-fluate of Cerium, *Berzelius.*

Ext. Char.—Color, yellow; occurs in small masses, with traces of a crystalline structure; resembles porcellanite.

Chem. Char. Behaves like the preceding variety, under the blowpipe, except that its color changes in cooling, from dark brown, to red, and orange.

Var. 3. FLUATE OF ITTRIA AND CERIUM.

Ext. Char.—Color, pale red, passing into deep red; occurs in masses, hardly exceeding the size of a pea; yields to the nail; fracture, and texture earthy.

Chem. Char. Corrodes glass, when heated in it; with borax and salt of phosphorus, forms a reddish, or yellowish bead.

Locat. These several varieties are found at Finbo, and Broddbo, in Sweden.

Obs. The varieties of fluate of cerium, have but lately been discovered, and their chemical characters not yet fully examined. For the above short descriptions, the public are indebted to Berzelius, the discoverer of this new species. They are at present very rare, having been found only in the above localities, and in small quantities.

Genus 21.—TITANIUM.

This metal has hardly been seen in its pure metallic state. Laugier, exposed its oxide, mixed with combustible matter, to the highest heat of a forge for six hours, when a mass full of pores was obtained. This he considered metallic titanium. It was brittle, with a bright lustre, and in thin pieces, elastic: sp. gr. unknown.

The ores of titanium, are considerably numerous, and are widely disseminated.

No use has yet been made of any of them.

Species 1. OXIDE OF TITANIUM.

Ext. Char.—Colors, red, reddish brown, yellowish red, and reddish grey; also, indigo blue, pale blue, and dark red; occurs massive, but more commonly, crystallized in octohedrons, or in prismatic crystals, imperfectly terminated; fracture granular, or uneven, in one direction, and laminated in another; texture foliated; lustre metallic, or adamantine; opake, or translucent; scratches glass; sp. gr. 3.8 to 4.24.

Chem. Char. Infusible alone; with borax, melts into a transparent globule, either reddish, or tinged of various colors, according to the proportion oi borax.

Comp. Titanium 66.05; oxygen 33.95.—*Rose.*

It is a pure oxide of titanium.

Var. 1. RED OXIDE OF TITANIUM.

Titane oxidé, H. Prismato-Pyramidal Titanium-Ore, J. Titanite, A. P. Red Oxide of Titanium, C. Peritomous Titanium-Ore, M.

Ext. Char.—Colors, red, reddish brown, or copper red, sometimes grey on the surface; occurs crystallized, in four, six, or eight-sided prisms, sometimes terminated by four-sided pyramids, and sometimes with rounded terminations; crystals often long, straight, acicular, and striated; also occurs, in minute, reticulated crystals; and in bent, or geniculated prisms; structure lamellar; lustre adamantine, or metallic; fracture conchoidal, or uneven; translucent; scratches glass; brittle; sp. gr. 4.24.

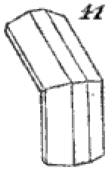

Fig. 42. A geniculated crystal, or two crystals united base to base, forming an obtuse angle or knee. In other respects, there is nothing peculiar in the prisms which this variety presents.

Chem. Char. Infusible by itself; with borax, melts into a reddish transparent glass.

Comp. It is a pure oxide of titanium.—*Klaproth.*

Dist. Char. It differs from the silico-calcareous oxide of titanium, in being more transparent, in occurring in more perfect crystals, and in being harder. It resembles the red garnet, but this is fusible alone. The oxide of tin has a greater specific gravity, and decrepitates strongly when heated.

Obs. 1. Titanium, in connection with some other substances, often forms very beautiful specimens.

2. The *reticulated* variety, composed of capillary or acicular crystals, is found investing, or penetrating other minerals. Sometimes it shoots through limpid pieces of quartz, the crystals crossing each other and forming a kind of net work; hence the name, *reticulated*. Such specimens, when polished, sometimes display the crystals of titanite, of the size of needles, or even hairs, of a blood red color, and appearing as though they were shot into their places, when the quartz was perfectly soft. Some of these specimens, are singularly curious and beautiful.

Titanite occurs chiefly in veins, in primitive rocks, and particularly in granite, gneiss, and quartz.

Local. St. Gothard, often reticulated in quartz. Tarentain, in spathose iron. Carpathian Mountains, in Hungary. Arendal, in Norway. Cairngorm, in Scotland. Fernbo, near Sahla, in Sweden.

U. S. Near Richmond, *Vir.* compact, blood red, in white quartz, —*Bruce.* Also in the Counties of Randolph, Amherst, Campbell, and Bedford, *Vir.* At some of these places, fine specimens are found, some of which are near four inches long.—*T. D. Porter.* Near Baltimore, *Md.* London Grove, Chester County, *Penn.* Also in Delaware County, and at East Marlborough. Bergen County, near Schuyler's copper mine, *N. J.* embedded in limestone. Its lustre is highly metallic.—*Bruce.* Near New Haven, and at Oxford, and Litchfield, *Conn.* At Oxford it is geniculated, and at Litchfield it is sometimes reticulated. Worthington, and Leyden, *Mass.* At Leyden, the crystals are four and eight-sided prisms. Near Kingsbridge, and on Hudson river, *N. Y.* color, from dark blood red to light red, sometimes geniculated, and sometimes acicular.—*Bruce.*

Var. 2. OCTOHEDRAL OXIDE OF TITANIUM.

Anatase, H. Pyramidal Titanium-Ore, J. M. Anatase. Octohedrite, P. Octohedral Oxide of Titanium, C.

Ext. Char.—Colors, various shades of brown, and blue; also reddish; by transmitted light, it is greenish yellow, or bluish; occurs crystallized, in small acute octohedrons, with equal and similar isoceles triangular faces; one of the forms may be considered, as two elongated pyramids, with square bases, joined base to base; crystals variously modified by truncation; structure lamellar; cleavage, parallel to the faces of the octohedron, and the common base of the two pyramids; opake, or translucent; lustre metallic adamantine; scratches glass; brittle; sp. gr. 3.8.

Chem. Char. Infusible by itself. With borax, it melts into a globule, the color of which, seems to depend on the proportion of borax, with which it is fused.

Dist. Char. It is harder than sulphuret of zinc, and softer than spindle.

Chem. Char. Like the preceding variety, it is nearly a pure oxide of titanium.

Obs. These two varieties have been hitherto arranged as separate species, but analysis seems to point out the propriety of placing them as varieties of each, since they differ little, except in color.

Local. Near Oisans, in Dauphiny, in veins of granite and gneiss. In New Castile. In Norway, and Brazil. It is a rare mineral.

Species 2. FERRUGINOUS OXIDE OF TITANIUM.

Titane oxydé ferrifere, H. Ferruginous Oxide of Titanium, C.

Ext. Char.—Colors, black, and brownish black; occurs in small grains, either rounded, or angular; structure lamellar; opake; brittle; lustre glistening, or dull; fracture foliated, in one direction, and conchoidal in the other; sometimes magnetic. It is also said to occur in prismatic crystals. Sp. gr. 4.27 to 4.67.

This species is divided into several varieties, which differ considerably in respect to their chemical characters.

Var. 1. NIGRINE.*

Nigrine, A. P. C.

Ext. Char.----Color, black, or brownish black; occurs in small loose, rounded, or angular masses; structure lamellar; cross fracture, flat conchoidal; lustre shining, adamantine; opake; brittle; not magnetic; sp. gr. 4.4.

Chem. Char. Infusible alone. With borax, melts into a translucent, hyacinth red globule.

Comp. Oxide of titanium 84; oxide of iron 14; oxide of manganese 2.—*Klaproth*

Dist. Char. Its want of magnetic power, will distinguish it from iron.

Local. In Ceylon, and in the Uralian mountains, in granite. Ohlapian, in Transylvania, it is found in alluvial earths, with garnets, and cyanite. It is a rare ore.

Var. 2. MENACCANITE.†

Titane oxydé ferrifere, H. Menachanite, J. A. P. C.

Ext. Char.----Color, greyish black, or iron black; occurs in very small angular grains. resembling gunpowder; structure imperfectly lamellar; fracture fine grained, uneven; lustre glistening, and metallic; yields to the knife; brittle; opake; attracts the magnet, feebly; sp. gr. about 4.

Chem. Char. Infusible alone. With borax, melts into a brownish green glass.

Comp. Oxide of titanium 45.25; oxide of iron 51; silex 3.5; oxide of manganese 0.25.—*Klaproth.*

Dist. Char. From the above variety, it may be known by the different color it gives borax, and from iron, by its weak magnetism.

Local. Near Menaccan, in Cornwall, aslo at Lanarth. Botany Bay, in New South Wales.

Var. 3. ISERENE.‡

Iserene, J. C. P.

Ext.Char.----Colors, iron black, and brownish black; occurs in angular grains and small rounded masses; structure lamellar in one direction; cross fracture, con-

* From its black color.

† Because, first found at Menaccan, in Cornwall.

‡ From its being founu at Iser, in Silesia.

choidal; lustre brilliant, semi-metallic; opake; hard; feebly magnetic.

Chem. Char. Fusible alone, into a blackish brown, magnetic glass.

Comp. Oxide of titanium 48; oxide of iron 48; oxide of uranium 4.—*Thomson.*

Dist. Char. Its fusibility, will distinguish it from the other two varieties, and its feeble magnetism, will show that it is not octohedral iron ore.

Local. Iser, in Silesia. At Aberdeenshire, in Scotland. Isle of Fetlar, among the Shetlands. On the banks of the Mersey, opposite Liverpool.

U. S. Near Richmond, *Vir.* East Marlborough, *Penn.* in calcareous spar. It is both massive, and in cylindrical crystals, terminated by four-sided pyramids.—*Jessup.* Sparta, *N. Y.*—*Cleveland.*

Species 3. SILICO-CALCAREOUS OXIDE OF TITANIUM.

Titane siliceo-calcaire, H. Prismatic Titanium-Ore, J. M. Sphene, A. P. Silico-Calcareous Oxide of Titanium, C.

Ext. Char.—Colors, reddish grey, lilac grey, chesnut brown, and blackish grey; colors dull; also greenish, yellowish green, and greenish white; occurs in masses, composed of angular prismatic pieces, with distinct joints, easily separable; and in crystals, of which the primary form is an oblique, rhombic prism; secondary forms, numerous; viz. an oblique anguled four-sided prism, with an uncertain number of terminal faces; sometimes this prism is bevelled on the lateral angles, and sometimes on the angles of the extremities; sometimes the crystals are compressed into cuneiform shapes, and sometimes by truncation they take nearly a hexahedral form; structure, foliated with broad, smooth faces; lustre shining, but scarcely metallic; cleavage easy; cross fracture, uneven; translucent on the edges; crystals seldom very distinct, but commonly grouped and compressed; scratches glass; does not yield to the knife; sp. gr. 3.50.

Chem. Char. In small fragments, it is fusible, with slight effervescence, into a dark colored enamel. The dark varieties, turn yellow before melting. With borax, it turns yellowish, and sinks to the lowest part of the globule, but scarcely dissolves.

Comp. Oxide of titanium 35; silex 35; lime 30—*Klaproth.*

Dist. Char. It differs from the red oxide of titanium, in color, and in crystalline form. The oxide of tin, has more of the metallic lustre, and is much heavier, than the present species. The brown garnet is much harder, and does not possess its laminated structure.

It occurs chiefly in primitive rocks, and is found in considerable quantities, at various localities. Sometimes it forms a part of the rock in which it is found.

Local, Passau, in Bavaria. Arendal, in Norway, where it is found with magnetic iron, epidote, hornblende, and augite. It also occurs in England, Scotland, France, &c.

U. S. Newton, Sussex County, *N. J.* in yellowish rhomboidal prisms. Also at Wantage. in the same County. Kingsbridge. On Staten Island. Near Peekskill. At Ticonderoga, and near Lake George, *N. Y.* Also at Cold Spring, *N. Y.* where it presents the rhomboidal prismatic form, and from whence magnificent specimens of a dark brown color, and presenting broad flat faces, of several inches in extent, are found. Noble specimens from this locality, are among the collection of Dr. Barrett, of Middletown, who was its discoverer. Petapsco Falls, *Md.* And also at Bare-Hills near Baltimore. Near the falls of Schuylkill, five miles from Philadelphia. Also at London Grove, in Chester County.

Species 4. CRICHTONITE.*

Crichtonite, J. P. C. M.

Ext. Char.—Color, velvet black; occurs in small crystals, in form of an acute rhomb, with the summits replaced, or otherwise modified; structure foliated; lustre shining; opake; cross fracture, conchoidal; scratches fluate of lime, but not glass.

Local. Oisans, in France, in a primitive rock.

Obs. It has not been analyzed. Mohs, has arranged it as an iron ore, and according to Berzelius, it affords the same results before the blowpipe as titaniferous iron. Phillips, however, affirms, that it is understood to be a compound of titanium, and silex—a silicate of titanium.

Genus 22.—TELLURIUM.†

When pure, this metal is greyish white, between the colors of zinc, and lead; texture laminated like antimony, which it also resembles, in some of its properties. It melts at a temperature, somewhat above 600 deg. Fah. sp. gr. 6.11; brittle, and easily reduced to powder. Under the blowpipe, it burns with a bluish, or greenish flame, and is volatalized, without the pungent odor, resembling that of horse radish, by which the native tellurium is distinguished. It is soluble in the acids.

Obs. It is found only in the native state, mixed, or alloyed with other metals.

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*In honor of Dr. Crichton.

† From the Latin, Tellus, the Earth.

Species 1. NATIVE TELLURIUM.

Tellure natif auro-ferrifere, H. Hexahedral Tellurium, J. Native Tellurium, A. P. C. M.

Ext. Char.—Color, tin white, passing into lead grey; occurs massive, and in minute crystals, which are commonly aggregated, or grouped; primary form, unknown, owing to the minuteness of the crystals; secondary forms, the octohedron, variously modified; also, occurs in crystalline grains, and plates; lustre, strongly metallic; structure foliated; yields to the knife; brittle; sp. gr. 5.7 to 6.11.

Chem. Char. Fusible, and volatile, with a dense white vapor. Emits the smell of horse radish, only when it is alloyed with selenium.

Comp. Tellurium 92.55; iron 7.20; gold 0.25 —*Klaproth.*

Dist. Char. It does not occur like native antimony, in broad foliated plates, neither is it as hard, or as heavy, as antimony. Its color will distinguish it from native bismuth.

Local. Freebay, in Transylvania, where it is found in a gangue of quartz and porphyry.

U. S. Huntington, in *Conn.* associated with ferrugineous oxide of tungsten, native bismuth, and native silver.—*Silliman.*

Var. 1. AURO-ARGENTIFEROUS NATIVE TELLURIUM.

Tellure natif auro-argentifere, H. Graphic Tellurium, J. A. P. Prismatic Antimony Glance, M. Auro-Argentiferous Native Tellurium, C.

Ext. Char.—Color, steel grey, sometimes approaching tin white; occurs crystallized in the form of four, or six-sided prisms, sometimes variously modified; lustre metallic; structure foliated; crystals very minute; fracture uneven; yields to the knife; sp. gr. 5.7.

Obs. The crystals of this variety are arranged so as to resemble written characters, hence the name *graphic tellurium.*

Chem. Char. Fusible into a grey globule, with the emission of white vapor, which covers the charcoal, and is an oxide of tellurium. Finally there remains on the charcoal a globule of malleable metal, which is an alloy of gold and silver.

Comp. Tellurium 60; gold 30; silver 10.—*Klaproth.*

Local. Offenbanya, in Transylvania, only, where it occurs with native gold, grey copper, and iron pyrites, in porphyry.

Obs. This is a valuable ore, and is worked for the gold and silver it contains.

Var. 2. AURO-PLUMBIFEROUS NATIVE TELLURIUM.

Tellure natif auro-plumbifere, H. Prismatic Black, and Yellow Tellurium, J. Black and Yellow Tellurium, A. P. Auro-Plumbiferous Native Tellurium, C.

Ext. Char.—Colors, silver white, passing into yellowish grey, lead grey, and iron black; occurs in small four-sided prisms, and in hexahedral tables, or plates; lustre, shining metallic; structure foliated; yields to the knife; sp. gr. 8 to 10.

Chem. Char. Fusible, with the escape of white fumes, leaving a metallic globule, composed of gold, silver and lead.

Comp. (Yellowish) Tellurium 44.75; gold 26.75; lead 19.5; silver 8.5; sulphur 0.5. (Blackish) Tellurium 32.2; gold 9; lead 54; copper 1.3; sulphur 3.—*Klaproth.*

It has been found only at Nagyag, in Transylvania, where it occurs with gold, native arsenic, manganese, and the other variety of this species.

Genus 23.----TUNGSTEN.

This metal has scarcely been reduced to its pure metallic state. In nature it is found highly oxyginated, and performing the office of an acid, forming the *tungstates* of iron and lime. It is also found in the state of an oxide. According to Joyce its sp. gr. is 17.15.

Species 1. OXIDE OF TUNGSTEN.

Oxide of Tungsten.—*Silliman.* Yellow oxide of Tungsten, C.

Ext. Char.—Color, various shades of yellow, as orange, or chrome yellow; occurs massive, and pulverulent; fracture of the massive, conchoidal, or small foliated; lustre adamantine; brittle; sp. gr. when pure, 6; has neither taste nor smell.

Chem. Char. Infusible, and insoluble in acids. Soluble in warm liquid ammonia, from whence it is precipitated, white, by acids, but becomes yellow by standing.

Local. It has been found only at Huntington, in *Conn.* in a gangue of quartz, at Lane's mine. It is associated with the other ores of tungsten, all the known varieties of which are found at the same locality.

Obs. This new ore of tungsten was discovered by Benj. Silliman, L.L.D. of N. Haven, and by him first described in his Journal of Science.

Species 2. TUNGSTATE OF IRON.

Scheelin ferrugine, H. Prismatic Wolfram, J. Wolfram, P. Ferruginous oxide of Tungsten, C. Prismatic Scheelium-ore, M.

Ext. Char.—Color, brownish black, or nearly black; occurs massive, and crystallized; primitive form, which it sometimes presents, the rectangular four-sided prism; modifications various; sometimes the crystals are terminated by truncated pyramids; sometimes the prism is so modified as to have ten sides; and sometimes, it is in broad six-sided pyramids, terminated by four-sided summits; structure foliated; lustre somewhat metallic; when massive, it presents the aspect of manganese, or masses of iron ore; yields to the knife; opake; very heavy; sp. gr. 7.15.

Chem. Char. Fusible, with difficulty, into a dark scoria; easily soluble in glass of borax.

Comp. Tungstic acid 78.77; protoxide of iron 18.32; protoxide of manganese 6.22; silex 1.25.—*Berzelius.*

Dist. Char. It resembles oxide of tin, but this, by the continued action of the blowpipe is reducible to the metallic state. It also resembles the carbonate, and oxide of iron, but these are magnetic, or become so when heated.

Local. It occurs in Cornwall, in all the tin mines; also, according to Mohs, in almost every one of the Saxon and Bohemian tin mines, and in Siberia.

U. S. Huntington, *Ct.* where it is found massive and in octohedral crystals.—*Silliman.*

Species 3. CALCAREOUS OXIDE OF TUNGSTEN.

Scheelin calcaire, H. Tungsten, A. P. Pyramidal Tungsten, J.—Pyramidial Scheelium Baryte, M. Calcareous oxide of Tungsten, C.

Ext. Char.—Colors, white, passing into yellowish grey, and reddish brown; occurs crystallized, and massive; primitive form, the acute octohedron; secondary forms, the octohedron, bounded by isosceles triangles; the cuniform octohedron, and the octohedron, variously modified by truncation; structure imperfectly foliated; lustre vitreous, or adamantine; translucent; yields to the knife; brittle; sp. gr. 5 to 6.

Chem. Char. Infusible, but decrepitates, and turns white and opake. By digestion with nitric acid, it forms a yellow powder, which is the peroxide of tungsten. With borax it forms a white transparent glass.

Comp. Tungstic acid 80.42; lime 19.40.—*Berzelius.*

Dist Char. It may be distinguished from the light varieties of the oxide of tin by the yellow powder, which it forms with nitric acid.—The carbonate of lead effervesces with acids, the tungstate of lime does not effervesce. The sulphate of barytes, is fusible, and is insoluble in acids.

This ore is found in primitive rocks only, and is associated with the ores of tin, tungstate of iron, hæmatite and arsenic.

Local. Oisans, in France, Cornwall, in England, Bitsberg in Sweden, &c.

U. S. Huntington, *Conn.* in a gangue of quartz, with the oxides of tungsten.

(For a particular account of the ores of tungsten as they occur in Huntington, see Silliman's Journal, vol. 1.)

Genus 24.—PALLADIUM.*

Color, greyish white, much resembling that of platina. It is ductile, without much elasticity, lustre metallic; structure fibrous, occurs native and alloying, native platina.

Species 1. NATIVE PALLADIUM.

Native Palladium.—*Wollaston.* Palladium, J. M. Native Palladium, P. C.

Ext. Char.—Color, steel grey, inclining to silver white; cccurs in grains, composed of diverging fibres; lustre metallic; sp. gr. 11.8 to 12.14.

Chem. Char. Infusible alone. but melts with sulphur, or with arsenic, into a brittle mass. With nitro-muriatic acid, it forms a deep red solution, from which it is precipitated in the metallic state by all the metals, except gold, silver and platina.

Dist. Char. The red solution, which it forms with aqua-regia, will distinguish it from all the metals which it resembles.

Genus 25.—IRIDIUM.†

Alloy of Iridium and Osmium.—*Wollaston.*

Color, greyish white, a little darker than platina; occurs in flattish grains, and according to Mohs, in six-sided prisms, with six-sided pyramids, combined in a parallel position, with two isosceles; lustre metallic; brittle; harder than platina; structure foliated; sp. gr. 19.5.

Chem. Char. Fusible with nitre, when it becomes black, but again acquires its original color if heated on charcoal. Not dissolved by aqua-regia, until after fusion with potash or soda.

Dist. Char. It resembles platina, but platina is malleable and soluble in aqua-regia.

Obs. 1. This metal is an alloy of iridium and osmium, and is found with native platina in South America.

2. Of *Osmium* little is known in its metallic state. Its oxide has

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*From the planet Pallas.

†From *iris* the rainbow, in allusion to the change of colors it gives while dissolving in acids.

been obtained by dissolving platina in nitro muriatic acid, and distilling the black powder which remains with nitre. It possesses some properties different from those of any other metal.

Rhodium. This metal, like those above named, has been but little examined. Its specific gravity is 11. It is infusible alone even by the oxy-hydrogen blowpipe. With arsenic it becomes easily fusible, and after long continued heat the arsenic is driven off, leaving the rhodium in a striated porous mass. It is soluble in the acids, but not malleable. The solutions do not crystallize, but when mixed with water, or alcohol, give a fine red color.

Genus 26—CADMIUM.

This metal has been obtained from some of the ores of zinc, in which it exists in small quantities. Its color is tin white, it is malleable and ductile, and bears a fine polish. By the blowpipe it readily inflames, and passes off in the form of a dense vapor, which when collected is found to be a brown oxide of the metal. Sp. gr. of the pure metal 8.6.

This metal was discovered a few years since, by Stromeyer.

Genus 27.—SELENIUM.

This metal was first noticed in some iron ore from Fahlun, by Berzelius. When pure it is of a deep brown color, with a metallic lustre. It fuses at 220 deg. Fah and if slowly cooled assumes a crystalline texture. When warmed, it becomes so soft as to be kneaded by the fingers, and may even be drawn out into threads. It sublimes before the blowpipe giving out a strong disagreeable odor, resembling that of horse radish. This odor is good test of the presence of selenium.

CLASS VII.

COMBUSTIBLE MINERALS.

The Minerals belonging to this Class, combine with oxygen, and undergo combustion, under ordinary circumstances, not requiring, like most of the metals, a high temperature, or the aid of pure oxygen, to effect their combustion. The Class includes substances widely differing from each other, in their external characters, and chemical properties. In general, their chief ingredients, are sulphur, and carbon.

Species 1. NATIVE SULPHUR.

Ext. Char.—Colors, yellow, passing into orange, greenish, or greyish; occurs in nodular masses, and in crystals; form, an acute pyramidal octohedron, with scalene triangular faces, and its varieties; fracture uneven, passing into splintery; translucent, or transparent; lustre shining, resinous; acquires negative electricity, by friction; gives the sulphureous odor, when rubbed; sp. gr. 2; refraction, double, through parallel faces.

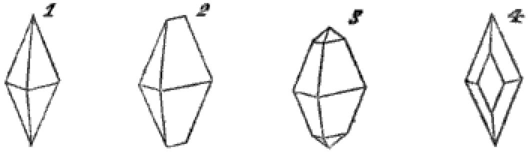


Fig. 1. The pyramidal octohedron, with scalene, triangular faces. This is the primitive form.

Fig. 2. The same, with the summits truncated.

Fig. 3. The same, with the summits replaced, by four triangular planes, forming a low pyramid.

Fig. 4. In this form, the solid angles are replaced, by rhombic planes.

Chem. Char. It burns with a bluish flame, giving out sulphureous acid gas, which has the property of bleaching vegetable substances.

It is found in veins, in primitive, and secondary rocks.

Local. Murcia, and Arragon, in Spain, where it occurs in splendid crystals, in a deposite of gypsum, and marle. Suabia, Hungary, and Peru, in mica-slate, and granite. Gibraltar, in swinestone.

U. S. At the coal mines, near Richmond, *Vir.* Chatham, *Conn.* of a greenish color, in masses, intermixed with quartz. Barren hill, Montgomery County, *Penn.* granular, or pulverulent, with reddish white quartz.—*Shaeffer.* In the waters of Clifton springs, Farmington, *N. Y.*—*Mitchell.* Also near West Point, in the cavities of a ferruginous granite rock.—*Douglass.*

Species 2. VOLCANIC SULPHUR.

Volcanic Sulphur, P.

Ext. Char.—Color, yellow, or yellowish red; occurs massive, investing, cellular, and in small crystals, of the same form as those of native sulphur. In its other characters, it agrees with native sulphur.

It is found in the fissures of lava, in volcanic countries.

Local. Iceland, Italy, Gaudaloupe, Nevis, Solfatara, and more or less, in almost every volcanic district.

Obs. Volcanic sulphur, probably owes it origin, to the decomposition of metallic sulphurets, by the heat of burning mountains. It is found lining the fissures of lava, and other volcanic products, being elevated from the depths below, by sublimation.

Perhaps the most remarkable deposit of volcanic sulphur, is that of Solfatara, near Naples, in a kind of sunken plain, surrounded by rocks, which is regarded as the crater of an ancient volcano; and from it, since the age of Pliny, has been obtained a considerable proportion of the sulphur used in Europe.—*Phillips.*

In the plain within the crater of Soltafara, smoke issues from many parts, as also from its sides; here, by means of stones, and tiles, heaped over the crevices, through which the smoke passes, they collect *sal ammoniac;* and from the sand of the plain, they extract *sulphur, and alum.*—*Hamilton.*

Species 3. DIAMOND.

Diamant, H. Diamond, P. C. Octohedral Diamond, J. M.

Ext. Char.—Colorless, or of a yellowish, bluish, yellowish green, clove brown, brownish black, Prussian blue, or rose red color; occurs crystallized, and in roundish grains, which often present indications of crystalline faces; form, the octohedron, with its varieties; faces often convex; structure perfectly lamellar, with cleavage parallel to all the planes of an octohedron; transparent, translucent, or opake; sp. gr. 3.5. It is the hardest of all known substances. Refraction simple.

Chem. Char. At a white heat, its combustion is slowly effected. When burned in oxygen gas, the combination forms carbonic acid gas, hence, its composition is pure carbon.

The secondary forms of the diamond, are very numerous. The following are among the most common.

5 6 7 8

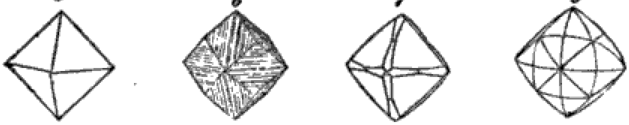


Fig. 5. The primitive form, a regular octohedron.

Fig. 6. This figure is intended to exhibit the laminated structure of the diamond, when cleaved.

Fig. 7. The octohedron, with the edges replaced by interrupted, narrow, convex surfaces. This is the most common truncated variety.

Fig. 8. The primitive octohedron, so modified, as to present forty-eight curvilinear faces, each face of the primitive, being divided, by elevated edges, into six smaller ones.

Obs. 1. The diamond is commonly found in alluvial deposites, or among the sand and pebbles of running streams. Little, or nothing, is therefore known of its geological situation, since in these cases, it has been removed from the place where it was originally formed. A specimen in the possession of Mr. Heuland, is said to be imbedded in a compact variety of iron ore, but this is by no means thought to be its original gangue.

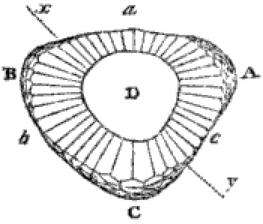
2. The mode of searching for diamonds, in Brazil, is described by Mawe. In that country, the diamond mines are the beds of certain rivers, which in the summer season, become dry. During this season, the gravel, or soil, which has been deposited by the heavy rains, is removed, and placed in heaps on the nearest plain. When the rain commences, and the water becomes abundant, the miners wash this soil in small conical bowls, until all the mud, and earthy particles, are carried off, and the gravel is entirely clean. It is then carefully searched for the diamonds, and particles of gold, both of which are at, or near, the bottom of the vessel.

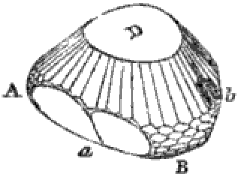
3. In India the diamond mines extend through a long tract of country, from Bengal to Cape Cormorin. The chief of these, are now, between Golconda, and Masulipatam, where the diamonds are found in beds of ferruginous sand or gravel. Fifty years ago, there were more than twenty places in the kingdom of Golconda, in which diamonds of different sizes were found, and fifty places were also wrought in the kingdom of Visapour. Many of these mines are now abandoned, there being none but small diamonds found in them. At present, the diamonds of Pastael, twenty miles from Golconda, at the foot of the Gate mountains, are most in request.—*Phillips.*

The following list contains all the known Diamonds, of remarkable size, existing.

1. The great diamond brought from India, and for which the India Company asked £30,000, was by far the largest in Europe, except the Pitt diamond, belonging to the French crown. Its weight

is 89 3-4 carats, and its worth at £80 the carat, would be £637,000. The following figures represent the size and shape of this diamond.





The upper figure, is a geometrical view of the diamond, from its upper face; the lower figure is a perspective view, taken in the direction of the dotted lines x. y. of the upper figure. The letters A, B, C, set against the angles of the figure, and, a. b. c. against the intermediate sides, respectively refer the same parts of the figure to each other. D, both in the geometrical, and perspective drawing, marks the upper, or flat face; and the inclined position of the latter, in the perspective view, indicates the direction of the plane.

Shaw's, Nature displayed.

2. One of the largest diamonds, hitherto known, is in the possession of the Rajah of Mattan, in the Island of Borneo, where it was found about a century since. It is shaped like an egg, with an indented hollow, near the smaller end. It is of the finest water, and weighs, 367 carats, or 2 oz. 169 grs. Troy.

For this diamond, the Governor of Batavia, offered the Rajah, one hundred and fifty thousand dollars, two large brigs of war, with their guns, and ammunition, and a certain number of great guns, and a quantity of ammunition besides. The Rajah, however, refused, partly, perhaps, because the stone was considered to possess miraculous powers, the water in which it was dipped, being an imaginary remedy, for all diseases. The fortune of his family, was also supposed to be connected with this stone.

3 The Queen of Portugal, was said to have possessed a diamond, weighing eleven ounces, which, according to the rule of estimating its value, at £80 the carat, would be worth, £224,000,000, sterling. This stone, is however, said to be a white topaz.—*Bingley.*

4. The Pitt Diamond, was brought from India, by George Pitt, Esq. and sold by him, to the Regent Duke of Orleans, for about £100,000 sterling. It is the same which was set in the hilt of Napolean's state sword.

5. The sceptre of the Emperor of Russia, is adorned with a diamond, about the size of a pigeon's egg. It had once been the eye of an eastern idol, and is said to have been stolen by a French grenadier, who contrived to become one of the priests of the idol, for this purpose. Count Orloff, bought it for Queen Catharine, fo £90,000 sterling, and an annuity of £4000 a year, during the life of the person who sold it.

6. A Diamond, in possession of the Great Mogul, is said to weigh about 280 carats, and is valued at £700,000 sterling. This diamond, in the rough, weighed, 793 carats.

7. The King of Portugal, possesses a Diamond, weighing, 215 carats.

The following, is a part of the inventory of the crown jewels of France, according to the estimate of a commission of jewellers, appointed by the National Assembly, in 1791.

	Weight, in carats.	Estimated at Dolls.
1. *Le Regent*, or the Pitt diamond,	136 14-15,	2,220,000.
2. Le Sancy, a translucent diamond, cut in facets,	33 11-16,	185,000.
3. A rich sky blue brilliant,	67 2-16,	555,000.
4. A pear-shaped diamond, of a peach blossom color,	24 13-10,	37,000.
5. The Mirror of Portugal,	21 2-16,	46,250.
6. A brilliant diamond,	26 12-16.	32,750.
7. A diamond, cut in facets,	28 1-16.	46,250.
8. A colorless brilliant,	14 14-16.	32,750.
9. A peach blossom brilliant,	14 12-16.	5,550.
10. A brownish brilliant,	13 8-16.	6,475.
11. A yellowish brilliant,	11 2-16.	1,850.
12. A wine colored brilliant,	18 9-16.	13,875.
13. Fifteen brilliants, weighing from 5 to 10 carats each,		154,105
14. 1631 small diamonds, weighing in all,	425.	14,287.
15. A pale blue brilliant,	31 12-16.	55,000.
16. An Epaulette, containing 9 larger, and 197 smaller brilliants,		8,695.

Obs. The above list will serve to show the immense disproportion there is, between the value of small, and large diamonds, and also, how their value is increased, or diminished, by transparency, and by color. Thus, number 8, is more than seven times as valuable as number 9, because it is colorless.

Rule for estimating the value of Diamonds.—Diamonds are valued by the *carat*. A carat is 4 grains. The estimate is made by squaring the number of carats, and multiplying the result, by the price of a single carat. Thus the price increases in a much greater proportion than the weight.

The price of a small rough diamond, fit for polishing, is £2, the carat. One weighing 2 carats, is worth, $2\times2=4\times2£.=8£.$ One of 4 carats, $4 \times 4 = 16 \times 2 = 32£$. One of 10 carats, $10 \times 10 = 100 \times 2 = 200£$.

The value of small diamonds, cut and polished, is from £6, to £8, the carat. One weighing 10 carats, or 40 grains, would therefore be worth, $10 \times 10 = 100 \times 6 = £600$, or $2,666,64, at £6 the carat. But some large, and beautiful diamonds, are valued at £80 the carat.

The first attempt to polish the diamond was made, by rubbing two against each other. In this way, after years of incessant labor, a diamond was polished. At the present time, diamonds are cut, with copper wire, coated with *diamond bort*, or dust, and polished on a wheel, with the same.

When cut and polished, diamonds are divided by jewellers, into *brilliant, rose, and table* diamonds, depending on the form and number of their artificial faces.

The colored varieties are seldom cut and polished for jewelry, but are powdered, for polishing the transparent variety.

When a diamond is perfectly colorless, and transparent, it is said to be of the *first water*.

Diamonds are set without a back, and when worn as head dresses, &c. are placed on black velvet.

Species 5. MINERAL CHARCOAL.

Mineral Charcoal, A. P. C.

Ext. Char.—Color, black, or greyish black; consists of charcoal, with various proportions of earth, and iron; but without bitumen; lustre glimmering; structure fibrous, with a texture like wood. It is a little heavier than common charcoal.

Chem. Char. Before the blowpipe, it is reduced to ashes, without either flame, or smoke.

It occurs in thin layers, in several formations of mineral coal. Sometimes, the two kinds are found attached to each other.

Species 5. CARBURET OF IRON. GRAPHITE.

Graphit, H. Graphite, C. Plumbago, P.

Ext. Char.—Color, steel grey, passing into iron black; occurs in amorphous, or reniform masses, or disseminated in other minerals; also, according to Phillips, in regular six-sided crystals, with striated summits; lustre glittering, metallic; fracture uneven, granular, or foliated; unctuous to the touch; soils the fingers; writes on paper or wood; opake; conducts electricity; sp. gr. 2.

Chem. Char. Before the blowpipe, slowly consumes, leaving a small portion of oxide of iron on the charcoal. With borax, it dissolves and coats the outside of the globule, metallic black.

Comp. Carbon 96; iron 4.—*Saussure.*

Dist. Char. It resembles sulphuret of molybdena, but is commonly less brilliant. The two minerals, are readily distinguished by the blowpipe, with borax. The graphite slowly dissolves, or separates into small particles, which incrust the surface of the borax. The molybdena adheres to the surface in distinct brilliant scales, not being in the least altered by the heat.

Obs. This mineral is very improperly called *black-lead,* from its resemblance to that metal.

It is found chiefly in primitive rocks.

Local. Bavaria, Germany, Piedmont, Calabria, Bohemia, Austria, England, &c.

One of the most remarkable repositories of graphite, is at Borrowdale, in Cumberland, *Eng.* where it forms a considerable mountain. From this place, a great proportion of that used in commerce is taken.

U. S. Cornwall, *Conn.* in considerable quantities.—*Brace.* Tolland, Sharon, and Hebron, *Conn.* Two miles from Holland meeting-house, *Mass.* Chester, and Mount Monadnock, *N. H.* Sutton, do. of a good quality.—*Cleveland.* Transylvania, Buck's County, *Vir.* in considerable quantity.—*Conrad.* From this graphite, good pencils have been made in New York.—*Cleveland.* Near Lake Champlain, near the city of New York, and near Lake George, *N. Y.* At the latter locality, it is sometimes found in masses weighing 12 pounds, and is very compact.—*Gibbs.*

Uses. The fine kinds of graphite are sawn into thin plates, one edge of which is then inserted into a groove, in a small semi-cylinder of cedar wood, which is then sawn off in a line with the wood, and the other half glued on. In this manner, the common black lead pencils are made. Crayons, are made by melting the refuse, or sawings, with sulphur, and then casting it into moulds. These are easily distinguished, when rubbed, or heated, by their sulphureous smell.

Graphite, is also used to form crucibles, which are much less liable to fail at high degrees of heat, than those made of clay and sand.

Species 6. ANTHRACITE.*

Anthracite, H. Glance Coal, J. Anthracite, Blind Coal, P. Anthracite, C. Non-Bituminous Mineral-Coal, M.

Ext. Char.—Color, greyish black; occurs massive, slaty, and columnar; lustre metallic; often presenting irised, or tarnished, splendid metallic colors, consisting of red, blue, and yellow, intermixed; easily frangible; sometimes soils the fingers; opake; sp. gr. 1.40 to 1.60.

Chem. Char. Before the blowpipe, it slowly disappears without flame, smoke, or smell. When burning in a wind furnace, the small quantity of water which it contains, is decomposed, and the hydrogen gives a feeble flame.

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* From the Greek; consisting of carbon.

Comp. From 72 to 95 per cent. of carbon ; the residue being oxide of iron, silex, and alumine.

Dist. Char. It resembles graphite, but its fracture presents a more shining and conchoidal surface. With borax, it floats on the surface without change, while the graphite, slowly dissolves and coats the surface. It is heavier than common mineral coal, which also gives out a bituminous odor before the blowpipe.

There are three varieties of anthracite.

Var. 1. *Slaty Anthracite.*—Structure imperfectly slaty in one direction, and in which, it may be cleaved into layers, of greater, or less thickness ; cross fracture conchoidal, or uneven ; lustre metallic.

Obs. This perhaps, is the most common variety of this species. A great proportion of the Rhode Island anthracite, is of this kind.

Var. 2. *Massive Anthracite.*—This variety agrees with the description of the species, with the addition of a compact texture, and a conchoidal or undulating fracture.

Obs. 1. The fracture often resembles that of glass, or obsidian, the point where it is struck, being surrounded by wave-like, undulations, like those produced by dropping a stone into a calm sheet of water.

2. The Lehigh coal, belongs to this variety.

Var. 3. *Columnar Anthracite.*—It occurs in the form of short prismatic concretions, sometimes perfectly plane and straight, sometimes curved ; color, iron black ; sometimes displaying the prismatic colors, soft, light, and brittle ; fracture flat conchoidal.

Anthracite, is found chiefly in primitive rocks, though sometimes in those of secondary formations.

Local. Near Allemont, in France, anthracite forms layers in a bed of black slate, at an elevation of about 7,500 feet above the level of the sea. In England, it is found in the coal formations of Walsal, in Staffordshire. In Scotland, at Carlton Hill, near Edinburgh, and in several other places. In Wales, there are several formations of anthracite. It also occurs in Holland, Norway, Switzerland, Savoy, Spain, &c.

Obs. In England, it is called *stone coal,* in Scotland, *blind coal,* and in Ireland, *Kilkenny coal.*

U. S The anthracite formation of Pennsylvania, is very extensive. From the northeast branch of the Susquehannah, it extends eastward about 30 miles, and westward from the same river, about 2 or 3 miles. It extends down the Susquehannah, to about 10 miles below Sunbury. The waters of the rivers Fishing, Lehigh, Muncey, and Schuylkill, pass through this formation. On the Schuylkill, it extends to about 20 miles above Reading. At Wilkesbarre, the anthracite appears at the surface, and there forms a bed, from 20 to 30 feet thick. Mines are worked at Wilkesbarre, and at the heads of the Lehigh, and Schuylkill rivers. "At Wilkesbarre, the price is 12 1-2 cents the bushel. At Philadelphia, it has been sold at 50 or 60 cents the bushel ; but by improvement in the navigation of the rivers, its price must be lowered to 25 or 30 cents.—*Cooper.*

This anthracite is of a jet black color, sometimes inclining to lead grey ; lustre shining, sometimes splendent, and semi-metallic ; not very brittle ; does not soil the hands ; specific gravity, about 1.60.

It burns without smoke or flame, and when once ignited, which is readily done with charcoal, it makes a very intense heat, and consumes so slowly, as to require replenishing, only 3 or 4 times in 24 hours.

The use of Lehigh coal, is strongly recommended by many practical mechanics, and particularly by Founders and Blacksmiths, Wire makers, &c.

From the certificate, of Messrs. *White & Hazard*, proprietors of a Wire Manufactory, and Rolling and Slitting Mill, near Philadelphia, it appears on actual experiment, that it takes only five bushels of this coal, to heat 10 cwt. of bar iron, for rolling, and that for this purpose, Lehigh coal at 90 cents the bushel, is as cheap as Virginia coal, at 2 1-2 cents the bushel.

From the certificate of Mr. David Hess, it appears that a peck of this coal, with a small proportion of charcoal, is sufficient to manufacture 8 gun barrels.

Mr. Smith, states in his certificate, that, "In forging twenty plough clevices, he used a *full heaped half bushel*, of this coal, weighing 45lbs. and that in making the same number of clevices with charcoal, he used *six bushels*, and took *two hours* more time."

Silliman's Journal, Vol. 4.

In Portsmouth, Rhode Island, reposes a bed of anthracite, which has been worked, more or less, for many years. Its color varies from lead grey, to greyish black; structure slaty; sometimes breaks into small rhomboidal fragments, the general surface of the fractured faces being uneven, or hackly. It soils the fingers, and is easily broken. Its specific gravity, according to Dr. Meade, is from 1 45 to 1.75; and its composition, about 94 per cent. of carbon, without any contamination from sulphur. The remainder appears to be chiefly iron, and silex.

According to the experiments, of Mr. Marcus Bull, of Philadelphia, the comparative value of the Rhode Island, and Lehigh anthracites, for fuel, is as 71 to 99.

Species 7. MINERAL OIL.

Mineral Oil, P.

There are two varieties of this species, viz. naptha, and petroleum.

Var. 1. NAPTHA.

Bitume lignide blanchâtre, H. Naptha, J. P. C.

Ext. Char.—Color, yellowish, or wine yellow; sometimes without color, and transparent; it exhales a strong bituminous odor, and burns with a blue flame, and much smoke, leaving no residuum. It swims on water. sp. gr. from 0.71 to 0.85. water being 1000.

Obs. It is exceedingly inflammable, and takes fire, even on the approach of flame.

Comp. Carbon 87.21; hydrogen 12.79.—*Saussure.*

Obs. 1. When distilled and made perfectly pure, it contains neither water, nor oxygen, in any other form.

2. Advantage was taken of this circumstance, by Sir Humphrey Davey, in order to preserve the new metals, potassium, and sodium, which are instantly decomposed by water, or any other substance containing oxygen, but are kept for any length of time, when covered with naptha.

3. Plutarch, in his life of Alexander, relates how astonished and delighted that monarch was, when at Ecbatana, the people laid a train of naptha through the street, and set it on fire.

4. Pliny and Galen suppose, that this was the substance, with which Medea destroyed Creusa, the daughter of Creon. She sent that unfortunate princess a robe, besmeared with a substance which burst into flames, as soon as she approached the altar, where incense was burning, and thus was miserably destroyed.

5. Beckmann, has related several instances where effects, considered magical, were produced by the extreme inflammability of this substance.

Local. Copious springs of naptha, occur on the Caspian sea. The earth in that vicinity, constantly exhales its vapor, and it is said that the inhabitants, by concentrating this vapor, and passing it through tubes, have perpetual lights, and that they cook their food by this kind of fire. It is collected by digging wells, a few yards deep. It is also found in Sicily, Dalmatia, Hungary, Siberia, &c. The streets of Genoa, are said to be lighted with it, instead of oil.—*Phillips.*

Var. 2. PETROLEUM.

Bitume liquide brun et noiratre, H. Petroleum, A P. C.

Ext. Char.—This is a black, bituminous semi-fluid, with a strong odor, especially when heated. It is very combustible, and burns with a copious, thick and black smoke, leaving a small quantity of coaly residue. By distillation, it yields a colorless fluid, which resembles naptha, in many of its properties, and probably does not differ materially from that substance.

It is found in many countries, particularly in the vicinity of coal formations.

Local. France, at several places. England. St. Catharine's Well, at Edinburgh. Bavaria. Switzerland. Near Parma, in Italy.

But it is most plentifully found in Asia. In the Birman Empire, in one neighborhood, there is 520 wells in full activity, into which petroleum flows from over coal formations. The quantity of petroleum, annually produced by them, amounts to more than 400,000 hogsheads. In that section of country, it is used instead of oil for lamps; mixed with earth, or ashes, it is used for fuel..—*Phillips.*

Obs. It is said that when naptha is exposed to the air, it becomes brown; thickens, and passes into petroleum. It has already been observed, that petroleum when distilled, yields a fluid much resembling naptha. It is most probable, therefore, that naptha becomes petroleum, after the loss of its more pure and volatile particles.

U. S. Robertson, enumerates 11 localities of petroleum in the United States. Only the most important can be mentioned.

Five miles from Scottsville, *Ken.* It is found on a spring of water, and sells at 25 cents the gallon.—*Jessup.* Seneca Lake, *N. Y.* It is called *Seneca oil*, and is collected in considerable quantitities.—*Cleveland.* Medina County, *Ohio*, and in several other places in that state.

Species 8. BITUMEN.

Bitume, H. Black Mineral Resin, J. Bitumen, P. C.

Of this species there are three varieties, viz. Earthy, Elastic, and Compact. In most of their properties they agree; but differ in their external characters.

Var. 1. EARTHY BITUMEN.

Earthy Pitch, J. Earthy Bitumen, P.

Ext. Char.—Color, blackish brown; fracture earthy, and uneven; soft enough to take an impression from the nail. It burns with a clear brisk flame, emits an agreeable odor, and leaves much soot. It appears to consist of inflammable matter, mingled with a considerable proportion of earthy substances.----*Phillips.*

Local. Persia, where it is collected with great care and sent to the king as a remedy for wounds. Also, in France, England, and in the Hartz.

Var. 2 ELASTIC BITUMEN.

Bitume elastique, H. Elastic Bitumen, P. C.

Ext. Char.—Color, black or brownish black; soft; yields easily to pressure, and is flexible, and elastic, like India rubber; burns easily and rapidly, with a thick black smoke, and strongly bituminous odor. In a gentle heat it melts, loses its elasticity, and is converted into a substance, like petroleum, or asphaltum.

Obs. It effaces the marks of a lead pencil, like India rubber, and has hence been called *mineral caoutchouc.*

Local. Odin mine, Derbyshire, *Eng.*

Var. 3. COMPACT BITUMEN. ASPHALTUM.

Bitume solide, H. Compact Bitumen, P.

Ext. Char.----Color, jet black, black, or brownish black; occurs massive; fracture conchoidal; lustre shining, resinous; opake; very brittle; when rubbed, or heated, gives out a bituminous odor, like that of naptha; when burned, it leaves a small quantity of ashes.

Comp. It consists chiefly, according to Phillips, of bituminous oil, hydrogen gas, and carbon, but often contains a little oxide of iron, and earth.

Local. Lake Asphaltites, or the Dead Sea, in Judea. Barbadoes, and Trinidad, in the West Indies. Cape St. Antoine, in Cuba. Neufchatel, in Switzerland. Cornwall, in England.

Obs. At Trinidad, there is a lake covered with asphaltum, three miles in circumference. It is divided by cracks, or fissures, of unknown depth, filled with fresh water, and containing several species of fish. Sometimes it contains pieces of unaltered wood, showing that it was once soft; indeed, in one part of the lake, the petroleum is fluid at the present day. In general, it may be easily cut, and its interior is oily and vesicular. When mixed with oil, tallow, or tar, it acquires fluidity, and is used as pitch.—*Nugent.*

Uses. The ancients employed this substance as a cement in building. It is the opinion of historians, that the bricks of the walls of Babylon were cemented with asphaltum. The Egyptians, are said to have made use of it, as an ingredient in the process of embalming. At the present time, it is used in the composition of a particular kind of paint, and when mixed with tar or oil, it is used instead of pitch, for coating the bottoms of vessels.

Species 9. MINERAL COAL.

Houille, H. Black Coal, J. A. P. Coal, C.

Ext. Char.—Color, black, or brownish black; occurs massive, and slaty; lustre shining, often with an irridescent tarnish, and pseudo-metallic lustre, which is sometimes, very beautiful; fracture, large conchoidal, or uneven; yields to the knife, but not to the nail; easily broken; opake; sp. gr. about 1.30.

Chem. Char. Most varieties of coal burn easily, and with more or less flame. When submitted to distillation, they yield, carburetted hydrogen, a bituminous oil, a quantity of mineral tar, and a portion of ammonia.

Comp. From 97 to 40 per cent. of carbon; from 47 to 9 per cent. of volatile matter, and from 3 to 13 per cent. of ashes.

There are several varieties of this species, depending chiefly on color and purity.

Var. 1. BLACK COAL.

Black Coal. Coarse Coal, P. Coarse Coal, J. C.

Ext. Char.—Color, black, often with an irridescent tarnish; occurs massive; fracture in one, and sometimes in two directions, slaty; fragments, after cleavage, rhombic, or cubic; cross fracture, imperfectly conchoidal, or uneven; sometimes contains layers of mineral carbon; sp. gr. 1.45.

Chem. Char. Burns with a bright flame, and much smoke, but does not swell and agglutinate.

Comp. Carbon 75.28; hydrogen 4.18; azote 15.96; oxygen 4.58, —*Thomson.*

Obs. This is the most abundant, and common of all the varieties of coal, and is the principal fuel of many countries, particularly of England.

Var. 2. CANNEL* COAL.

Houille compacte, H. Cannel Coal, J. P. C. Candle Coal, A.

Ext. Char.—Color, black; texture compact; fracture, large conchoidal; lustre glistening, and resinous; hard, and brittle; bears a fine polish; sp. gr. 1.23 to 1.27.

Comp. Carbon 75.2; bitumen 21.68; ashes 3.12.—*Kirwan.*

Obs. It decrepitates, when first heated, and burns without softening, with a bright flame, and rather pleasant odor.

It is sometimes worked into ink-stands, snuff-boxes, toys, &c.

Local. Wigan, and Whitehaven, *Eng.* Gilmerton, and other places, in Scotland.

Obs. 1. Coal is found chiefly among secondary rocks, where it occurs in beds of various extent and thickness.

2. In many instances, these beds lie one over another, with earth interposed between them. At Whitehaven, in England, 20 distinct beds have been explored, lying one above the other. Near Liege, there are 60 beds, occurring in the same manner.

3. It is a general observation, that the layers of slate, which form the roofs of coal beds, bear impressions of vegetables, and particularly of ferns.

4. Coal, is sometimes found in highly elevated situations. According to Brongniart, it occurs on the Cordilleras, in South America, at the height of more than 13,000 feet above the level of the sea.

5. The deepest coal mines, are said to be those of Namar, one of which is 2,400 feet deep.—*Pinkerton.*

6. Coal mines are subject to spontaneous combustion, probably in consequence of the decomposition of the pyrites, which some coal beds contain in abundance. Some mines are known to have been on fire for years, and then to have ceased burning.

7. Heaps of coal, when large, and exposed to a small quantity of moisture, are subject to the same accident.

8. The coal mine at Whitehaven, England, is 1200 feet deep, and extends more than 5,000 feet under the sea.

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* *Cannel,* is a corruption of *candle.* It is sometimes used to give light, instead of candles.

The United States, contain many coal formations, which have been explored, more or less, extensively.

In *Virginia*, at least 25 shafts have been sunk for the raising of coal, within an extent of 70 miles. At Heth's mine, according to *Grammer*, the bed of coal is 50 feet thick, and one of the shafts is 350 feet deep. The strata which cover the coal are sandstone, and argillaceous slate, often exhibiting vegetable impressions. Pure charcoal, says the same writer, in the form of sticks or logs, is frequently associated with the coal.

In *Ohio*, coal is found in different parts of the state. In some cases, three successive beds are found, separated from each other, by argillaceous slate, bearing vegetable impressions. The bed nearest the surface, according to Atwater, burns well, agglutinates, and leaves only a small residuum ; that of the second bed, is coarse, burns with a flame less bright, and leaves a greater residuum ; while that of the third bed, though much more abundant, is inferior in quality.

In *Pennsylvania*, the country watered by the western branch of the Susquehannah, is chiefly a coal formation. Indeed, coal, in greater or less quantities, is supposed to underlay about one third of this state. At Pittsburg, where it is found on, or near the surface, it is pretty extensively explored, as an article of fuel.

In *Connecticut*, a coal formation, commencing at New Haven, crosses Connecticut river at Middletown, and embracing a width of several miles on each side of the river, extends to some distance above Northampton, in Massachusetts.—*Silliman.*

Within the above described tract of country, coal has been found at Durham, Middletown, Chatham, Hartford, Farmington, Windsor, Enfield, and South Hadley. The quantities found, have been small, and have occurred, sometimes in veins, between strata of clayslate, and sometimes in detached pieces. That of Windsor, is a vein in clayslate, and is about an inch thick at the surface. A small quantity found in Farmington, is very full of bitumen, and burns with a bright blaze, and black smoke.

Origin of Coal.—All naturalists, says Jameson, are now agreed, that the greater part of coal is derived from vegetables, which have been altered by certain natural operations, hitherto but imperfectly known.

It often happens, that charcoal is found with perfect mineral coal. In some instances, one side of a specimen, will be mineral coal, and the other side, charcoal. In several coal mines, the remains of trees, either petrified, or partly penetrated with bituminous matter, have been discovered. Indeed, most of the phenomena observed, on a close examination of this subject, indicate the vegetable origin of coal.

Species 10. LIGNITE.

Lignite, W. C. Brown Coal, P.

Ext. Char.----Color, brown, or brownish black; occurs massive; structure woody; burns with a weak flame, and the odor of peat. The compact varieties, are black, with a resinous lustre, and imperfectly conchoidal, or uneven fracture. The less compact kinds, are brown, and without lustre.

Chem. Char. It burns with flame, but does not swell and agglutinate like coal. The odor is not bituminous, but like that of decayed vegetation, and similar to that of peat

Comp. Carbon 45; water 30; oily bitumen 10; gases 15. There is, however, much difference in the composition of the several varieties.

Obs. The external characters of lignite, together with its chemical properties, evince that it is of vegetable origin. Indeed, the branches of trees, but little changed, are sometimes found among it.

Lignite, admits of the following varieties.

Var. 1. BRITTLE LIGNITE.

Moor Coal, J. P. Brittle Lignite, C.

Ext. Char.----Color, brownish black; occurs massive; surface always cracked; easily broken into cubic pieces; structure ligneous.

Chem. Char. It burns easily, but emits a very disagreeable odor. Smiths cannot use it, in their forges.

Obs. It is found in sand beds, and argillaceous marl. By exposure to the air, it falls in pieces.

Local. France, and Bohemia.

Var. 2. FIBROUS LIGNITE.

Bituminous Wood, J. C.

Ext. Char.----Color, brown, or clove brown; texture and form, that of wood; longitudinal fracture, fibrous; cross fracture, uneven, displaying the annual circles of the tree; opake; brittle, friable, and light.

Obs. It is easier to break, than wood; under the knife, it assumes a kind of lustre.—*Brongniart.*

Local. Bovey, in England. Iceland. Munden, in Hanover. Near Paris. Abundant in the Amber mines of Prussia.

Obs. 1. At Bovey, Brongniart says, there are 17 thick beds of lignite, which are at the depth of about 66 feet.

2. It is very abundant in Iceland. In many instances, the trunks of the trees are perfect, being merely compressed into an oval shape.

3. This variety passes by imperceptible degrees, into those, which are more distinctly carbonaceous. In many instances, the several varieties are found together, and sometimes the same specimen will show the brittle and fibrous varieties

4. The coal, says Shaw, in the centre of the lowest bed, is of a black color, nearly as heavy as pit coal, makes a strong and durable fire, and is in all respects, a perfect mineral coal. The other beds

are more of a chocolate color, not so heavy, and with more of the appearance of wood, consisting of pieces which lie crossing each other, in all directions. Some pieces are found, which have the knots of wood in them, in one part, while another portion of the same piece, is converted into perfect mineral coal. So that nature in this instance, is seen in the very act of forming mineral coal, from vegetable matter.—*Shaw's Nature Displayed, Vol.* 2.

5. At Cape Sable, *Md.* there is a bed of lignite, from 3 1-2 to 4 feet thick, composed of jet, brittle lignite, bituminous wood, and brown lignite.—*Troost.*

Var. 3. EARTHY LIGNITE.

Earth Coal, J. Earthy Lignite, C.

Ext. Char.—Color, black, or brownish black; occurs massive; fracture, and aspect, earthy; texture fine grained; smooth to the touch; somewhat friable; when burned, emits a disagreeable odor. It is nearly as light as water.

Local. Near Cologne. Hessia. Bohemia, Saxony, Iceland, &c.

Obs 1. It forms very extensive beds in the environs of Cologne, where it is covered with a bed of pebbles, of quartz, and jasper, and embraces trunks of trees, of a black, or reddish color, and compressed into an oval shape.—*Cleveland.*

2. This lignite is used as fuel; also for painting in distemper, and oil. The Dutch use it to adulterate their snuff, which is said to give it a much esteemed fineness, and softness.

3 Faujues observes, that the trunks of trees, which are found in beds of lignite, are always deprived of their branches, hence he concludes that they have been conveyed by the ocean.

4. The same author relates, that nuts which now belong only to Hindostan, and China, together with a kind of frankincense, are found in the bed at Cologne.—*See Pinkerton's Petrology.*

5. Authors agree, that lignite is an entirely different formation from that of coal, and that it is in fact, a deposit of wood, which has been covered by earth, and in consequence, undergone a change by which it only approximates to coal. It is, however, most probable, that in time, it will be completely mineralized and converted into coal.

Species 11. JET.

Jayet, H. Pitch Coal, J. Jet, P. C.

Ext. Char.—Color, jet, or pitch black; occurs in masses, or thin layers; texture compact; fracture conchoidal, and undulated; lustre shining; perfectly opake; sometimes the texture is ligneous, and the specimen is in the form of the branch of a tree. It becomes weakly electric by friction; sp. gr. 1.25.

Chem. Char. It burns with a greenish flame, and emits a strong bituminous smell.

It is found with coal, of the newest formation, and sometimes with lignite, and amber.

Local. Various places in England. Aude, in France. Various places in Germany. Silesia, Hessia, Italy, Spain, and Prussia.

Obs. Brongniart says, that jet, proper to be worked, is found in masses, the weight of which seldom exceeds 50 pounds.

Uses. It bears a fine polish, and is worked into trinkets, and mourning ornaments. In France, in the Department of Aude, 1200 persons are employed in fabricating the jet, which is found there, into rosaries, buttons, ear-rings, snuff-boxes, bracelets, &c.—*Journal des Mines.*

Species 12. DYSODILE.

Dysodile, *Cordier*. Dysodile, P. C.

Ext. Char.—Color, greenish grey, or yellowish; occurs massive; structure compact, or laminated, sometimes both; extremely fragile; gives an argillaceous odor, when breathed on; sp. gr. 1.146.

Chem. Char. It burns with flame, and gives an insupportably fetid odor, leaving a residue of about one half its weight. Macerated in water, it becomes translucent, and its laminæ, flexible.

Local. Near Syracuse, in Sicily, in secondary limestone.

Species 13. AMBER.

Succin, H. Amber, A. P. C.

Ext. Char.—Colors, wine yellow, greenish, or yellowish white, or reddish brown; occurs in nodules, or roundish masses, of various sizes, from grains, to that of a man's head; texture compact; transparent, or translucent; fracture perfectly conchoidal; lustre resinous; becomes strongly electric by friction; bears a high polish.

Chem. Char. It burns silently, and with little smoke. While burning, it emits a bituminous odor, which is not unpleasant. Soluble in oils, when gently heated.

Dist. Char. It resembles copal, but this, while burning, crackles, and emits an aromatic resinous odor; while amber burns silently, and emits an odor, distinctly bituminous.

Local. Greenland. Moravia. Poland. France. Prussia.

Obs. It is found among sand and gravel, accompanied with lignite, bitumine and jet.

2. In Prussia, a mine of amber is explored to the depth of more than 100 feet. Under a stratum of sand and clay 20 feet thick, there succeeds a stratum of trees 40 or 50 feet thick. The wood is partly decomposed, and is impregnated with pyrites and bitumen, and is of

a blackish brown color. Under the stratum of trees, and sometimes attached to them, the amber is found; it is most probable therefore that it has proceeded from the vegetable juices.—*Phillips.*

The amber pits of Prussia, are said to afford the King, a revenue of 26,000 dollars, annually.—*Parkes.*

U. S. At Cape Sable, in Ann-Arundel County, *Md.* It occurs in a bed of lignite, and is found in grains, or masses, sometimes 4 or 5 inches in diameter.—*Troost. Cleveland.* Near Trenton, *N. J.* and Camden, opposite to Philadelphia. At the latter place, a transparent specimen was found, several inches in diameter.—*Woodbridge.* That found near Trenton, occurs in small grains, and rests on lignite, or carbonated wood, or even penetrates it.

Uses. It is cut into articles of ornament and dress, as ear rings, bracelets, beads, amulets, &c. It bears a high polish, and was anciently considered the most precious of jewels. The greatest quantity at present is purchased by the Armenian, and Grecian merchants.—*Jameson.*

Obs. It often contains insects of various species, in a state of complete preservation. These are sometimes introduced by art, in order to increase the value of the specimen.

2. There is no doubt but *gum copal* is often sold for amber, as when cut and polished, the pale varieties of amber cannot easily be distinguished from copal. By attending attentively to the distinctive characters above pointed out, the two substances may readily be distinguished.

Species 13. HATCHETINE.*

Hatchetine, *Conybeare.* Hatchetine, C. M.

Ext. Char.—Colors, yellowish white, wax yellow, or greenish yellow; occurs in flakes like spermaceti, or in grains, like broken bees-wax; lustre of the flaky kind, pearly; of the granular, dull, and opake; possesses neither odor, nor elasticity; hardness, equal to soft tallow; melts in hot water, below 170 deg.; very light; soluble in ether.

Chem. Char. When distilled over the naked flame of the spirit lamp, it assumes the bituminous smell, and yields a butyraceous substance, of a greenish yellow color.

Local. South Wales; where it is found in small veins, in ironstone.

Obs. Its discover, the Rev. Mr. Conybeare, considers it a new substance, and as distinct from petroleum, or elastic bitumen.

Species 14. MELLITE. HONEY-STONE.†

Ext. Char.—Color, various shades of honey yellow; occurs granular, and crystallized in the form of an ob-

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* After Chas. Hatchett, F. R. S.

† In allusion to its color.

tuse octohedron, of which the common base of the two pyramids is square; cleavage parallel to all the planes of the octohedron; surface, not brilliant; cross fracture, conchoidal; translucent; softer than amber; sp. gr. 1.6.

Chem. Char. Before the blowpipe, it becomes opake and white, with black spots, and is finally reduced to ashes. When burned in the open air, neither smoke, nor flame is observed, and it acquires an appearance like chalk.

Comp. Mellitic acid and water 84; alumine 16.—*Klaproth.*

Local.—District of Saol, Switzerland, only, in bituminous wood.

Species 15. RETINASPHALT.

Retinasphalt, *Hatchett.*

Ext. Char.—Color, brownish yellow; occurs in irregular opake masses; lustre glistening; fracture imperfectly conchoidal; brittle, and soft; a little heavier than water.

Chem Char. When placed on hot iron, it melts, smokes, and burns with a bright flame, giving out a fragrant odor.—*Phillips.*

Comp. Resin 55; asphaltum 42; earth 3.—*Hatchett.*

Local. Bowery Tracy, in Devonshire, adhering to brown coal, in layers about a line in thickness.

Species 16. FOSSIL COPAL.

Fossil Copal, P. Highgate Resin, A.

Ext. Char.—Color, yellowish, or brownish; occurs in irregular pieces; somewhat translucent; lustre resinous; brittle; yields easily to the knife; sp. gr. 1.046.

Chem. Char. Melts into a limpid fluid; burns with a clear yellow flame and much smoke, like other resins.

Local. Highgate Hill, near London, in a bed of blue clay. Also Wolchow, in Moravia.

APPENDIX.

Some of the following named minerals, are new, and their characters doubtful; others are imperfectly described; others have not been analyzed, and others came to the knowledge of the writer, too late to be inserted in their proper places.

Species 1. ARFWEDSONITE.

Arfvedsonite,—*Brooke*, M. Arfwedsonite, P.

Ext. Char.—Color, black, without any perceptible shade of green; occurs in crystalline shapes, but not in regular crystals; cleavage parallel to the planes of a rhombic prism, an angle of which, measures 123 deg. 55 min.; planes of cleavage, brilliant; not so hard as hornblende.

Chem. Char. Fusible with ease, into a black globule; with borax, gives a glass, colored by iron; with salt of phosphorus, a globule, which becomes colorless on cooling, leaving a skeleton of silex on the charcoal.

Dist. Char. It differs from hornblende, in being a pure black, instead of greenish; and also in the quantity of its angles. On these accounts, it has separated from hornblende, of which it was considered a variety.

Local. Greenland, where it is associated with sodalite, and hornblende.

Species 2. BABINGTONITE.

Babingtonite,—*Levy*, Ann. Phil. vol. XL.

Ext. Char.—Color, black, often greenish; occurs in short, eight-sided prismatic crystals; cleavage distinct in two directions; fracture, imperfect conchoidal; translucent, or in larger crystals, opake; hardness, nearly that of felspar.

Comp. Silex, iron, manganese, and lime, with a trace of titanium. —*Children.*

It occurs at Arendal, in Norway, in small crystals, disposed on the surface of crystals of albite.

Species 3. BARYTO-CALCITE.

Baryto-Calcite,—*Brooke*, Ann. Phil. Vol. XLIV. Hemi-prismatic Hal-Baryte, M.

Ext. Char.—Colors, white, greyish, yellowish, or greenish; occurs massive, and in eight-sided prismatic crystals, terminated obtusely; cleavage, more or less perfect, in two directions; fracture uneven, imperfect conchoidal; certain faces of the cleavage, striated; lustre, vitreous, inclining to resinous; translucent, or transparent; yields to the knife; sp gr. 3.66.

Chem. Char. Infusible alone; with borax, gives a clear glass.

Comp. Carbonate of barytes 65.9; carbonate of lime 33.6.—*Children.*

Local. It is found at Marston-Moor, in Cumberland, *Eng.*

Species 4. BERGMANITE.

Bergmanite, J C. M.

Ext. Char.—Color, several tints of grey, passing into white, and brick red; occurs massive; fracture uneven; texture fine grained; lustre pearly; appears like a mixture of several earthy substances; scratches glass, and even quartz; sp. gr. 2.3.

Chem Char. Becomes white, and melts without effervescence into a colorless glass.

Local. Near Stavern, in Norway, with felspar, and quartz.

Obs. It is considered a variety of Wernerite.

Species 5. BLOEDITE.

Bloedite, M.

Ext.Char.—Color, between flesh red, and brick red; occurs massive; structure thin columnar; fracture uneven, splintery; translucent; becomes white, and opake, by decomposition; lustre faintly vitreous; soft.

Comp. Sulphate of manganese 36.66; sulphate of Soda 33.34; protosulphate of manganese 0.33; muriate of soda 22; water 0.34. —*John.*

Local. Upper Austria, with gypsum, and polyhalite.

Species 6. BREWSTERITE.

Brewsterite,—*Brooke.* P. Kouphone-Spar, M.

Ext. Char.—Color, white, inclining to grey, and yellow; occurs in small prismatic crystals, generally terminated by two planes; cleavage, perfect in one direction, and imperfect in another; translucent, transparent; lustre vitreous, or pearly; yields to the knife; sp. gr. 2.12 to 2.20.

Chem. Char. Loses its water—becomes opake, then froths, and swells, but does not melt.

Local. It is found in crystals, and crystalline coats, at Strontian, in Scotland.

Obs. It was formerly considered, as a variety of apophylite.

Species 7. BROOKITE.

Brookite.—*Levy*. Ann. Phil. Feb. 1825.

Ext. Char.—Color, hair brown, passing into deep orange yellow; streak yellowish white; occurs in short prismatic crystals; lustre adamantine; brittle; yields to the knife.

Obs. It contains titanium, but has not been analyzed. Fine crystals of this substance, have lately been found at Snowdon, in Wales.

Species 8. BUCRLANDITE—*Levy*. Ann. Phil. Feb. 1824.

Bucklandite, M.

Ext. Char.—Color, dark brown, approaching black; occurs in six-sided prismatic crystals, terminated by two principal faces; cleavage not observable; opake; scratches glass; resembles augite.

Local. Near Arendal in Norway, with felspar, and carbonate of lime.

Species 9. BROCHANTITE.

Brochantite.—*Levy*. Ann. Phil. Oct. 1824. Brochanite, M.

Ext. Char.—Color, emerald green; occurs in hexahedral prisms, with modified pyramidal terminations; one face of the pyramid, blackish and dull, the others, smooth and shining; traces of cleavage, parallel to the dull face; transparent; yields easily to the knife.

Comp. According to the experiments of Mr. Children, it consists of sulphuric acid, and oxide of copper, with, perhaps, a quantity of alumine, or silex. It is insoluble in water.

Species 10. CHIASTOLITE* MACLE.

Chiastolite, J. A. P. Macle, H.

Ext. Char.—Colors, of the exterior, white, greyish, or yellowish white; of the interior, black, or bluish black; occurs in crystals only; form, four-sided prisms, which appear square, but are slightly rhombic; each crystal, when broken across, exhibits another crystal, running through its axis, whose sides correspond with those of the exterior; sometimes, from the

* From the Greek, in allusion to the form of X, on the end of the crystals.

angles of the inner crystal, there runs a small black, or bluish line, which reaches the corresponding angle of the outer crystal, or crust, thus forming four lines of the color of the inner square, reaching to each corner of the outer one, and dividing it diagonally into four parts. In some crystals, at each corner, and just under the surface of the external rhomb, there is also a small black crystal, which is joined by the line running from the central square, or rhomb; so that the crystal consists of five rhombic prisms, of a black color, one in the middle, and one at each corner, embedded in a greyish white substance, the whole appearing externally, as one square, or slightly rhombic prism; structure lamellar; scratches glass; crystals often several inches long, and perfectly straight; sp. gr. 2.94.

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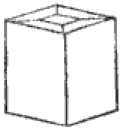

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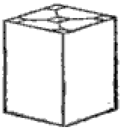

Fig. 1. Represents the dark lines, running from each angle of the central prism, to the several angles of the exterior one.

Fig. 2. The same, with the addition of a small prism, at each corner of the external prism.

Chem. Char. Infusible alone; but melts with borax, into a transparent glass.

It is found embedded in clay-slate, and sometimes in mica-slate.

Local. Portugal, Britanny, in the Pyrennees, Spain. On the Skiddaw Mountain, in Cumberland, and in several other places in England.

U. S. Sterling, *Mass.* in abundance, in a dark, bluish argillite. Bellows Falls, Croyden, Cornish, Charlestown, Langdon, and Alstead, *N. H.* Brunswick, and Georgetown, *Maine.—Hall.*

Species 11. CHLOROPAL,

Chloropal,—*Brandes*, P. M.

Ext. Char.—Color, pistachio green; occurs massive; fracture conchoidal, or earthy; translucent on the edges, or opake; hardness about equal to that of fluor; brittle; sp. gr. from 1.7, to 2.

Comp. Silex 46; oxide of iron 35.30; manganese 2; alumine 1; water 18; potash a trace.—*Brandes.*

Obs. This substance, is remarkable for a very singular magnetic property. When taken from its original repositories, it breaks pretty readily into a kind of parallelopipeds, the upper end, and two adjoining lateral edges, having the opposite magnetic poles, from the other two edges, and the lower end. It is not phosphorescent.—*Mohs.*

Local. Hungary, associated with opal.

Species 12. COBALTIC GALENA.

Cobaltic Galena, or Cobaltic Lead-Glance, J. M.

Ext. Char.—Color, lead grey, inclining to blue; occurs massive, and in very small moss-like grouped crystals; lustre metallic, and when recently fractured, splendent; opake; soft; sectile; soils the fingers a little; sp. gr. 8.44.

Chem. Char. Reducible on charcoal to metallic lead, attended with the arsenical odor; with borax, gives a blue bead.

Comp. Lead 62.89; arsenic 22.47; sulphur 0.47; iron 2.11; cobalt 0.94; arsenical pyrites 1.44.—*Du Menil.*

Local. Near Clausthal, in the Hartz, in a vein of clay-slate, and brown spar, traversing grey-wacke.

Species 13. CHLOROPHÆITE.*

Chlorophæite,—*Mac Culluch,* M.

Ext. Char.—Color, when newly broken, pistachio green, passing into muddy green; transparent; turns dark after a few hours exposure, and soon becomes quite black; occurs in small nodules; fracture, when transparent, conchoidal; when dull, earthy or granular; soft, scratched by a quill; brittle; sp. gr. 2.

Chem. Char. Before the blowpipe, it is entirely refractory, neither crackling, nor changing color, or transparency. With muriatic acid, it shows indications of iron.

Comp. It appears to be composed, chiefly of silex, with proportions of iron, and alumine.

Local. The Isle of Rum, and Fife, in Scotland. It occurs in amygdaloid, or black indurated clay-stone, generally in round nodules, from the size of a raddish seed, to that of a pea, and upwards.

U. S. Chlorophæite, has been discovered in this country, in Gill, *Mass.* by Prof. Hitchcock. It occurs in trap rock, near Turner's Falls.

Species 14. COMPTONITE.†

Comptonite, *Brewster.* P. C.

Ext. Char.—Color, white, or whitish; occurs in small crystals; transparent, or translucent; primary form, the right rectangular prism; secondary forms the six-sided prism, or table, with obtuse terminations; cleaves

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* From the Greek, in allusion to its appearing green, when newly broken.

† In honor of Lord Compton.

in two directions; fracture small conchoidal, uneven; lustre vitreous; yields easily to the knife.

Chem. Char. Before the blowpipe, it first gives off water, intumesces a little, and becomes opake, then it melts imperfectly into a vesicular glass. The globule obtained with borax, is transparent, but vesicular; that with salt of phosphorus, contains a skeleton of silica, and becomes opake on cooling. With a little soda, it melts imperfectly, but with a larger quantity, it becomes infusible.—*Mohs.* If exposed in the state of powder to the action of nitric acid, it forms a gelatine.—*Brewster.*

Obs. It appears to belong to the zeolite family.

Local. It has hitherto been found only at Mount Vesuvius, lining the cavities of an amygdaloidal rock.

Species 15. COUZERANITE.

Couzeranite, *Leonhard.* P.

Ext. Char.—Color, indigo blue, passing into greyish black; occurs in rectangular prisms, of which the lateral edges are sometimes replaced by planes, occasionally so deep, as to impart to the crystal, the form of a rhombic prism, having two of its lateral edges replaced; opake, or in thin portions, translucent; lustre shining; crystals fasciculated, rarely single; soft; scratched by apatite.

Chem. Char. Infusible. Becomes softer in acids, but is insoluble.

Local. It occurs in the country, heretofore called, Des Couzerans, in steep defiles of Saleix, particularly on the sides of the road to Port d' Aulus.—*Phillips.*

Species 16. FUCITE.

Fucit, *Schumacher.*

Ext. Char.—Colors, greyish, or greenish black; occurs in four, or six-sided prisms, which yield to mechanical division, parallel to the lateral planes of a rhombic prism, of about 87 deg. and 93 deg.; opake; soft; sp. gr. 2.5. to 3.

Chem. Char. Infusible, but becomes shining, and enamel like.

Obs. Phillips, thinks it may prove to be a variety of augite. It is said to resemble pinite.

Local. Near Arendal, in Norway, in rolled masses of granular quartz.

Species 17. FORESTERITE.

Foresterite, *Levy.* Ann. Phil. Vol. XXXVII.

Ext. Char.—Color, white, or colorless; occurs in small prismatic crystals, with obtuse terminations, resembling those of strontian; transparent, or translucent; lustre brilliant; cleaves in one direction; angles agree nearly, with those of prismatic corundum; scratches quartz.

Comp. According to Children, it is composed of silex and magnesia.

Local. Mount Vesuvius, where it was discovered by Lévy, associated with pleonaste, and augite.

Species 17. GMELINITE.*

Sarcolite, *Vauquelin.* Hydrolite, *De Dree.* Gmelinite, *Brewster.* M.

Ext. Char.—Color, white, passing into flesh red; occurs in very short six-sided prisms, terminated by low six-sided pyramids, with truncated summits; the figure differs from a dodecahedron, with isoceles, triangular faces, only in having a short prism between the pyramids; and in the truncation of their summits; surface streaked; cleavage distinct in one direction; lustre vitreous; translucent; yields easily to the knife; sp. gr. 2.05.

Chem. Char. When held in the flame of a candle, it flies off in numerous scales.

Comp. Silex 50; alumine 20; lime 4.5; soda 4.5; water 21.—*Vauquelin.*

Obs. This mineral appears to be a variety of analcime. According to Mohs, *Gmelinite* has no connection with the *sarcolite* of Vauquelin, or the *hydrolite* of De Dree, though by some, it has been considered the same mineral.

Local. Glenarm, in the County of Antrim, in Ireland, in amygdaloid.

Species 18. HISINGERITE.†

Hisingerit, *Berzelius.* Hisingerite, P. M.

Ext. Char.—Color, black; occurs massive; cleavage distinct in one direction; fracture earthy; streak greenish grey; soft; sectile; sp. gr. 3.

Chem. Char. Becomes magnetic, when gently heated. Fusible into a dull, opake, black globule. With borax, yields a yellowish green glass.

Comp. Oxide of iron 51.50; silex 27.50; alumine 5.50; oxide of

* In honor of the celebrated Gmelin.

† In honor of the chemist, Hisinger.

manganese 0.77 ; volatile matter 11.75 ; magnesia, a trace.—*Berzelius.*

Local. Sudermanland, with rhomb spar.

Species 19. HOPEITE.*

Hopeite, *Brewster*. Trans. Roy. Soc. Vol. X.

Ext. Char.—Color, greyish white; streak white; occurs in prismatic crystals, with pyramidal terminations; lustre vitreous, or pearly; transparent or translucent; cleavage perfect in one direction, and less so in another; one of the prismatic faces deeply striated, the others smooth; very soft; sectile; sp. gr. 2.75.

Chem. Char. Fusible, with borax, into a transparent glass. Alone, it gives off water before the blowpipe, and then melts into a transparent globule, which tinges the flame green. With salt of phosphorus, it gives no skeleton of silex; but melts with it in all proportions. With solution of cobalt, it forms a fine blue glass.

Comp. Hopeite, therefore, seems to be a compound of some of the stronger acids, as phosphoric, or boracic acid; of zinc; an earthy base; a little cadmium, and a great deal of water.—*Mohs.*

Species 20. HUMITE.†

Humite, *Bournon*. Humite, P. M.

Ext. Char.—Color, various shades of yellow or yellowish white, passing into reddish brown; occurs in small prismatic crystals, modified, by a great number of transverse, or oblique planes; primary form, a right rhombic prism of 60 deg. and 120 deg.; fracture imperfect conchoidal; lustre vitreous; transparent, or translucent; brittle; harder than felspar.

Chem. Char. Alone, it is infusible, but becomes opake on the outside; with borax, it gives a clear glass.

Local. Mount Somma, with brownish mica.

Species 21. HUMBOLDITE.

Humboldite, *Levy*. Ann. Phil. Feb. 1823. Humboldite, P. M.

Ext. Char.—Color, yellowish, and translucent, or colorless and transparent, sometimes nearly opake; occurs in small crystals of a rhombic form, often, variously and peculiarly modified; primitive form, the oblique rhombic prism; traces of cleavage parallel to the shorter diagonal of the prism; crystals irregularly

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* In honor of Dr. Hope.

† In honor of Sir Abraham Hume.

aggregated, and seldom separate; scratches fluor, but not glass.

Comp. According to the experiments of Dr. Wollaston, it consists of nearly the same constituents, as borate of lime.

Local. It has been lately discovered, associated with calcareous spar and apophylite, in trap rocks, near Sonthofen, in the Tyrol.

Species 22. HYALOSIDERITE.

Hyalosiderite, Edin. Jour. of Science, Vol. I.

Ext. Char.—Color, reddish, or yellowish brown; surface tarnished brass, or gold yellow; occurs in six-sided prisms, terminated by six-sided pyramids; lustre vitreous, on the surface, metallic; cleavage indistinct; streak cinnamon color; translucent on the edges; yields to the knife; sp. gr. 2.87.

Chem. Char. Becomes black, and melts into a dark magnetic globule.

Comp. Silex 31.63; protoxide of iron 29.71; magnesia 32.40; alumine 2.21; oxide of manganese 0.48; potash 2.78; chrome, a trace.—*Walchner.*

Local. Near Sasbach, in Brisgau, in a brown basaltic amygdaloid.

Species 23. KUPFERINDIG.

Kupferindig, *Breithaupt.* M.

Ext. Char.—Color, indigo blue, inclining to blackish blue; occurs massive, in plates, and in implanted spheroidal shapes, with a crystalline surface; fracture, flat conchoidal, uneven; texture compact; opake; lustre resinous; not very soft; yields to the knife; sp. gr. 3.80.

Chem. Char. Burns with a bluish flame, before it becomes red hot; and melts into a globule which is strongly agitated, and emits sparks; finally, it yields a button of copper.

Local. Sangerhausen, in Thuringia.

Species 24. LEVYNE.*

Levyne, *Brewster.* Ed. Jour. of Science, Vol. II.

Ext. Char.—Color, white; streak unchanged; occurs in rhomboidal crystals, of which the angles measure 136 deg. 1 min., 117 deg. 24 min. and 109 deg. 13 min.; cleavage indistinct; fracture imperfect conchoidal; lustre vitreous; brittle; soft; semi-transparent.

Chem. Char. With salt of phosphorus, it yields a transparent skele-

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* In honor of Mr. Levy.

ton of silex, which becomes opake on cooling. When heated in a glass tube, it gives off water, and becomes opake. On charcoal alone, it swells a little, but does not melt.

Local. Dalsnypen, in Faroe.

Species 25. ICE-SPAR.*

Eis-path, W. Ice-spar, P. M.

Ext. Char.—Color, greyish, or yellowish white; occurs massive, and in flattish crystals, of which the primitive differs little from a right rhombic prism; external form, small, thin, six-sided tables, the broader planes of which are striated, and the opposite narrow faces bevelled; lustre shining; transparent; structure imperfectly foliated; very brittle; scratches glass.

Chem. Char. Becomes vitreous, translucent, and white, and fuses with difficulty on the edges, into a blebby glass; with borax gives a diaphanous glass.

Local. Mount Somma, near Naples, with nepheline, meionite and mica.

Obs. It is considered a variety of felspar.

Species 26. KNEBELITE.†

Knebelite, P. M.

Ext. Char.—Colors, grey, white, brownish red, green, and brown, often spotted; occurs massive, with an uneven, and cellular surface; lustre glistening; fracture imperfectly conchoidal; opake; hard; brittle. sp. gr. 3.71.

Comp. Silex 32.5; protoxide of iron 32; protoxide of manganese 35.—*Dobereiner*.

Obs. No locality of this mineral is given.

Species 27. KONILITE.‡

Konilite, *Dr. Mac Cullock*, P.

Ext. Char.—Color white; occurs in the form of a loose powder, somewhat coarser than the silex obtained from silicated alkalies; it is gritty between the teeth, but not so hard as to scratch glass.

Chem. Char. Very easily fusible into a transparent colorless glass. Muriatic acid, dissolved a small quantity of it, but what remained was still fusible.

Comp. On attempting to analyze a small quantity, Dr. Mac Cullock found that it consisted chiefly of silex.

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* From its resemblance to ice, and its brittleness.

† After Major Von Knebal.

‡ From the Greek, in allusion to its form of a powder.

Obs. Dr. Mac Cullock observes, that it is difficult to account for the great fusibility of this mineral, unless it should contain a portion of some new alkali,as it was found not to contain any of the common alkalies, boracic acid, nor any trace of metallic matter.

Species 28. LIGURITE.*

Ligurite, *Leonhard*, P. M.

Ext. Char.—Color, apple green, sometimes speckled externally; occurs in oblique rhombic prisms of 140 deg. and 40 deg, occasionally modified by truncation; fracture uneven; lustre vitreous; powder, and streak, greyish white; translucent, or transparent; not electric by heat, or friction; does not phosphoresce on live coals; hardness, about that of quartz; sp. gr. 3.49.

Comp. Silex 57.45; alumine 7.36; lime 25.30; magnesia 2.56; oxide of iron 3.00; oxide of manganese 0.50.—*Viviani.*

Obs. According to Leonhard, it is considered as a gem in respect to hardness, transparency, and color.

Local. On the banks of the Stura in the Appenines, in a talcose rock.

Species 29. MARGARITE.

Margarite *Fuchs*, P. Rhomboidal Pearl-Mica, J. Rhombohedral Pearl-Mica, M.

Ext. Char.—Color, pale pearl-grey, passing into reddish, and yellowish white; occurs in small crystalline laminæ, intersecting each other in various directions; cleavage perfect in one direction; lustre pearly on one of the faces, and vitreous on the others; brittle; soft; sp. gr. about 3.

Comp. Silex 37; alumine 40.50; oxide of iron 4.50; lime 8.96; soda 1.24; water 1.—*Du Menil.*

Local. Sterzing, in the Tyrol, in foliated chlorite.

Species 30. MELLILITE.†

Mellilite J. P. M.

Ext. Char.—Color, yellow, honey or orange yellow; occurs in small square prisms, with the lateral edges truncated; opake; gives sparks with steel; crystals usually coated externally, with brown oxide of iron.

Chem. Char. Fusible, without ebullition, into a greenish glass. In powder, forms a jelly with nitric acid.

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* From Liguria, the country in which it is found.

† Mellilite, Lat. from its being of a honey yellow.

Comp. Silex 38; lime 19; magnesia 19.40; alumine 2.90; oxide of iron 12.10; oxide of titanium 4; oxide of manganese 2.—*Carpi.*

Local. Capo di Bove, near Rome, in the fissures of compact black lava.

Obs. Another mineral, called *mellite* or *honey-stone*, on account of its color, is a mellate of alumine, and a very different substance from the present species.

Species 31. OMPHACITE.

Omphacit, W. Omphacite, P.

Ext. Char.—Color, green, of various shades, often deep grass green; occurs massive, composed of small crystalline filaments; translucent; transparent on the edges; cleavage parallel to the sides of a rhombic prism.

Chem. Char. Fusible, with difficulty.

Local. Near Hoff, in the Tyrol, with actynolite, garnet and mica.

Species 32. PICROLITE.

Picrolith, *Hausmann.* Picrolite, P. M.

Ext. Char.—Color, leek-green, passing into yellow; occurs massive; structure compact, or fibrous; fracture splintery; lustre glimmering, and a little pearly; translucent on the edges; brittle; varies from soft, to pretty hard.

Chem. Char. Colors borax green, but the color disappears on cooling.

Comp. Silex 40.04; magnesia 38.80; protoxide of iron 8.28; carbonic acid 4.70; water 9.08.—*Almroth.*

Local. Taberg and Nordmarken, in Sweden, in the beds of octohedral iron ore.

Species 33. PICROSMINE.*

Picrosmin, *Haidinger.* Mohs' Mineralogy.

Ext. Char.—Colors, greenish white, greenish grey, oil green, leek, and blackish green; occurs massive; structure fibrous, passing into compact; cleavage perfect in one direction, and less so in two others; fracture fine, uneven, or earthy; lustre pearly on one of the faces, and vitreous on the other; streak white; opake, or translucent on the edges; soft; very sectile; sp. gr. 2.59 to 2.66.

Chem. Char. Infusible, but emits water and becomes first black,

* From the Greek, signifying *bitter odor,* in allusion to the peculiar smell it emits, when moistened.

then white and opake, and acquires considerable hardness. Soluble with salt of phosphorus, except a skeleton of silex. When heated with solution of cobalt, it assumes a pale red color.

Obs. Haidinger supposes that several varieties of the common asbestus of Werner, should be referred to this species.

Local. Near Presnitz, in Bohemia, in an iron mine.

Species 34. SILICIOUS HYDRATE OF ALUMINE.

Siliciferous Hydrate of Alumine, P.

Ext. Char.—Color, white, with a tinge of yellow, or blue; occurs massive; when dry, the lustre is resinous, and it absorbs about one eighth of its weight of water; adheres to the tongue; fracture earthy; on exposure, becomes friable, and loses about 40 per. cent. of its weight.

Chem. Char. Infusible; forms a jelly with acids.

Comp. Alumine 44.5; silex 15; water 40.5.—*Berthier.*

Local. In the Pyrenees, on the bank of the river Oo, in a lead mine.

Var. 1. SEVERITE.

Severite, P.

Ext. Char.—Color, white; occurs massive; fracture earthy; texture fine grained; translucent; resembles lithomage, but is a little harder; lustre, none; yields to the knife; brittle; polishes by friction; adheres to the tongue; has no argillaceous odor, when breathed on; does not form a paste with water.

Chem. Char. It does not effervesce with acids, nor is its color changed by heat. When newly fractured, it is said to diffuse an odor like that of apples.

Comp. Silex 50; alumine 22; water 26.—*Pelletier.*

Local. Near St. Sever* in France, in small masses, in a gravel soil.

Var. 2. LENZINITE.†

Lenzinite, P.

This has been divided into two sub-varieties, viz. *Opaline* and *Argillaceous.*

Sub-Var. 1. OPALINE LENZINITE.

Ext. Char—Color, milk-white; occurs in small masses; fracture flat conchoidal; surface dull; texture earthy; transparent, or translucent; yields to the

* Hence the name, Severite. † In honor of the mineralogist, *Lenzius.*

knife; easily reduced to a white powder; adheres to the tongue; sp. gr. 2.10.

Chem. Char. When heated in a crucible, loses 25 per cent. of its weight, and becomes so hard as to scratch glass. When thrown into water, it divides.

Sub-Var. 2. ARGILLACEOUS LENZINITE.

Ext. Char.—Color, snow white. sometimes tinged yellowish, with oxide of iron; occurs in small pieces; fracture earthy; lustre dull; becomes polished by rubbing; translucent on the edges; unctuous to the touch; brittle; adheres strongly to the tongue; breaks to pieces in water, but does not become more translucent; sp. gr. 1.80.

Chem. Char. Exposed to a red heat, it becomes hard enough to scratch glass; but undergoes no other change.

Comp Silex 39; alumine 35.5; water 25.0; lime 0.05.—*Johns.*

Local. Both varieties occur at Kall, in Eifeld.

Var. 3. KOLLYRITE.

Kollyrite, *Lucas.* Bt. P. M.

Ext. Char.—Color, white; occurs compact; appears like clay; water may be obtained from it on pressure; retains its water so strongly, that it takes a month or more, for a small piece to dry, when it separates into columnar pieces, like starch; absorbs water, with a hissing noise, and becomes translucent.

Chem. Char. Infusible; soluble in nitric acid without effervescence.

Comp. Alumine 45; silex 14; water 40 —*Klaproth.*

Local. In Thuringia and Sheimnitz, in Hungary.

Var. 4. ALLOPHANE.

Allophane, *Stromeyer.*

Ext. Char.—Colorless, and semi-transparent; or sometimes blue, green, or brown; occurs massive; but shews signs of prismatic forms; lustre somewhat vitreous; brittle; sp. gr. 1.85.

Chem. Char. Intumesces, and falls into powder, but alone, is infusible; with borax melts into a colorless glass

Comp. Alumine 32.20; silex 29.92; water 41.30; carbonate of copper 3.05; and a little lime, sulphate of lime, and hydrate of iron. *Stromeyer.*

Obs. This was probably a green variety of this mineral, as it contained copper.

Local. Thuringia, in a bed of lime stone.

Species 35. SOMERVILLITE.

Somervillite, *Brooke.* Brande's Journal, Vol. XVI. Somervillite, M.

Ext. Char.—Color, pale dull yellow; occurs in octohedral crystals, with isosceles triangular faces, variously truncated, so as to resemble some varieties of the oxide of tin; cleavage, perfect in only one direction; lustre glassy; scratches glass.

Chem. Char. Fusible alone, into a grey globule; with borax, into a colorless one.

Local. Mount Vesuvius, with black mica.

Species 36. SPHÆRULITE.*

Sphærulite, P. M.

Ext. Char.—Colors, grey, and brown, of various shades; occurs in spheroidal, or botryoidal masses, and in fibrous concretions; fracture splintery; structure fibrous, or compact; opake, or translucent; lustre none; brittle; scratches quartz slightly: sp. gr. 2.50.

Chem. Char. Nearly infusible, the sharp edges only become glazed

Comp. In composition, it is said to be nearly related to obsidian.

Local. Near Schemnitz, in Hungary, imbedded in pitchstone.

Species 37. SORDAWALLITE.

Sordawallite, *Nordenskiold.* Ed. Phil. Jour. Vol. IX. Sordawallite, P. M.

Ext. Char.—Color, greenish, or greyish black; occurs massive; fracture conchoidal; texture compact; no trace of cleavage; lustre vitreous, and a little metallic; brittle; hardness equal to that of glass: sp. gr. 2.53.

Chem. Char. Fusible with difficulty, into a blackish globule. With borax, yields a green glass; with a small quantity of soda, a blackish green globule, and with a larger quantity, a rough slaggy mass. Becomes reddish, on exposure.

Comp. Silex 49.40; alumine 13.80; peroxide of iron 18.17; magnesia 10.67; phosphoric acid 2.67; water 4.38.—*Nordenskiold.*

Local. Sordawala, in the government of Wiborg, in Finland. It occurs in thin layers, in a primitive rock.

Species 38. THULITE.

Thulite, *Brooke.* Thulite, M. C.

Ext. Char.—Color, rose red; occurs in crystalline

* Probably because it occurs in spherical masses.

masses; cleavage, parallel to the lateral planes of a rhombic of 87 deg. 30 min. and 92 deg. 30 min.; not so hard as quartz, yields to the knife with difficulty.

Obs. No proper account of this mineral, has been given. It is said to come from Norway.

Species 39. TORRELITE.

Torrelite, *Renwick.* Ann. N. Y. Lyceum.

Ext. Char.—Color, vermillion red. powder, rose red; occurs disseminated, and in small fragments; fracture granular; in some specimens fine, and in others coarse grained; slightly magnetic; scratches glass.

Chem. Char. Infusible alone; with borax, forms a glass, of green color, while hot, but which becomes colorless on cooling.

Comp. Silex 32.60; peroxide of cerium 12.32; protoxide of iron 21.00; alumine 3.68; lime 24.08; water 3.50; loss 2.82.—*Renwick.*

Local. Andover Iron mine, Sussex County, *N. J.* where it is intimately connected with, and disseminated through the ore.

Obs. The present species, was first analyzed, and named, by Prof. Renwick, of Columbia College.

Prof. Renwick, makes the following observations, on the general aspect of this ore.

"This ore appears, at first glance, to be composed of three very distinct substances. The first is intermediate, in appearance between the granular Franklinite, and the large grained magnetic ore, of Gov. Dickerson's mine, at Succasinny: on a cursory examination, it seems to be a protoxide of iron, with a slight trace of zinc. The second, is an amorphous quartz, tinged with a color, varying from a pale rose color, to a deep vermillion. The third, is of a dull vermillion red, and of a granular fracture; in some specimens, fine, in others, coarse grained. This last, was chosen as the subject of examination."

Prof. Renwick, named it *Torrelite,* in honor of Prof. Torrey, of West Point.

Species 40. VERMICULITE.*

Vermiculite, *Webb.* Sill Jour. Sci. Vol. VII.

Ext. Char—Colors, yellowish, or greenish white, and dark brown, or blackish, interspersed, giving the mass a brownish cast; occurs massive; texture compact, interspersed with laminæ, or scales resembling mica; lustre glistening, or dull; powder yellowish, mixed with shining scales; emits an argillaceous odor, when moistened.

* In allusion to its vermicular, or wormlike motion, when heated.

Chem. Char. Under the blowpipe, swells, and shoots out excrescences, having a vermicular motion, and resembling worms.

Obs. This appears to be a new variety of talc, discovered by Mr. Webb, of *Mass* The name chosen by Mr. Webb, has been inserted, in conformity to the general rule, that if a man discovers a new mineral, he has a right to name it. The property, however, on which this name is founded, is by no means peculiar to the present mineral. The Skolezite of *Fuchs*, was named from the same property, and at least, one variety of zeolite, behaves in the same manner, before the blowpipe.

Local. Worcester, *Mass.*

Species 41. WAGNERITE.

Wagnerit, *Fuchs*. Schweigger's Journal. Wagnerite, M.

Ext. Char.—Color, several shades of yellow, sometimes orange yellow, and sometimes inclining to grey; occurs in crystals; form unknown; lustre vitreous; translucent; scratches glass: sp. gr. 3.11.

Comp. Phosphoric acid 41.72; fluoric acid 6.50; magnesia 46.66; oxide of iron 5; oxide of manganese 0.50.—*Fuchs.*

Local. Near Werfer, in Salzburg, where it is found with quartz, in clay-slate. This is its only known locality.

Species 42. WITHAMITE.*

Withamite, *Brewster*. Edin. Jour. Sci. Vol. II.

Ext. Char.—Color, carmine red, and pale straw yellow, in two different directions, perpendicular to each other, and to the lengthened prisms; occurs in minute prismatic crystals, aggregated into globular masses, radiating from their centres; lustre vitreous; translucent; brittle; scratches glass: sp. gr. 3.13.

Chem. Char. Swells, but fuses with difficulty, into a dark, greenish grey, scoria Salt of phosphorus dissolves it with effervescence, into a globule, which contains a skeleton of silver, and becomes opake on cooling.

Local. Glencoe, in Scotland, in a trap rock.

Species 43. ZEAGONITE.

Gismondin, *Leonhard.* Zeagonite, Gismondine, P. M.

Ext. Char.—Colors, white, greyish, and pale smalt blue; occurs in semi-globular masses; also, crystallized in the form of the octohedron, with a square base; angles sometimes truncated; lustre adamantine; cleavage, imperfect in two directions; brittle; fracture con-

* In compliment to Mr. Witham, who discovered it.

choidal; translucent; crystals small; hardness equal to that of quartz.

Chem. Char Infusible, but phosphoresces, and becomes friable.

Comp. Silex 41.4, lime 48.6; alumine 2.5; magnesia 1 5; oxide of iron 2.5.—*Carpi.*

Obs. Prof. Mohs, has little doubt, from the quantity of the angles of zeagonite, that it is a variety of zircon. Its composition, however, is entirely different, that of zircon being 70 parts zirconia, while the present species, contains not a particle of that earth.

Local. Capo de Boæ, near Rome, in the cavities of a volcanic rock.

Species 44. ZURLITE.

Zurlit, *Leonhard*. Zurlite, P. M.

Ext. Char.--Color, asparagus green; occurs in four-sided rectangular prisms, sometimes flattened, and occasionally with truncated angles; cleavage indistinct; also, occurs in botryoidal masses; fracture conchoidal, passing into uneven; texture compact, and corneous; surface rough, and covered with a white coating; yields to quartz, but gives sparks with steel: sp. gr. 3.27.

Chem. Char. Fusible with borax, into a blackish glass. Nitrous acid dissolves it in part, with effervescence, and assumes a yellow color.

Local. Mount Vesuvius, with calcareous spar, where is was first discovered by Remondini, and described by him in the Memoirs of the Academy of Naples.

ADDENDA.

Account of some new Vesuvian Minerals, by Seigniors MONTICELLI *and* COVELLI, *of Naples.*

(Our account of these Minerals, is an extract of Dr. J. Van Rensellaer's translation, published in Silliman's Journal, for Nov. 1826.)

Species 1. BREISLAKITE.

Ext Char.—Colors, brownish, or reddish brown; appears like down; under the microscope, appears in the form of extremely small, straight acicular crystals, of a red color, which are placed in the interstices of other extremely small crystals; capillary, contorted, and brown.

Chem. Char. Hot nitric acid, reduces it to an impalpable powder which on cooling, is precipitated. Before the blowpipe, it melts into a black enamel.

Comp. Silex, alumine, and a little iron.—*Wollaston.*

Local. It lines the small bubbles found in the lava of Scalla, on Vesuvius.

Species 2. HUMBOLDTILHITE.*

Umboldilite.

Ext. Char.—Color, brown, tending to brownish yellow; occurs in six, eight, and twelve-sided prisms, sometimes so short, as to become tabular, also cylindrical and massive; primitive form, a right rectangular prism, with a square base; translucent in mass, transparent in thin laminæ; lustre vitreous; fracture vitreous, and conchoidal; fragments irregular, and acuminated; scratches glass: sp. gr. 3.104.

Chem. Char. Fusible, with effervescence, but does not form a globule. With nitric acid, it is converted into a jelly.

Comp. Silex 54.16; lime 31.67; magnesia 8.83; alumine 0.50; oxide of iron 2.00.—*Monticelli and Covelli.*

Dist. Char. It approaches by its primitive form, anhydrous sulphate of lime, cryolite, cymophane, chrysolite, stilbite, dipyre, and analcime. From the first two, it is distinguished by its chemical, and physical characters. Cymophane, and chrysolite, do not form a

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*In honor of Baron Humboldt. Humboldtine, and Humboldtite, have already been noticed.

jelly with acids, and are infusible ; stilbite and analcime, do not form a jelly with acids; and dipyre contains no magnesia in its composition. In chemical composition, umboldilite, is similar to augite, sahlite, hornblende, and melilite, but from these species, it is also distinguished by its forming a jelly with acids.

Local. Vesuvius, in lava, associated with zurlite, augite, Thomsonite, mica, &c.

Species 3. DAVINA.*

Davyne.

Ext. Char.—Colors, brown, or white ; occurs in six, and twelve-sided crystals, also annular ; primitive form, the regular hexahedral prism ; transparent, translucent, or opake ; lustre of the transparent crystals, opaline, of the opake, pearly ; structure lamellar, the laminæ being parallel to the axis of the prism ; lamellar structure of the opake, very obvious ; transverse fracture, unequal ; longitudinal fracture, lamellar ; scratches glass : sp. gr. 2.25 ; refraction double.

Chem. Char. Forms a yellowish jelly, with nitric acid. Effervesces at first, owing to admixture. Fusible, with effervescence, into a porous, opaline enamel. Crystals retain their transparency, at a white heat.

Comp. Silex 42.91 ; alumine 33.28 ; lime 12.02; iron 01.25; water 07.43 ; loss 03.11.—*Monticelli and Covelli.*

Dist. Char. Sommite, which it resembles, is hardly acted on at all, by nitric acid, while this acid dissolves 50 per cent. of Davina. It differs from Thomsonite, in retaining its transparency when heated, and in being harder. From pseudo-sommite, it differs in being more easily fusible, and in possessing an opaline or pearly lustre.

Local. Vesuvius, associated with Wollastonite, calcareous spar, pumice, black spinelle, and mica.

Species 4. CAVOLINITE.†

Ext. Char.—Color, white, and opake ; lustre pearly, or silky ; longitudinal fracture, fibrous ; transverse fracture, rough and unequal ; occurs in six, and twelve-sided prisms, with obtuse, or low pyramidal terminations, prisms sometimes very short ; also occurs annular ; primitive form, the regular hexahedron, the height of the prism being less than its breadth ; cleavage, parallel to the axis of the prism ; crystals small, passing into microscopic ; scratches glass : sp. gr. 2.15.

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* In honor of Sir Humphrey Davy.

† In honor of Philipo Cavolini, the Neapolitan naturalist.

Chem. Char. Easily fusible, with effervescence, into an enamel, with the aspect of porcelain. With nitric acid, forms a jelly.

Dist. Char. It has the same primitive, with sommite, Davina, and pinite, but is distinguished from them all, by its structure, aspect, and chemical composition.

Obs. The analysis of Cavolinite, say the authors, as well as its action before the blowpipe, leads to the presumption, that this new species, is a double silicate of alumine, and potash.

Local. Vesuvius, in the interior of calcareous balls, accompanied by garnets, and isocrase, &c.

Species 5. CHRISTIANITE.

Ext. Char.—Colors, brown, yellow, and reddish; occurs in four, eight, and twelve-sided prisms, variously modified by truncation; primitive, an oblique rectangular prism; lustre ordinary, or dull on the superfices; transverse fracture, vitreous, longitudinal fracture, lamellar; is scratched by quartz; crystals small; translucent, or transparent: sp. gr. 2.77; refraction double, through the laminæ.

Chem. Char. Infusible alone. With *borax*, affords a brown, globular, opake, button, translucent at the edges. With *nitrate of cobalt*, the edges most exposed to heat, assume a beautiful blue. Sulphuric acid, converts it into an imperfect vesicular jelly, considerably increasing its bulk. Dissolves partially in nitric acid.

Dist. Char. Phosphate of lime, which it resembles, dissolves entirely in nitric acid. Chondrodite, is entirely insoluble in nitric acid. Topaz is harder, and has a higher sp. gr. than Christianite, and from the zeolites, felspar, and sommite, it is distinguished by its infusibility.

Local. Vesuvius, in small geodes of granitoid aggregates, composed chiefly of augite and mica, which occur in the matter, ejected from the volcano.

Species 6. BIOTINA.*

Ext. Char.—Colors, topaz yellow, brown and colorless; translucent, or transparent; occurs according to *Monticelli* and *Cavelli*; 1. Bis-marginate. 2. Tri-tetrahedral. 3. Sei-duodecimal. 4. Octo-duodecimal. 5. Octo-sesdecimal. 6. Amphi-hexahedral. 7. Amphi-octohedral. 8. Quadri-duodecimal. Primitive form, an obtuse rhomboid; fracture vitreous, tending to conchoidal; fragments angular; lustre vivid; refraction double: sp. gr. 3.11.

* In honor of the distinguished French naturalist, Biot.

Chem. Char. Infusible, and unalterable by the blowpipe. Nitric acid, partially dissolves it, without forming a jelly.

Dist. Char. The carbonates of lime, barytes, and strontian, effervesce with acids, which Biotina does not. It is less hard than quartz; and chabasie fuses before the blowpipe. Phosphate of lime, dissolves perfectly in acids; Biotina dissolves but partially. Biotina differs from crysolite, and Brucite, in respect to primitive form, and external aspect. Crysoberyl, scratches quartz.

Local. Mount Vesuvius.

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" " For Automollite read Automolite.
" " For Pyenite read Pycnite.
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" lxxiii, For Aurifirous read Auriferous.
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