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HAND-BOOK

OF

MINERALOGY

DETERMINATION, DESCRIPTION AND CLASSIFICATION

OF

Minerals Found in the United States

By J. [illegible], A. M., Ph. D.
[illegible]

[illegible]

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BY J. C. FOYE, A. M., PH. D.

Alexander W. Stow, Professor of Chemistry in Lawrence University

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PREFACE.

A PART of the material of this work was prepared by the author and published under the title of "Mineral Tables." The second edition of the "Tables" being exhausted, advantage is taken of the opportunity to revise, largely rewrite, make additions and corrections, and bring the work out in the present more convenient form.

It has been the intention of the author to furnish a work by the aid of which minerals found in this country may easily be determined, to give concisely their prominent and distinguishing characteristics, and to present the classifications usually used in arranging cabinets.

The tables for determining minerals are those constructed by the author and published in the work referred to above. Experience in using them in the classroom for the past eleven years has led to a slight modification of their original form.

It is thought best to give the description of the species in short paragraphs instead of presenting the matter in the original tabular form, as it allows a greater latitude in making descriptions and gives an opportunity to compare closely allied species. For the sake of convenience the subjects in this part of the work are arranged in alphabetical order. Although the new system of chemical nomenclature has been used, a few of the old terms still in common use, such as silica, alumina, and lime, have been retained for the sake of brevity. The composition of each species as calculated from the symbol of the pure specimen is given, unless otherwise indicated.

For convenience in passing from description to classification, each species in the chapter on "Description of Species" is numbered in a parenthesis to correspond to the numbering in the chapters on classification.

J. C. Foye.

Appleton, Wis., May 1, 1886.

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MINERALOGY.

CHAPTER I.

Introduction.

Apparatus and Reagents.

The following list includes all the apparatus and reagents needed in determining minerals by the methods given in this work:

A three-cornered file for cutting glass tubes and testing hardness.

A small magnet.

A strong knife may be used for testing hardness, and, if it has a magnetized blade, may be used for a magnet.

Steel forceps; a small hammer and anvil, and a small agate mortar and pestle, for crushing and pulverizing specimens.

Cutting-pliers for obtaining small pieces of a mineral for blow-pipe or chemical assay.

Platinum-pointed forceps for use in testing fusibility and color of flame.

A piece of blue (cobalt) glass.

A magnifying-glass is often convenient for examining assays after ignition.

Well-burnt charcoal, platinum foil and wire for supports.

Test-tubes and glass tubes for supports and testing the presence of water.

A lamp (for blow-pipe purposes) with a large wick, fed with olive-oil or a mixture of twelve parts alcohol and one part turpentine.

An alcohol-lamp for heating substances in test-tubes.

When gas can be had it is better to use a Bunsen burner in place of a lamp.

Blow-pipe with platinum jet,* or Black's blow-pipe with brass tip.

* The author has found that a very cheap and good substitute for the more expensive blow-pipe generally used can be made in a few moments from a common clay pipe. Having broken off a piece of the pipe-stem of suitable length for a jet, fill about one-fourth of an inch of the end with soft putty, through which pass a fine needle. The putty is then to be hardened in the flame of a spirit-lamp and the needle removed. Fit the jet thus made into a cork, and the cork into

Sodium carbonate, often called soda; borax; salt of phosphorus, sometimes called microcosmic salt; cobalt nitrate in solution; potassium bisulphate; potassium cyanide; potassium nitrate (nitre); fluorite (fluor spar); tin foil.

Hydrochloric, nitric, and sulphuric acids; hydrochloric acid diluted with two volumes of water, for testing solubility with effervescence.

Litmus paper, both red and blue, and Brazil-wood paper.

Scale of Hardness.

1. Talc; laminated light-green variety. Easily scratched by the nail.

2. Gypsum; a crystalline variety. Yields with difficulty to the nail. Does not scratch copper coin.

3. Calcite; transparent variety. Scratches and is scratched by copper coin.

4. Fluorite (fluor spar); crystalline variety. Not scratched by copper coin; does not scratch glass.

the bowl of another pipe. The extremity of the jet may be shaped, if necessary, with a common file.

5. Apatite; transparent variety. Scratches glass with difficulty, leaving its powder on it. Yields readily to the knife.

6. Orthoclase; white, cleavable variety. Scratches glass readily. Yields with difficulty to the knife.

7. Quartz; transparent variety. Does not yield to the knife. Yields to the edge of the file, though with difficulty.

8. Topaz; transparent variety.

9. Sapphire; cleavable varieties.

10. Diamond.

Scale of Fusibility.

1. Stibnite (gray antimony). Fusible in coarse splinters in the summit of a candle-flame without the blow-pipe.

2. Natrolite. Fusible in fine splinters in the summit of a candle-flame without the blow-pipe.

3. Almandite (iron-alumina-garnet). Does not fuse in the candle-flame. Fuses easily before the blow-pipe in obtuse pieces.

4. Green Actinolite. Fusible before the blow-pipe in coarse splinters.

5. Orthoclase. Fusible before the blow-pipe in fine splinters.

6. Bronzite. Before the blow-pipe becomes rounded only on the sharp edges.

Systems of Crystallization.

1. Isometric: Three axes rectangular and equal.

2. Tetragonal: Three axes rectangular, two lateral axes equal.

3. Orthorhombic: Three axes rectangular and unequal.

4. Monoclinic: Three axes unequal, two rectangular.

5. Triclinic: Three axes unequal, and obliquely inclined.

6. Hexagonal: Four axes, the three lateral intersecting at an angle of 60°, the vertical axis at right angles to the other three.

The names of the systems of crystallization given above are those adopted by Dana and are in general use.

Other names have been used by different authors. For Isometric the terms Tessular, Regular, Tesseral, Cubic, and Monometric have been used; for Tetragonal—Pyramidal, 2 and 1 axial, and Dimetric; for Orthorhombic—Orthotype, 1 and 1 axial, Prismatic, Rhombic, and Trimetric; for Monoclinic—Hemiorthotype, 2 and 1 membered, Oblique, Monoclinohedric, and Clinorhombic; for Triclinic—Anorthotype, 1 and 1 membered, Anorthic, Triclinohedric, and Clinohedric; and for Hexagonal—the terms Rhombohedral and 3 and 1 axial.

Blow-Pipe Reactions.

The examination of assay with borax and salt of phosphorus is generally made on platinum wire, where the color of the bead is more readily observed. Make a small loop in the end of the platinum wire, heat it to whiteness in the blow-pipe flame, and dip it into powdered borax or salt of phosphorus; heat again in the blow-pipe flame (adding more of the reagent, if necessary) until a clear, glassy bead is formed. While the bead is hot and soft touch it to a minute speck of the assay and heat again in the oxidizing, then in the reducing, flame. If no distinct color is produced add a little more of the assay to the same bead and heat again, repeating the operation as many times as may be necessary.

The examination with soda is generally performed on charcoal in the reducing flame. When the result looked for is the production of minute globules of metal, care should be taken that they do not escape observation. If necessary a portion of the charcoal around the assay may be cut out, ground up with a little water in a small mortar, and the charcoal and soda washed away. Any shining particles of metal may then be readily detected. When two or more metals are present an alloy is usually formed.

The specimen may be roasted or oxidized in an open tube (tube open at both ends). Tubes for this purpose should be of hard glass, free from lead, from $\frac{1}{4}$ to $\frac{1}{10}$ of an inch in diameter, and from four to six inches long. The substance should be placed in the tube about one inch from the end, the tube held horizontally at first, and afterwards inclined as found necessary. A slight bend in the tube where the substance is placed is sometimes needful to prevent falling out. The inclination of the tube will determine the flow of air through it and the rate of oxidization. Pieces the size of a grain of wheat should be used. If the substance decrepitates on heating, it should be finely pulverized and introduced into the tube by means of a paper trough, care being taken to keep the sides of the tube clean. Moistened litmus-paper should be placed in the upper end of the tube to determine whether the volatile products are acid or alkaline. The heat applied should be gentle at first and gradually raised, otherwise volatilization without oxidization may ensue. Heat of the lamp or Bunsen burner, alone or with blow-pipe, may be used as found necessary.

When the substance, because of its combustibility or any other reason, is to be heated out of contact, or with but a limited supply of air, a closed tube (tube closed at one end) or matrass (closed tube with bulb end) is used. The tube should be held horizontally and the heat applied as with the open tube. Litmus-paper is also to be used as with the open tube. Closed tubes should not be more than one-quarter of an inch in diameter and about three or four inches long. They can easily be made by closing the end of a short tube by melting, or by heating a long tube in the middle and drawing it into two parts.

In all cases clean tubes should be used.

Alkaline Reaction.—Many substances after ignition give an alkaline reaction if placed upon red litmus-paper and then moistened.

If the substance is ignited on charcoal great care must be taken that no ashes from the coal adhere to the assay when it is transferred to the test-paper.

Aluminum.—Heat in the oxidizing flame a small fragment of the mineral on charcoal or in platinum-pointed pincers, moisten with a drop of the cobalt solution, and heat again. If the mineral assumes a blue color it indicates the presence of aluminum.

This test is not applicable to fusible minerals, as fusible silicates give the same result, nor to minerals not white, or nearly so, after ignition. If the assay is not sufficiently porous to absorb the solution it should be powdered.

Antimony.—On charcoal before the blow-pipe antimony yields dense, white, inodorous fumes, which partly escape and partly condense on the coal. A compound of antimony mixed with sodium carbonate and potassium cyanide, on charcoal, yields in the reducing flame brittle globules of metallic antimony which give dense, white fumes before the blow-pipe, as mentioned above.

In a closed tube when sulphur is present the mineral yields a sublimate, black while hot, but becoming brownish red when cold.

Arsenic.—On charcoal before the blow-pipe compounds of arsenic mixed with an excess of sodium carbonate yield a white coating and evolve a garlic odor.

When pulverized and heated in a closed tube with five or six times their weight of a mixture of sodium carbonate and potassium cyanide, compounds of arsenic deposit a mirror of metallic arsenic on the cool part of the tube.

Some compounds of arsenic impart a light blue color to the outer blow-pipe flame.

Barium.—A yellowish green color is imparted to the outer blow-pipe flame by the compounds of barium, silicates excepted.

Bismuth.—Before the blow-pipe, on charcoal, bismuth yields a coating which is dark orange yellow while hot and lemon yellow when cold, the yellow coating being usually surrounded by a white ring.

Compounds of bismuth mixed with sodium carbonate and heated on charcoal in the reducing flame yield brittle globules of bismuth and the yellow incrustation.

Boron.—Boron imparts a bright yellowish green color to the blow-pipe flame; this is heightened by moistening the assay with sulphuric acid before heating. If the result is not satisfactory, mix one part of the powdered mineral with one part fluorite and three of potassic bisulphate, and fuse on platinum wire; boron, if present, will impart the green color to the flame at the instant of fusing.

Cadmium.—Before the blow-pipe, on charcoal, cadmium gives a coating which is, when cold, reddish brown. The test is more delicate when soda is mixed with the assay and brought to a paste with water.

Chromium.—With borax, both in the oxidizing and the reducing flame, chromium gives a bead which is green when cold. Tin causes no change.

Cobalt.—With borax on platinum wire minerals containing cobalt give a blue bead. If arsenic or sulphur is present the assay should first be heated on charcoal till fumes are no longer emitted. If a small quantity of iron is present the bead will be green while hot, but blue when cold. When the amount of iron is greater, the bead will be dark green while hot and bright green when cold.

Many minerals which contain cobalt, when mixed with sodium carbonate and potassium cyanide, and heated on charcoal in the reducing flame, yield metallic cobalt in a gray powder which is feebly attracted by the magnet. It is often necessary to pulverize the fused mass and treat with water to separate the powder, so that it may be sensibly affected by the magnet.

Copper.—When copper characterizes a mineral it can be reduced to the metallic state by heating the assay with soda on charcoal. With borax or salt of phosphorus a red bead is formed in the reducing flame; in the oxidizing flame the bead is green while hot, but becomes greenish blue or blue on cooling. When the bead is formed on charcoal with borax or salt of phosphorus in contact with tin, it assumes a very characteristic red color. Most copper compounds color the flame green.

Fluorine.—Fluorine combined with weak bases and little water may be tested by heating the substance in a closed tube in which a strip of moistened Brazil-wood paper is inserted, The paper becomes straw yellow, and a ring of silica is deposited near the assay.

Another process by which the presence of fluorine in any combination may be shown is to mix the pulverized assay with some salt of phosphorus previously fused on charcoal and powdered, and heat the mixture in an open glass tube in such a way that the flame may be carried inside the tube by the current of air.

Fluorine is recognized by its pungent odor, its effect on glass, and by moistened Brazil-wood paper placed in the upper end of the tube becoming straw yellow.

Iodine.—Fused on charcoal, many iodides give fumes of iodine. Fused with potassic bisulphate in a test-tube, compounds of iodine yield violet vapors which condense in the upper part of the tube.

Iron.—With borax on platinum wire a very little iron with the oxidizing flame gives a glass which is yellow when hot, colorless on cooling; with more, the glass is red while hot, yellow when cold; with still more, it is dark red when hot and yellow when cold. In the reducing flame the glass becomes bottle green. Minerals containing much iron become magnetic when highly heated in the reducing flame, especially if soda is used.

Lead.—Fused with soda in the reducing flame on charcoal, compounds of lead yield a globule of the metal, and a coating which is lemon yellow while hot and sulphur yellow when cold. The coating may be modified by the presence of other volatile metals. The coating imparts to the reducing flame an azure-blue color.

Lithium.—Some compounds of lithium color the blow-pipe flame bright purple red when heated in the platinum forceps. To obtain the best result mix one part of the powdered mineral with one part each of fluorite and potassium bisulphate, make the whole into a paste with a little water, and fuse on platinum wire, when, even if but little lithium is present, the characteristic color will be imparted to the flame.

Magnesinum.—Proceed as when testing for aluminum. A magnesium mineral will assume a pale red or pink color. The test is applicable to both fusible and infusible minerals which are white, or nearly so, after the first ignition.

Manganese.—Manganese is very readily detected by fusing a little of the powdered substance with two or three times its volume of a mixture of soda and nitre on platinum foil. A green mass flows around the undissolved portion, and on cooling becomes bluish green. Or fused with soda on platinum wire in the oxidizing flame, a bead green while hot, bluish when cold, is produced.

With borax on platinum wire manganese yields in the oxidizing flame a glass which is violet when hot, but on cooling becomes violet red. An excess renders the glass quite black and opaque.

Mercury.—Compounds of mercury, when heated in a closed tube with soda, yield a sublimate of metallic mercury, which may be rubbed into globules with a piece of copper wire.

Molybdenum.—Molybdenum colors the blow-pipe flame yellowish green. Its compounds before the blow-pipe, on charcoal, yield a coating which is yellow while hot and white when cold. The white coating assumes an azure-blue color when touched with an intermittent reducing flame; if, however, the heat is so great as to cause the coal to glow, the latter has a dark copper-red, metallic appearance, which is not further affected.

Nickel.—When volatile substances are present, the assay must be strongly heated on charcoal in the reducing flame until it no longer emits fumes or odors. With borax on platinum wire nickel yields a bead in the oxidizing flame which is violet while hot, but reddish brown when cold. In the reducing flame the bead becomes gray and cloudy, sometimes opaque, from a separation of metallic nickel. With continued blowing the metal collects together and the bead becomes colorless. The reaction is obscured by the presence of iron, cobalt, or copper.

Fused with soda on coal in the reducing flame, many compounds of nickel yield white metallic particles of nickel, which, after separation from the fused mass by crushing and washing in a mortar, are attracted by the magnet.

Phosphorus.—Phosphates impart a dirty green or bluish green color to the blow-pipe flame. The color is more distinct if the powdered mineral is first moistened with sulphuric acid and then fused on platinum wire.

Potassium.—Potassium imparts a pale violet color to the blow-pipe flame. The color is obscured if sodium or lithium is present, but viewed through cobalt glass is purple, violet-red, or red.

Silicon.—Silicates, when fused with soda on charcoal, dissolve with effervescence, forming a glass which is transparent while hot.

With salt of phosphorus on platinum wire silicates are decomposed, the "skeleton of silica" floating in the clear, hot bead.

Silver.—Many compounds of silver yield a globule of the metal when fused with soda on charcoal in the reducing flame. When treated for a long time with the reducing flame a slight, dark red coating is produced.

Sodium.—Compounds of sodium impart an intense yellow color to the blow-pipe flame.

Strontium.—When a mineral contains strontium it colors the blow-pipe flame bright red. When moistened with hydrochloric acid the color imparted to the flame is more intense.

After ignition the salts of strontium give an alkaline reaction when placed upon test-paper and moistened.

Sulphur.—A compound of sulphur, when fused on charcoal with two or three parts of soda, yields a mass which stains a silver coin black or brownish black when moistened and placed upon it.

The higher sulphides (sulphides containing a high proportion of sulphur) yield a sublimate of sulphur when heated in a closed tube. A volatile metal being present in combination, the sublimate will be a sulphide of that metal. If the sublimate is very dark brownish red while hot and reddish yellow to red when cold, the presence of a sulphide of arsenic is indicated. The sublimate of a sulphide of mercury is dull black, becoming red when rubbed. A black sublimate, being produced only by a strong heat and becoming cherry red or brownish red on cooling, shows the presence of a sulphide of antimony.

Sulphides, or substances containing sulphides even in very small quantities, yield sulphur dioxide when heated in an open tube. The sulphur dioxide may be recognized by its odor and by reddening and sometimes bleaching moistened blue litmus-paper inserted in the end of the tube.

Tellurium.—On charcoal tellurium gives a white coating and colors the reducing flame green. In an open tube a white or whitish sublimate is produced, which, before the blow-pipe, fuses to clear, colorless drops.

Tin.—Fused with soda and borax on charcoal in the reducing flame, compounds of tin yield a globule of the metal; at the same time a coating is formed on the coal close to the assay which is slightly yellow when hot, but is white when cold. This coating moistened with the cobalt solution and heated in the oxidizing flame assumes a bluish green color.

Titanium.— On platinum wire with salt of phosphorus, in the oxidizing flame, titanium forms a clear bead which appears yellow while hot, if much is present, but becomes colorless on cooling. The same bead reddens and finally assumes a violet color in the reducing flame. With salt of phosphorus on charcoal the bead becomes violet in the reducing flame if treated with tin. If iron is present the reaction will be obscured.

Tungsten.—With salt of phosphorus on platinum wire, in the oxidizing flame, a yellowish or colorless bead is produced which, treated with the reducing flame, is green while hot, but blue when cold. On charcoal with salt of phosphorus, in the reducing flame, the bead becomes a deep green if treated with tin. The reaction is obscured if iron is present.

Water.—When the mineral is heated in a closed tube, water, if present, will be condensed on the colder portion of the tube, and may be tested with litmus-paper to ascertain if it is acid or alkaline.

Care must be taken to free the tube from all moisture before inserting the substance. To obtain satisfactory results it is often necessary to pulverize the assay before making the test.

Zinc.—Compounds of zinc, when heated on charcoal, yield a coating of oxide of zinc which is yellow while hot, but white when cold. The coating wet with the cobalt solution and then heated assumes a fine yellowish green color which is most distinct when cold.

Substances containing much zinc, either as sulphide or oxide, yield the coating when treated alone on coal in the reducing flame; when containing but little zinc they should be powdered and fused with soda in the reducing flame. When the substance is a combination of metallic oxides it should be mixed with two parts soda and one and one-half parts borax before fusing. The zinc is thus volatilized, and by contact with the air is oxidized and deposited on the coal, where it may be treated with the cobalt solution.

The presence of tin and antimony so obscures the reactions that zinc in small quantities can be found only with great difficulty.

Abbreviations.

B.B., before the blow-pipe.

H., hardness.

Fus., fusibility.

G., specific gravity.

Yields water—*i.e.*, when heated in a closed tube deposits water on the cool surface.

CHAPTER II.

DETERMINATION OF SPECIES.

When determining a mineral, begin with Division I. of Table I. and subject the specimen to the tests designated under I., II., III., etc., in their order. Having found the specimen to give the result called for under a division, apply the tests in the order in which they occur in that division. Direction by number will thus be found to a section of Table II. where other tests will be given by which the species to which the mineral belongs may be determined.

In Chapter III., where for convenience the subjects are arranged in alphabetical order, will be found a brief description of each species, and in a few instances a list of varieties and some of their distinguishing characteristics. When species are so closely allied that they cannot easily be distinguished by use of the tables, they are so compared in Chapter III. that they may readily be recognized.

TABLE I.

Preliminary Examination.

(For abbreviations see page 28. The figures refer to divisions in Table II.)

I. Soluble (having taste).	
(*a*) Effervesces in either hot hydrochloric or sulphuric acid	1
(*b*) No effervescence in either acid.	
Yields no water.	2
Yields water.	
B. B. becomes magnetic	3
B. B. does not become magnetic.	
Reaction for sulphur	4
No sulphur reaction	5
II. Effervesces in hydrochloric acid, yielding no odor.*	
(*a*) Yields water.	
Fusible	6
Infusible	7
(*b*) Yields no water.	
Fusible	8
Infusible	9

* Do not mistake the odor of the acid for a gas yielding an odor. Use fine powder if there is no reaction with coarse.

III. Soluble in hydrochloric acid, yielding chlorine (a yellowish green gas of suffocating odor).

Yields water........................... 10
Yields no water........................ 11

IV. B. B. on coal yields odorous or colored fumes or coats the coal,* or with hydrochloric acid yields hydrogen sulphide (odor of decayed eggs).

(*a*) B. B. becomes magnetic, yielding:

Fumes of sulphur.............. 12
Fumes of arsenic...... 13
Fumes of antimony and sulphur.. 14

(*b*) B. B. with soda on coal yields globules of—

(1) Copper: Fumes of arsenic............ 15
Fumes of sulphur............. 16
Fumes of antimony (more or less impure)..... 17

(2) Silver............................. 18

(3) Lead: Fumes of sulphur † 19
Fumes of arsenic................ 20
Coating, but no odor............ 21

(*c*) Not included above:

(1) Infusible: Fumes of sulphur... 22
Fumes of antimony............. 23
Fumes of arsenic............... 24
Coating, but no odor............ 31

* A white coating from the combustion of charcoal always appears, and must not be mistaken for a coating from the specimen.

† Galenite, which occurs under this head, sometimes gives fumes of sulphur mixed with those of arsenic.

(2) Fusible: Fumes of sulphur only....... 25
Fumes of arsenic only........... 26
Fumes of antimony only......... 27
Fumes of sulphur and arsenic.... 28
Fumes of sulphur and antimony.. 29
Acrid fumes... 30
Coating, but no odor............ 31

V. Magnetic either before or after ignition (gives no odorous or colored fumes).
(*a*) Fusible: Yields water.................... 32
Yields no water...................... 33
(*b*) Infusible: Yields water.................. 34
Yields no water...... 35

VI. B. B. with borax and soda on coal yields tin or copper............................. 36

VII. Not included in the preceding divisions:
(*a*) Fusible.
(1) Yields water: Micaceous structure... 37
After ignition reacts alkaline.... 38
B. B. intumesces................ 39
B. B. exfoliates.................. 40
Not included above.............. 41
(2) Yields no water; Micaceous structure. 42
Fuses to a metallic globule....... 43
After fusing reacts alkaline...... 44
Not included above. { B. B. intumesces or swells up......... 45
B. B. fuses quietly... 46

(*b*) Infusible, or fusibility above 5.

(1) Reaction for aluminum.

Yields water		47
Yields no water		48

(2) No reaction for aluminum.

Yields water		49
Yields no water.	H=3 or less	50
	H=4—6.5	51
	H=7 or more	52

TABLE II.

Final Examination.

1.

Effervesces in hydrochloric acid.
  Wholly soluble in water.................Trona
  Partly soluble in water, leaving white residue,
    Gay-Lussite
Effervesces in sulphuric acid.
  Taste sharp, bitter................ Nitrocalcite
  Taste saline,
    B. B. on coal deflagrates..............Nitre
    B. B. on coal does not deflagrate......Halite

2.

B. B. fumes of arsenic....... ....Arsenolite
B. B. no fumes of arsenic { Streak white...Glauberite
  Streak metallic....Copper

3.

Streak yellow, shining.... ....Jarosite
Streak white, faintly greenish.............Morenosite
Streak uncolored.........................Melanterite

4.

B. B. with soda on coal yields copper....Chalcanthite
B. B. becomes brown or black............Johnannite
B. B. becomes a white mass,
Which does not react alkaline..........Alunogen
Which reacts alkaline.
Fused assay moistened with cobalt solution becomes blue, B. B.
With borax gives manganese reaction, Bosjemanite
With borax no manganese reaction...Kalinite
Fused assay with cobalt does not become blue.
Is in fine grains...................Epsomite
Is in coarse grains or crystals......Mirabilite

5.

H=1..................................Sassolite
H=2—2½..................................Borax

6.

Colors blow-pipe flame green. { Color blue.....Azurite / Color green..Malachite }
Fuses to a white enamel, colors flame yellow, Gay-Lussite
Fused on coal gives a yellow coating........Bismutite
Not included above....................Remingtonite

7.

After ignition reacts alkaline.

Yields but traces of water.... ......Magnesite

Yields much water ....Hydromagnesite

After ignition does not react alkaline.

B. B. with soda on coal gives zinc vapors.

Streak pale green or bluish........Aurichalcite

Streak shining...................Hydrozincite

B. B. with soda on coal gives no zinc vapors, Lanthanite

8.

B. B. with soda on coal yields lead.

Dissolves in nitric acid, leaving white residue, Leadhillite

Dissolves in nitric acid, without residue, Cerussite

B. B. becomes magnetic... ....Siderite

B. B. blackens..........................Rhodonite

Reaction for strontium..................Strontianite

Reaction for barium...................... Witherite

Reaction for silicon.....................Wollastonite

9.

B. B. blackens and becomes magnetic........Siderite

B. B. with soda on coal gives zinc vapors..Smithsonite

Dissolves readily in cold dilute hydrochloric acid.

Dilute solution yields precipitate with sulphuric acid..................... .....Strontianite

Concentrated but not dilute solution yields precipitate with sulphuric acid.

B. B. falls to pieces..................Aragonite

B. B. does not fall to pieces............Calcite

Does not, or but slightly, effervesce in cold dilute hydrochloric acid, but readily if heated.

Concentrated solution gives precipitate with sulphuric acid...........................Dolomite

No precipitate with sulphuric acid......Magnesite

10.

Soils fingers chocolate brown....................Wad

H=4. Streak reddish brown, nearly black..Manganite

H=5—6. Streak brownish black, shining..Psilomelane

11.

H=2½—3½. Stains paper black.............Pyrolusite

H=5—5½. Color brownish black. Streak chestnut brown.............................Hausmannite

H=5—6. Color iron black to dark steel gray. Streak brownish black, shining................Psilomelane

H=5½—6½. Color iron black. Streak dark reddish brown................................Franklinite

H=6—6½. Streak and color dark brownish black, Braunite

12.

Infusible............................Sphalerite
Fusible.
  Magnetic or powder attracted by magnet before fusing............................Pyrrhotite
  Not magnetic before fusing.

H=3—4 { Color red or brown..........Bornite
Color brass yellow. Streak greenish black............Chalcopyrite
Color brass yellow. Streak bright, Millerite }

H=5.5. Color steel gray, tarnishing copper red ....Linnæite

H=6—6.5. { Color brass yellow.........Pyrite
Color bronze yellow (sometimes including to greenish)..Marcasite }

13.

Yields water.............................Scorodite
Yields no water.
  Decomposed in nitric acid, giving pink solution, Smaltite
  With nitric acid solution not pink.
    Heated in a closed tube gives red sublimate, then black......................Arsenopyrite
    Heated in a closed tube gives black sublimate at first......................Leucopyrite

14.

Yields mixed fumes of sulphur and antimony, Berthierite

15.

Yields water ....Pseudomalachite

Yields no water.

Slightly malleable. H=3.5... ....Whitneyite

Brittle. { Fracture uneven. H=3—3.5, Domeykite
Fracture subconchoidal, with granular surface. H=4.............Algodonite

16.

Fuses quietly. { H=2—2.5..................Aikinite
H=3.5—4........ ....Chalcopyrite

Fuses and boils with spirting............. Chalcocite

17.

Fumes thick, more or less mixed with sulphur and arsenic...............................Tetrahedrite

Faint coating of antimony, arsenic, and oxide of zinc, Enargite

18.

Fumes of sulphur only.................... Argentite

Fumes of sulphur and antimony. { Streak red..............Pyrargyrite
{ Streak black.............Stephanite

Fumes of sulphur and arsenic.............. Proustite
White coating on coal, with red or yellow border,
Hessite
Purple red fumes (iodine)......... .... Iodyrite
Acrid fumes... ....Cerargyrite

19.

B. B. gives fumes of sulphur and antimony, nearly volatilizes............................Geocronite
B. B. gives sulphur fumes only, or mixed with those of arsenic,
Lustre metallic.............Galenite
Lustre non-metallic..... Anglesite

20.

Lead globule produced on coal without soda .Mimetite
Lead globule only by use of soda.......Pyromorphite

21.

Fuses on coal to an angular globule.....Pyromorphite
Fuses to a globule not angular.
Streak white.
Fuses to a metallic globule or mass...Wulfenite
Fuses to a non-metallic globule or mass,
Anglesite

Streak not white,

Color red (sometimes mixed with yellow), ... Minium

Color yellow, reddish................. Massicot

22.

H=1................ .... Molybdenite

H=2—2.5. B. B. volatilizes.............. Cinnabar

H=3—4 { Reacts for zinc................ Sphalerite
Reacts for cadmium......... Greenockite

23.

H=3—4. Color yellowish green to black...... Partzite

H=4—5. Color yellow, white, or reddish... Cervantite

24.

Volatilizes, giving fumes of arsenic........... Arsenic

25.

Burns with a bluish flame................... Sulphur

Reaction for mercury...................... Cinnabar

Reaction for copper..................... Stromeyerite

Reaction for bismuth................... Bismuthinite

Reaction for zinc......................... Sphalerite

26.

Yields water.
Soft; color green....................Annabergite
H=1.5—2.5. Colors violet, rose, gray...Erythrite
H=3.5—4.5. Colors pale green, brown..Scorodite
Yields no water.
Volatilizes before the blow-pipe........Arsenic
Does not volatilize.
Color tin white, steel gray..........Smaltite
Color pale copper red................Niccolite

27.

Fumes of antimony only...................Antimony

28.

H=1.5—2..............................Orpiment
H=5.5.................................Gersdorffite

29.

Volatilizes before the blow-pipe..............Stibnite
Fuses with spirting.... ....Polybasite

30.

Acrid fumes (fluorine)......................Cryolite

31.

When gently heated gives coating of mercury,
Gold Amalgam

Yellow or white coating, or both.
Infusible.
Reacts for zinc....................Zincite
Reacts for tin....................Cassiterite
Fusible.
B. B. volatilizes.
Color steel gray, soils paper... .Tetradymite
Color and streak, silver white, reddish,
Bismuth
Not volatile.
Yields water......................Montanite
Yields no water.
H=1—2......................Molybdite
H=5..................... ....Willemite

32.

Fuses with intumescence, or swells up.
B. B. white or grayish white glass......Lepidolite
B. B. dark, blebby glass................Allanite
B. B. grayish black globule, bluish green flame,
H=1.5—2.......................Vivianite
H=3.5—4.............. ....Dufrenite
B. B. black or dark brown mass or globule.
H=4.5—5......................Childrenite
H=6—7....... ....Epidote
Fuses quietly.
H=2. Soft and adhesive when moist....Glauconite

H=2.5.

Lustre somewhat pearly... .....Corundophilite

Lustre dull or glistening............Thuringite

H=2.5—3.5. Lustre feeble, subresinous,
Hydrophite

H=3—4. Lustre between vitreous and pearly or brassy..........................Stilpnomelane

H=5. Lustre subresinous.............Triphylite

H=5.5—6. Lustre pearly.............Chloritoid

33.

Streak black, grayish black, or dark reddish brown.

Lustre vitreous....................Schorlomite

Lustre metallic or submetallic.

Color iron black..... ....Magnetite

Color brownish black.... ....Wolframite

Streak white or lighter than color.

B. B. with soda, a light coating of oxide of zinc.

Color red or gray....................Danalite

Color black................. .....Jeffersonite

Fuses to a glass lighter than specimen,
Tourmaline

Fuses to a glass or mass black or darker than specimen.

Fuses with intumescence.

Lustre vitreous or pearly.

Color green.......................Epidote

Color black or greenish black,
Amphibole or Pyroxene

Lustre submetallic or resinous......Allanite

Fuses without intumescence.

When powdered and moistened with sulphuric acid, on platinum wire, colors flame bluish green with red streaks..........Triphylite

Lustre pearly. Streak gray or brownish gray, Hypersthene

Lustre vitreous or resinous. Streak white, Garnet

34.

Streak uncolored or grayish.............. .Chloritoid
Streak red..................................Turgite
Streak brownish yellow or ochre yellow........Gothite
Streak yellowish brown.......................Limonite

35.

Streak metallic or submetallic, powder black or reddish brown..........................Menaccanite
Streak black...............................Magnetite
Streak dark reddish brown. B. B. with borax and soda, and strongly heated on coal, gives coating of oxide of zinc.................... .....Franklinite
Streak brown (no coating of oxide of zinc on coal). Chromite
Streak cherry red or reddish brown...........Hematite
Streak uncolored or grayish................Staurolite

36.

Yields tin................................Cassiterite
Yields copper.
  Fusible.
    Yields water..................Pseudomalachite
    Yields no water.......................Cuprite
  Infusible.
    Yields water.....................Chrysocolla
    Yields no water...................Melaconite

37.

B. B. exfoliates.
  Colors flame red........................Cookeite
  B. B. glows strongly, gives white or colorless glass, Euphyllite
  B. B. becomes white, then fuses to a dark gray mass...............................Jefferisite
B. B. intumesces.
  B. B. blackish mass, colors flame green...Autunite
  B. B. fuses to white or grayish glass....Lepidolite
B. B. neither exfoliates nor intumesces, Fahlunite or Margarite

38.

Fusibility=1..............................Cryolite
Fusibility=3..............................Gypsum

39.

Fuses to a black or colored mass ....Epidote
Fuses to a black or colored glass............Titantite
Fuses to a white or grayish glass (not blebby).
Fus.=2, not scaly.........................Pinite
Fus.=2, scaly............... ....Lepidolite
Fus.=4.............................Margarite
Fuses to a white enamel (not blebby).
H=3.5—4..........................Laumonite
H=5—5.5...... ....Thomsonite
Fuses to a glass, clear either hot or cold (not blebby)...... ....Datolite
Fuses to a glass, clear when hot, opaque when cold (not blebby)........................Amblygonite
Fuses to a blebby glass.
White, opaque .... Ekebergite
White, nearly opaque.. ....Chabazite
Grayish...... ....Chlorastrolite
Clear. ....Ulexite
Fuses to a blebby enamel like glass..........Prehnite
Fuses to a blebby enamel.................Epistilbite

40.

Fuses on the edges, colors flame red.........Cookeite
Fuses to a white enamel (not blebby),
Heulandite and Stilbite
Fuses to a blebby enamel or glass.........Apophyllite

41.

Fuses to a colorless glass.......Natrolite and Analcite
Fuses to a green glass............ . ...Eudialite
Fuses to a white enamel............... ....Pectolite
Fuses to white, blebby glass...............Fahlunite

42.

Fus.=1.................................Cryophyllite
Fus.=4, gives reaction for iron...............Biotite
Fus.=4, does not give iron reaction.......Phlogopite

43.

B. B. brittle globule.................... Hubnerite
B. B. malleable globule.
Not soluble in nitric acid...................Gold
Soluble in nitric acid.
Streak and color silver white, tarnishes...Silver
Color copper red. Streak metallic, shining, Copper

44.

Fused with soda on coal blackens silver if moistened.
B. B. with soda sinks into the coal.
Reaction for barium.....................Barite
Reaction for strontium................Celestite
B. B. with soda does not sink into the coal, Anhydrite
Does not blacken silver as above. { H=2.5.....Cryolite; H=4.......Fluorite }

45.

B. B. black or colored glass.

H=1—2........................Vermiculite

H=6.5—7. B. B. gives green color to oxidizing flame..................................Axinite

H=5—6.5.

B. B. yellow, brown, or black glass; with borax yellowish green glass.... ....Titanite

B. B. reddish brown or black glass; manganese reaction........ .... Rhodonite

B. B. greenish or brown glass; iron reaction, Vesuvianite

B. B. black mass..............................Epidote

B. B. grayish enamel (not blebby)........Cryophyllite

B. B. blebby enamel......................Epistilbite

B. B. blebby mass, white or lighter than color.	H=7—7.5	Tourmaline
	H=6—6.5	Zoisite
B. B. blebby glass, white or lighter than color.	H=5—6	Wernerite
	H=7—7.5	Tourmaline
B. B. white or colorless glass, not blebby.	H=5—6	Sodalite
	H=6.5—7	Spodumene

46.

Fuses to white or clear glass or enamel.

Soluble in hydrochloric acid..............Apatite

Partly soluble in hot hydrochloric acid not gelatinizing ....Labradorite

Gelatinizes in hydrochloric acid.

B. B. with soda, a faint coating of oxide of zinc.........................Willemite

B. B. with soda, no zinc coating.

B. B. with little soda a bead; with more, a slag........................Wollastonite

B. B. with soda a bead only........Nephelite

Not acted upon by hydrochloric acid either hot or cold.

Gives reaction for boron.............Danburite

Gives reaction for lithium..............Petalite

No reaction for boron or lithium.. .....Albite, Oligoclase, Orthoclase

Fuses to a black slag.........................Tephroite

Fuses to a black enamel; with soda gives zinc coating. Danalite

Fuses to a glass, black or darker than the specimen.

Streak grayish black............... Schorolomite

Streak white or paler than color.

H=6 or less..............Amphibole, Pyroxene

H=6.5—7.5............................Garnet

47.

H=1—2. Not micaceous; blow-pipe flame not red.
Plastic when wet... ....Kaolinite or Pholerite
Claylike or earthy, but not plastic......Halloysite
Neither claylike nor plastic..........Pyrophyllite
H=1.5. Structure micaceous...............Pihlite
H=2—2.5. Structure micaceous; blow-pipe flame not red ....Muscovite
Blow-pipe flame red............... .....Cookeite
H=2.5—3.5. Not micaceous; blow-pipe flame not red.
Argillaceous odor when breathed upon....Gibbsite
B. B. crumbles and burns white......Schrotterite
B. B. crumbles and does not burn white,
Allophane
B. B. colors flame green, if pulverized and moistened with sulphuric acid..............Wavellite
H=4.5—5. Does not color flame green....Calamine
H=5—6. B. B. colors flame bluish green, if pulverized and moistened with sulphuric acid........Lazulite
H=6.5—7. Does not color flame green.....Diaspore

48.

Micaceous structure.........................Pihlite
B. B. with soda not attacked..............Corundum
B. B. with soda yields a slag.
In octahedral crystals......................Spinel
Heated in a closed tube decrepitates strongly, giving thin scales......................Diaspore
Gives fluorine reaction....................Topaz
Colored, and color does not change B. B.,
Chrysoberyl

49.

Color white or becomes white B. B.

Andalusite, Cyanite, Fibrolite

Heated in close tube, blackens.

Soft like butter or cheese, but brittle when dry, Saponite

H=3—4........................... Genthite

H=6................................ Turquois

Resembles somewhat gum-arabic or resin... Deweylite

Micaceous structure.

H=2.5—3.

Iron reaction......................... Biotite

No iron reaction.................. Phlogopite

H=3.5—4.5......................... Euphyllite

B. B. exfoliates.* { H=1—1.5.................... Talc
H=2—3................ Penninite }

Reacts alkaline after ignition. { H=2.5....... Brucite
H=4—5... Yttrocerite }

Not included in the foregoing.

H=1—2. Streak black.................. Graphite

H=1—2. Streak uncolored, greenish.. Prochlorite

H=2—2.5. Streak uncolored, greenish.. Ripidolite

H=2.5—4. Streak white, slightly shining, Serpentine

H=3—4. Streak bluish black......... Warwickite

* Ripidolite from Willimantic, Ct., also exfoliates when heated. —*Dana.*

H=4.5—5. Streak white, B. B. with soda gives zinc coating on coal.................Calamine
H=4—5. Streak uncolored, greenish or grayish, Seybertite
H=5.5—6.5. Streak white..................Opal

50.

Pulverulent or earthy... ....Tungstite
H=1—2. Color black, soils paper...........Graphite
H=1—1.5. Not black or micaceous..............Talc
H=2—3 Micaceous structure.
Iron reaction...........................Biotite
No iron reaction......................Phlogopite

51.

Soluble in hydrochloric acid.................Apatite
Soluble with difficulty in hydrochloric acid..Monazite
Partly soluble in hydrochloric acid, leaving yellow residue.............................Hubnerite
Gelatinizes in hydrochloric acid.
Fluorine reaction....................Chondrodite
No fluorine reaction.....Forsterite or Chrysolite
Not acted upon by hydrochloric acid.
Lustre metallic or submetallic.
Color black.................Columbite
Color whitish steel gray..............Platinum
Color tin white; light steel gray.....Iridosmine
Phosphorescent when gently heated; becomes glassy, transparent on ignition.........Petalite

Powdered and moistened with sulphuric acid colors flame green, B. B............ ......Xenotime
With soda on coal fuses to a bead.
Lustre vitreous.....................Orthoclase
Lustre not vitreous.
Streak pale brown...................Rutile
Streak uncolored or grayish yellow, Brookite or Octahedrite
With little soda fuses to a bead: more, a slag, Enstatite
With soda fuses to a slag............. Microlite

52.

Decomposed by hydrochloric acid, gelatinizing. Forsterite or Chrysolite
Not acted upon by hydrochloric acid.
With soda fuses to a bead..... ..Quartz or Beryl
With little soda fuses to a bead; with more, to a slag...........................Tourmaline
B. B. with soda gives slag or not acted upon.
B. B. fine powdered wholly consumed. Diamond
Fused on coal with mixture of borax and soda gives zinc coating.............. ...Gahnite
B. B. loses transparency.................Iolite
B. B. unaltered.
Color green, greenish white......Chrysoberyl
Color red, blue, yellow, brown, gray, Corundum

Color black { Octahedral crystals. .....Spinel
Not octahedral.......Staurolite

White or colorless..................Zircon

B. B. colors grow lighter.

Lustre vitreous.................Tourmaline

Lustre adamantine..... ....Zircon

B. B. colors grow darker. Lighter varieties of Spinel and Staurolite—see a few lines above.

CHAPTER III.

DESCRIPTION OF SPECIES.

The classification of each species may be found by the numbers in the parenthesis, the Arabic numerals corresponding to the numbering of the species in chapter iv., the Roman to the numbering in chapter v.

Actinolite.—See Amphibole, of which actinolite is a variety.

Aikinite (49, vii.)—Orthorhombic, massive. Fracture uneven. H=2—2.5. G=6.1—6.8. Lustre metallic. Streak lead gray. Color blackish lead gray, tarnishes pale copper red. Decomposed by nitric acid. Fusible. Reacts for sulphur and copper. Composition: sulphur 16.7, bismuth 36.2, lead 36.1, copper 11.

Albite (135).—Triclinic, massive, either granular or lamellar. Fracture uneven. H=6—7. G=2.59—2.65. Lustre pearly, vitreous. Streak uncolored. Color usually white; also bluish, gray, green, reddish. Insoluble in acids. Fus.=4. Composition: silica 68.6, alumina 19.6, soda 11.8. See remarks under Orthoclase.

Algodonite (22, xiv.)—Minutely crystalline incrustations, massive and granular. Fracture subconchoidal with granular surface. Lustre metallic, often dull from exposure. Color steel gray, silver white. Streak nearly same as color. Soluble in nitric acid Fusible. Reacts for arsenic and copper. Composition: arsenic 16.50, copper 83.50.

Allanite (119). — Monoclinic, massive. Fracture subconchoidal, uneven. H=5.5—6. G=3—4.2. Lustre submetallic, pitchy, resinous, sometimes vitreous. Streak gray, greenish, brownish. Color brown, black, greenish, yellowish, grayish. Gelatinizes in hydrochloric acid Fusible, swelling up to a dark, blebby, magnetic glass. Reacts for iron. Composition varies; averages not far from silica 35, alumina 15, oxides of iron 20, cerium oxide 14, lime 12, together with water and other oxides.

Allophane (155). — Incrustations, stalactitic. Fracture imperfectly conchoidal. H=3. G=1.85—1.89. Lustre vitreous, subresinous. Streak uncolored. Color blue, green, brown, yellow, colorless. Gelatinizes in hydrochloric acid. Infusible. Reacts for water and aluminum. Composition: silica 23.75, alumina 40.62, water 35.63.

Alunogen (237, xxv.)—Monoclinic, massive, fibrous. Fracture uneven. H=1.5—2. G=1.6—1.8. Lustre vitreous, silky. Streak white. Color white, yellowish, reddish. Soluble in water. Fusible. Reacts for sulphur, aluminum, water. Taste like alum. Composition: alumina 15.4, sulphur trioxide 36.0, water 48.6.

Amblygonite (203, xxv.)—Triclinic, massive, sometimes columnar. Fracture uneven. H=6. G=3—3.11. Lustre pearly, vitreous. Streak white or paler than color. Color green, white, grayish, brownish. Soluble in sulphuric acid. Reacts for water, phosphorus, lithium, and aluminum. Fuses with intumescence. Composition: phosphorus pentoxide, alumina, and lithia, with sometimes small percentages of soda, potassa, and fluorine. Authorities do not agree as to the exact proportions.

Amphibole (108).—Monoclinic, imperfectly crystalline, fibrous, columnar, sometimes lamellar, massive granular. H=5—6. G=2.9—3.4. Lustre vitreous, pearly, in fibrous varieties silky. Streak uncolored or paler than color. Color white through green to black. Some varieties slightly acted upon by acid, others not. Fusibility and other reactions vary very widely, owing to the want of uniformity in composition in the different varieties.

Varieties: 1. Tremolite (magnesia-lime amphibole); occurs in crystalline as well as in columnar, fibrous, and massive granular forms. Color white to gray. Contains little or no iron. 2. Actinolite (magnesia-lime-iron amphibole). Forms same as in tremolite. Color bright green to grayish green. Contains a little iron. 3. Cummingtonite (iron-magnesia amphibole). Forms fibrous and fibro lamellar. Color gray to brown. Contains much iron. B. B. becomes magnetic. 4. Hornblende (aluminous-magnesia-lime-iron amphibole). Forms as in tremolite. Colors deep green, greenish black, and black. Sometimes contains much iron and becomes magnetic before the blow pipe. 5. Asbestus is a name given to tremolite, actinolite, and some other varieties of amphibole when they pass into fibrous varieties. The fibres are sometimes long and slender, and easily separable by the fingers, and have a silky lustre. When the fibres are knitted together the names mountain paper, mountain cork, mountain leather, or mountain wood are applied, according to the resemblances.

Amphibole and pyroxene are very much alike, and when there is no crystalline structure it is impossible to distinguish between them. Amphibole crystals are usually long and bladed, though sometimes stout. The angles of cleavage are 124° 30′ and 55° 30′. Has no cleavage parallel to the base. Pyroxene crystals are usually thick and stout, never having a slender, bladed form. The angles of cleavage parallel to the prism are

87° and 93°. Has cleavage parallel to the base.

Analcite (160).—Isometric, massive, granular. Cleavage cubic in traces. Fracture subconchoidal, uneven. H=5—5.5. G=2.22—2.29. Lustre vitreous. Streak white. Color white, sometimes greenish, bluish, reddish, yellowish, grayish. Gelatinizes in hydrochloric acid. Fuses to a colorless glass. Reacts for water, becoming opaque. Composition: silica 54.47, alumina 23.29, soda 14.07, water 8.17. See remarks under Natrolite.

Andalusite (139).—Orthorhombic, massive. Fracture subconchoidal, uneven. H=7.5. G=3—3.35. Lustre vitreous. Streak uncolored. Color white, red, violet, gray, brown, green. Insoluble in acid. Infusible. Reacts for aluminum. Composition: silica 36.8, alumina 63.2.

Andalusite, cyanite, and fibrolite are alike in chemical composition and many of their physical characters.

Andalusite is never fibrous. Crystallizes in right, nearly square prisms. Occurs also imperfectly columnar, sometimes radiated, and granular, also massive. Fibrolite crystals are inclined rhombic prisms, generally long, slender, rough, and sometimes striated. Is often fibrous or columnar massive. Cyanite occurs in long, flat, oblong, and nearly rectangular crystals, also as coarsely bladed columnar.

Anglesite (227, xv.)—Orthorhombic, massive, sometimes stalactitic. Fracture conchoidal. H=2.75 — 3. G=6.12 — 6.39. Lustre adamantine, resinous, vitreous. Streak uncolored. Color white, often tinged yellow, gray, green, blue. Soluble with difficulty in nitric acid. Fuses easily, decrepitating. Reacts for sulphur and lead. Composition: sulphur trioxide 26.4, lead oxide 73.6.

Anhydrite (226, xxviii.)—Orthorhombic, fibrous, lamellar, granular. Fracture uneven. H=3—3.5. G=2.899—2.985. Lustre vitreous, pearly. Streak grayish white. Color white, grayish, bluish, reddish, brick red. Soluble in hydrochloric acid. Fusible, yielding a bead which reacts alkaline. Reacts for sulphur. Composition: lime 41.2, sulphur trioxide 58.8.

Annabergite (206, xxi.)—Monoclinic, massive. Fracture uneven, earthy. Soft. Color green. Streak greenish white. Soluble in acid. Reacts for water, turning dark; also for arsenic, cobalt, and nickel. Fusible. Composition: arsenic acid 38.6, oxide of nickel 37.2, water 24.2; cobalt usually replaces a small per cent. of the nickel.

Antimony (11, vi.)—Rhombohedral, massive, lamellar, botryoidal. Fracture uneven. H=3—3.5. G=6.64—6.72. Lustre metallic. Streak and color tin white. Soluble in aqua regia. Fusible. Reacts for antimony. Composition: antimony, often containing silver, iron, or arsenic.

Apatite (198, xxviii.)—Hexagonal, globular, reniform, massive. Fracture conchoidal, uneven. H=4.5—5. G=2.92—3.25. Lustre vitreous, subresinous. Streak white. Color green, blue, white, gray, yellow, red, brown, never bright. Slowly soluble in nitric acid. Fuses with difficulty. Reacts for phosphorus. Composition: calcium phosphate, with calcium chloride or fluoride, or both.

Apophyllite (154).—Tetragonal, massive, lamellar. Fracture conchoidal, uneven. H=4.5—5. G=2.3—2.4. Lustre vitreous, pearly. Streak uncolored. Color white, grayish, flesh red; greenish, yellowish, or reddish tint. Decomposed by hydrochloric acid. Fuses and exfoliates. Reacts for potassium, fluorine, and water. Composition: silica 52.97, lime 24.72, potassium 5.20, water 15.90, fluorine 2.10.

Aragonite (248, xxviii.)—Orthorhombic and various non-crystalline forms. Fracture subconchoidal. H=3.5—4. G=2.931—2.947. Lustre vitreous, resinous. Streak uncolored. Color white, gray, green, yellow, violet. Soluble in acid, with effervescence. Infusible. After ignition reacts alkaline. Reacts for calcium. Composition: carbon dioxide 44, lime 56.

Argentite (24, x.)—Isometric, amorphous, and various forms not crystalline. Fracture subconchoidal, uneven. H=2-2.5. G=7.196—7.365. Lustre metallic. Color blackish lead gray. Streak same as color but shining. Partly soluble in nitric acid. Fuses with intumescence. Reacts for sulphur and silver. Composition: silver 87.1, sulphur 12.9.

Arsenic (10, v.)—Rhombohedral, massive, other forms. Fracture uneven, granular. H=3.5. G=5.93. Lustre submetallic. Color and streak tin white, tarnishes to dark gray. Soluble in nitric acid. Volatilizes without fusing. Reacts for arsenic. Composition: arsenic, often with traces of antimony, iron, silver, gold, bismuth.

Arsenolite (93, v)—Isometric, other forms not crystalline. Fracture conchoidal. H=1.5. G=3.698. Lustre vitreous, silky. Color white, sometimes reddish or yellowish Streak white, yellowish. Slightly soluble in hot water. Taste sweetish, astringent. Volatilizes. Reacts for arsenic. Composition: oxygen 24.24, arsenic 75.76.

Arsenopyrite (45, xxiii.)—Orthorhombic, columnar, granular. Fracture uneven. H=5.5—6. G=6—6.4. Lustre metallic. Streak grayish black. Color silver white to steel gray. Decomposed by nitric acid. Fusible. Reacts for sulphur, arsenic, and iron. Composition: arsenic 46, sulphur 19.6, iron 34.4; a little of the iron sometimes replaced by cobalt.

Asbestus.—See varieties of Amphibole and Pyroxene.

Augite.—See varieties of Pyroxene.

Aurichalcite (261, xvi.)—Incrustations, columnar, granular, lamellar. H=2. Lustre pearly. Color green, blue. Streak paler than color. Soluble in acid, with effervescence. Infusible. Reacts for copper, zinc, and water. Composition: carbon dioxide 16.2, copper oxide 29.2, zinc oxide 44.7, water 9.9.

Autunite (213, xxii.) — Orthorhombic. H=2—2.5. G=3.05—3.19. Lustre pearly, subadamantine. Streak yellowish. Color yellow. Soluble in nitric acid. Fusible. Reacts for phosphorus and water. Composition: phosphorus pentoxide 14.9, uranium trioxide 60.4, lime 5.9, water 18.8.

Axinite (121).—Triclinic, massive, lamellar. Fracture conchoidal. H=6.5—7.

G=3 271. Lustre glassy. Streak uncolored. Color brown, blue, gray. Insoluble in acids. Fuses with intumescence. Reacts for iron, manganese, and sometimes boron. Composition varies: one analysis by Rammelsburg gives silica 43.68, boric oxide 5.61, alumina 15.63, iron sesquioxide 9.45, manganese sesquioxide 3.05, lime 20.67, magnesia 1.70, potassium oxide 0.64.

Azurite (263, xiv.)—Monoclinic, massive, earthy. Fracture conchoidal. H=3.5—4.5. Lustre vitreous, adamantine. Color blue. Streak paler than color. Soluble in acids, with effervescence. Fusible. Reacts for copper and water. Composition: carbon dioxide 25.6, copper oxide 69 2, water 5.2.

Babingtonite (105).—Triclinic. Fracture conchoidal. H=5.5—6. G=3.35—3.37. Lustre vitreous. Streak white. Color dark greenish black. Not acted upon by acids. Fusible. Reacts for iron and manganese. Composition: silica 50.1, sesquioxide of iron 11.1, iron monoxide 10.0, manganese monoxide 7.4, lime 21.4.

Barite (224, xxix.)—Orthorhombic, globular, laminated. Fracture uneven. H=2 5—3.5. G=4.3—4.8. Lustre vitreous, resinous, pearly. Streak white. Color white, yellow, gray, blue, red, brown. Insoluble in acids. Fus.=3. Reacts for barium and sulphur. Composition: baryta 65.7, sulphur trioxide 34.3.

Barnhardtite (39, xiv.)—Massive. Fracture conchoidal, uneven. H=3.5. G=4.521. Lustre metallic. Streak grayish black, slightly shining. Color bronze yellow. Decomposed by nitric acid. Reacts for sulphur, iron, and copper. Composition: sulphur 30.5, copper 48.2, iron 21.3.

Berthierite (46, vi.)—Massive, elongated prisms. H=2—3. G=4—4.3. Lustre metallic. Streak iron black. Color dark steel gray, brownish. Soluble in hydrochloric acid. Reacts for sulphur, antimony, and iron. Composition: sulphur 29.9, antimony 57.0, iron 13.1.

Beryl (109).—Hexagonal, coarsely columnar. Fracture conchoidal, uneven. H=7.5—8. G=2.63—2.76. Lustre vitreous, resinous. Streak white. Color green, blue, yellow, white. Not acted upon by acids. Fusibility=5.5. Composition: silica 66.8, alumina 19.1, glucina 14.1.

Biotite (125).—Hexagonal, micaceous, in scales. Fracture lamellar. H=2.5—3. G=2.7—3.1. Lustre splendent, vitreous, submetallic. Streak uncolored. Color green, black, brown, red, white. Decomposed by sulphuric acid. Fuses on thin edges. Reacts for iron. Results of analyses vary much. A specimen from Portland, Conn., gave silica 35.61, alumina 20.03, iron sesquioxide 0.13, iron monoxide 21.85, magnesia 5.23, potash 9.69, together with small amounts of manganese, monoxide, soda, fluorine, chlorine, and titanic oxide.

Bismuth (12, vii.)—Hexagonal, other forms not crystalline. Brittle, no characteristic fracture. H=2—2.5. G=9.727. Lustre metallic. Streak and color silver white with a reddish tint, tarnishes. Soluble in nitric acid. Fusible, and reacts for bismuth. Composition: bismuth, sometimes containing traces of arsenic, sulphur, or tellurium, *Bismuthinite* (18, vii.)—Orthorhombic, massive. Fracture conchoidal. H=2. G=6.4. Lustre metallic. Streak and color lead gray to tin white, tarnishes. Soluble in hot nitric acid. Fuses easily. Reacts for sulphur and bismuth. Composition: sulphur 18.75, bismuth 81.25.

Bismutite (264, vii.)—Pseudomorphous acicular crystals, amorphous. H=1.5—4.5. G=6.86—7.67. Lustre vitreous, dull. Streak white, greenish gray. Color white, green, yellow, yellowish gray. Soluble in nitric acid, with slight effervescence. Fuses easily. Reacts for bismuth and water. Composition: carbon dioxide 6.4, bismuth trioxide 90.1, water 3.5.

Borax (218, xxxii.)—Monoclinic. Fracture conchoidal. H=2—2.5. G=1.716. Lustre vitreous, resinous. Streak white. Color white, grayish, bluish, greenish. Soluble in water. Taste alkaline, sweetish. Fuses to a transparent glass after much intumescence. Reacts for boron, sodium, and water. Composition: boric oxide 36.6, soda 16.2, water 47.2.

Bornite (26, xiv.)—Isometric, massive. Fracture conchoidal, uneven. H=3. G=4.4—5.5. Lustre metallic. Streak pale grayish black. Color copper red to brown, tarnishes. Partly soluble in nitric acid. Fusible. Reacts for copper, iron, and sulphur. Composition of crystallized varieties: sulphur 28.06, iron 16.36, copper 55.58. In other varieties the proportions of iron and copper vary.

Bosjemanite (239, xxv.)—System of crystallization doubtful; occurs in acicular or capillary crystallization, as crusts and efflorescences. Streak and color white. Soluble in water. Has a weak alum taste. Fusible. Reacts for aluminum, sulphur, manganese, and water. Composition: sulphur trioxide 36.82, alumina 11.83, manganese monoxide 2.73, magnesia 3.06, water 45.56.

Braunite (79, xxiv.)—Tetragonal, massive. Fracture uneven. H=6—6.5. G=4.75—4.82. Lustre submetallic. Streak and color dark brownish black. Soluble in hydrochloric acid, yielding chlorine. Infusible. Reacts for manganese. Composition varies somewhat. One analysis gives manganese monoxide 80.94, oxygen 8.08, baryta 0.44, silica 8.63, water 1.00, lime 0.91.

Breithauptite (36, xxi.)—Hexagonal, arborescent. Fracture uneven, subconchoidal. H=5.5. G=7.541. Lustre metallic. Streak reddish brown. Color light copper red, violet. Decomposed by nitric acid. Fusible. Reacts for antimony and nickel. Composition: antimony 67.4, nickel 32.6.

Brookite (81, xix.)—Orthorhombic, massive. Fracture uneven. H=5.5—6. G=4.12—4.23. Lustre metallic, adamantine. Streak uncolored, grayish, yellowish. Color brown, red, yellow, black. Infusible. Reacts for titanium and sometimes for iron. Composition: titanium 61.00, oxygen 39.00; sometimes contains a small percentage of iron sesquioxide.

It occurs generally in thin plates, which are referred to the right rhombic prism, and has a very indistinct cleavage. It is thus distinguished from octahedrite, which is always in octahedral or tabular crystals having perfect cleavage, and from rutile crystals, which are tetragonal with perfect cleavage.

Brucite (88, xxvii.)—Rhombohedral, massive, usually foliated, sometimes fibrous. Fracture uneven. H=2.5. G=2.35—2.46. Lustre pearly, waxy, vitreous, silky. Streak white. Color white, gray, blue, green. Soluble in acid. Infusible. Reacts for magnesium and water. Composition: magnesia 68.97, water 31.03.

Calamine (151).—Orthorhombic, massive and imitative forms. Fracture uneven. H=4.5—5. G=3.16—3.9. Lustre vitreous, subpearly, adamantine. Streak white. Color white, bluish, greenish, brown. Gelatinizes in acids. Fus.=6. Reacts for zinc and water, and sometimes aluminum (Brush). Composition: silica 25.00, zinc oxide 67.5, water 7.5.

Calcite (243, xxviii.)—Rhombohedral, massive and imitative forms. Fracture conchoidal. H=2.5—3.5, earthy kinds=1. G=2.508—2.778. Lustre vitreous, earthy. Streak white, grayish. Color white; pale shades of gray, red, green, blue, violet, and yellow; brown or black when impure. Soluble with effervescence in acid. Infusible. After ignition reacts alkaline. Composition : carbon dioxide 44, lime 56.

Caledonite (229, xv.)—Monoclinic. Fracture uneven. H=2.5—3. G=6.4. Lustre resinous. Streak greenish white. Color green. Partly soluble in nitric acid, often with slight effervescence. Fusible. Reacts for sulphur and lead. Composition: sulphur trioxide 19.1, lead oxide 65.2, copper oxide 11.4, water 4.3.

Cassiterite (75, xviii.)—Tetragonal, massive, reniform. Fracture subconchoidal, uneven. H=6—7. G=6.4—7.1. Lustre adamantine. Streak white, grayish, brownish. Color brown, black, red, gray, white, yellow. Slightly acted upon by acids. Infusible. Reacts for tin. Composition: tin 78.67, oxygen 21.33.

Celestite (225, xxx.)—Orthorhombic, fibrous, globular. Fracture conchoidal uneven. H=3—3.5. G=3.92—3.975. Lustre vitreous, pearly. Streak white. Color white, bluish, reddish. Insoluble in acids. Fus.=3. Reacts for sulphur and strontium. Composition: sulphur trioxide 43.6, strontia 56.4.

Cerargyrite (56, x.)—Isometric, massive. Fracture conchoidal. H=1—1.5. G=5.552. Lustre resinous, adamantine. Streak shining. Color gray, green, whitish, blue, brown on exposure, colorless when perfectly pure. Insoluble in acid. Fuses easily. Reacts for silver. Composition: chlorine 24.7, silver 75.3.

Cerolite (173).—Massive, reniform, compact or lamellar. Fracture conchoidal. H=2—2.5. G=2.3—2.4. Lustre vitreous, resinous. Streak uncolored. Color white, yellow, reddish. Infusible, and blackens before the blow-pipe. Reacts for water. Feels greasy. Composition, according to Kühn: silica 46.96, magnesia 31.26, water 21.22.

Cerussite (251, xv.)—Orthorhombic, massive, stalactitic. Fracture conchoidal. H=3—3.5. G=5.4—6.48. Lustre adamantine, vitreous, resinous. Streak uncolored. Color white, gray, blue, green, black. Soluble with effervescence in nitric acid. Fuses easily. Reacts for lead. Composition: carbon dioxide 16.5, lead oxide 83.5.

Cervantite (96, vi.)—Orthorhombic, massive. H=4—5. G=4.084. Lustre greasy, pearly, earthy. Streak yellowish white, white. Color yellow, white, reddish white. Soluble in hydrochloric acid. Infusible. Reacts for antimony. Composition: antimony 79.2, oxygen 20.8.

Chabazite (161).—Rhombohedral. Fracture uneven. H=4—5. G=2.08—2.19. Lustre vitreous. Streak uncolored. Color white, red. Decomposed by hydrochloric acid, with separation of slimy silica. Fuses with intumescence. Reacts for water. Composition: silica 50.50, alumina 17.26, lime 9.43, potassium oxide 1.98, water 20.83.

Chalcanthite (236, xiv.)—Triclinic, amorphous, stalactitic, reniform. Fracture conchoidal. H=2.5. G=2.213. Lustre vitreous. Streak uncolored. Color blue. Soluble in water. Taste metallic, nauseous. Fusible. Reacts for copper, sulphur, and water. Composition: sulphur trioxide 32.1, copper oxide 31.8, water 36.1.

Chalcocite (29, xiv.) — Orthorhombic, massive. Fracture conchoidal. H=2.5—3. G=3.5—3.8. Lustre metallic. Streak black·

ish lead gray, sometimes shining. Color blackish lead gray. Soluble in nitric acid. Fusible. Reacts for sulphur and copper. Composition: sulphur 20.2, copper 79.8.

Chalcopyrite (38, xiv.)—Tetragonal, massive. Fracture conchoidal, uneven. H=3.5—4. G=4.1—4.3. Lustre metallic. Streak greenish black. Color brass yellow, tarnishes, sometimes iridescent. Dissolves in nitric acid, with separation of sulphur. Fusible. Reacts for sulphur, copper, and iron. Composition: sulphur 34.9, copper 34.6, iron 30.5.

Childrenite (211, xxv.)—Orthorhombic. Fracture uneven. H=4.5—5. G=3.18—3.24. Lustre vitreous, resinous. Streak white, yellowish. Color yellowish white, brown, black. Soluble in hydrochloric acid. Swells up and fuses on the edges to a black mass. Reacts for phosphorus, iron, manganese, and water. Composition: phosphorus pentoxide 28.92, alumina 14.44, iron monoxide 30.68, manganese monoxide 9.07, magnesia 0.14, water 16.98 (Rammelsberg).

Chlorastrolite (153).—Massive, finely radiated or stellated. Fracture fibrous. H=5.5—6. G=3.18. Lustre pearly. Streak white. Color bluish green. Soluble in hydrochloric acid, with separation of silica as a flocky precipitate. Fuses with intumescence. Composition: silica 37.6, alumina 24.6, iron sesquioxide 6.4, lime 18.7, sodium oxide 5.2, water 7.5.

Chloritoid (191).—Monoclinic or triclinic, massive, foliated, in scales. Fracture lamellar, scaly. H=5.5—6. G=3.5—3.6. Lustre pearly. Streak uncolored, grayish, greenish. Color dark gray, green, black. Decomposed by sulphuric acid. Fuses with great difficulty. Reacts for iron and water. Composition: silica 24.0, alumina 40.5, iron monoxide 28.4, water 7.1.

Chondrodite (137). — Orthorhombic, in grains or masses. Fracture subconchoidal, uneven. H=6—6.5. G=3.118—3.24. Lustre vitreous, resinous. Streak white, yellowish, grayish. Color white, yellow, red, brown, green, black. Gelatinizes in acids. Infusible. Reacts for iron and fluorine. Composition: silica 34.10, iron monoxide 7.28, magnesia 53.72, fluorine 4.14, alumina 0.48.

Chromite (73, xxiii.)—Isometric, massive. Fracture uneven. H=5.5. G=4.321. Lustre submetallic. Streak brown. Color iron black, brownish black. Not acted upon by acids. Infusible, or with difficulty rounded on thin edges in the reducing flame. Reacts for iron and chromium. Composition: iron monoxide 32, chromium sesquioxide 68.

Chrysoberyl (74, xxv.)—Orthorhombic. Fracture conchoidal, uneven. H=8.5. G=3.5–3.84. Lustre vitreous. Streak uncolored. Color green, greenish white. Not acted upon by acids. Infusible. Reacts for aluminum. Composition: alumina 80.2, glucina 19.8.

Chrysocolla (150, xv.)—Opal-like or enamel-like, earthy, botryoidal, crystallization not apparent. Fracture conchoidal. H=2—4. G=2—2.238. Lustre vitreous, earthy. Streak white when pure. Color green, blue, brown, black. Decomposed by acids. Infusible. Reacts for copper and water. Composition when pure: silica 34.2, copper oxide 45.3, water 20.5.

Chrysolite (111).—Orthorhombic, massive. Fracture conchoidal. H=6—7. G=3 33—3.5. Lustre vitreous. Streak uncolored, sometimes yellowish. Color green, brownish, grayish red. Decomposed in hydrochloric and sulphuric acids, with separation of gelatinous silica. Infusible, but whitens. Reacts for iron. Composition: silica 41.39, magnesia 50.90, iron monoxide 7.71.

Cinnabar (31, xiii.)—Rhombohedral, massive. Fracture subconchoidal, uneven. H=2—2.5. G=8.998. Lustre adamantine, metallic. Streak scarlet. Color red to lead gray. Soluble in aqua regia. Volatilizes. Reacts for sulphur and mercury. Composition: sulphur 13.8, mercury 86.2.

Columbite (196, xxiii.)—Orthorhombic, massive. Fracture subconchoidal, uneven. H=6. G=5.4—6.5. Lustre submetallic. Streak dark red, black. Color black, often iridescent. Insoluble in acids. Infusible. With soda and nitre reacts for manganese; also reacts for iron, but the reaction is apt to be obscured by other metals present. Composition of a specimen from Haddam, Con.: columbic pentoxide 51.53, tantalic pentoxide 28.55, tungstic trioxide 0.76, tin dioxide 0.34, zirconia 0.34, iron monoxide 13.54, manganese monoxide 4.97, water 0.16.

Cookeite (185).—In minute scales and slender prisms. Micaceous structure. H=2.5. G=2.7. Lustre pearly. Streak uncolored. Color white to yellowish green. Partly decomposed by sulphuric acid. Fuses with difficulty and exfoliates. Reacts for lithium, aluminum, and water. An analysis of a specimen gave: silica 34.93, alumina 44.91, lithia 2.82, potassium oxide 2.57, water 13.79, silicon fluoride 0.47.

Copper (7, xiv.) — Isometric, massive. Fracture hackly. H = 2.5 — 3. G = 8.838. Lustre metallic. Streak metallic, shining. Color copper red. Dissolves readily in nitric acid, with evolution of nitrous fumes, solution giving deep blue with ammonia. Fuses and becomes covered with a coating of black oxide.

Corundophyllite (190).—Monoclinic. Fracture lamellar. H=2 5. G=2.9. Lustre pearly. Streak colorless, greenish. Color green. Decomposed by sulphuric acid. Fuses with difficulty. Reacts for iron and water. Composition of a specimen from Chester, Mass.: silica 24.0, alumina 25 9, iron monoxide 14.8, magnesia 22.7, water 11.9.

Corundum (66, xxv.)—Rhombohedral, massive. Fracture conchoidal, uneven. H=9. G=3.909—4.16. Lustre vitreous. Streak uncolored. Color blue, red, yellow, brown, gray. Not acted on by acids. Infusible. Reacts for aluminum if finely pulverized and subjected for a long time to blow-pipe flame. Composition: aluminum 53.4, oxygen 46.6.

Cryolite (60, xxv.)—Orthorhombic, massive. Fracture uneven. H=2.5. G=2.9—3.077. Lustre vitreous, pearly. Streak white. Color usually white, sometimes reddish, brownish, brick red, seldom black. Dissolves in sulphuric with evolution of hydrofluoric acid. Fuses easily. Reacts for fluorine and sodium. After long fusing a crust of alumina remains, which, with the cobalt solution, reacts for aluminum. Composition: aluminum 13.0, sodium 32.8, fluorine 54.2.

Cryophyllite (128).—Orthorhombic, massive. Fracture lamellar. H=2—2.5. G=2.909. Lustre pearly, resinous. Streak grayish to greenish. Color green, brownish red. Decomposed by acids if in fine powder. Fuses easily with intumescence to a grayish enamel. Reacts for lithia. An analysis of a specimen gave: silica 51.49, alumina 16.77, iron sesquioxide 1.97, iron monoxide 7.98, manganese sesquioxide 0.34, magnesia 0.76, lithia 4.06, potassium oxide 13.15.

Cummingtonite.—See *Amphibole.*

Cuprite (61, xiv.)—Isometric, massive, earthy. Fracture conchoidal, uneven. H=3.5—4. G=5.85—6.15. Lustre adamantine, submetallic, earthy. Streak brownish red, shining. Color red, of various shades. Soluble in strong hydrochloric acid. Fuses. Reacts for copper. Composition: oxygen 11.2, copper 88.8.

Cyanite (141).—Triclinic, coarsely bladed columnar to subfibrous. Fracture uneven. H=5—7.5. G=3.45—3.7. Lustre vitreous, pearly. Streak uncolored. Color blue, white, gray, green, black. Insoluble in acids. Infusible. Reacts for aluminum. See remarks under Andalusite.

Danalite (114).—Isometric. Fracture subconchoidal, uneven. H=5.5—6. G=3.427. Lustre vitreo-resinous. Streak lighter than color. Color flesh red to gray. Fuses on edges to black enamel. Reacts for zinc. Decomposed by hydrochloric acid, with evolution of sulphuretted hydrogen and separation of gelatinous silica. One of J. P. Cooke's analyses gives: silica 31.73, iron monoxide 27.40, manganese monoxide 6.28, zinc oxide 17.51, glucina 13.83, sulphur 5.48.

Danburite (122).—Triclinic, massive. H=7. G=2.95—2.958. Lustre vitreous. Streak white, slightly yellowish. Color yellow, whitish. Feebly soluble in hydrochloric acid. Fusible. Reacts for boron. Composition: silica 48.9, boron trioxide 28.4, lime 22.7.

Datolite (143). — Monoclinic, botryoidal, globular, massive. Fracture uneven, subconchoidal. H=5—5.5. G=2.8—3. Lustre vitreous. Streak white. Color white, gray, green, red, yellow. Gelatinizes with hydrochloric acid. Fuses with intumescence. Reacts for boron and water. Composition: silica 37.5, boron trioxide 21.9, lime 35.0, water 5.6.

Deweylite (172).—Amorphous, resembles gum arabic. H=2—2.5. G=2.19—2.31. Lustre greasy. Streak uncolored. Color whitish, yellowish, yellow, greenish, reddish. Decomposed by hydrochloric acid. Fuses with difficulty. Reacts for water. Composition: silica 40.2, magnesia 35.7, water 24.1.

Diamond (14, viii.)—Isometric, rarely massive. Fracture conchoidal. H=10. G=3.5295—3.55. Lustre adamantine. Color colorless, white; often tinged yellow, red, orange, green, blue, brown; sometimes black. Infusible. In fine powder burns before the blow-pipe. Not acted upon by acids. Composition: carbon.

Diaspore (84, xxv.)—Orthorhombic, massive, stalactitic. Fracture uneven. H=6.5—7. G=3.3—3.5. Lustre vitreous, pearly. Streak white, grayish. Color white, grayish, greenish, brown. Not acted upon by acid. Infusible. Reacts for aluminum, also water at high temperature. Composition: alumina 85.1, water 14.9.

Dolomite (244, xxviii.)—Rhombohedral, amorphous, imitative forms. Fracture conchoidal, uneven. H=3.5—4. G=2.8—2.9. Lustre vitreous, pearly. Streak white, grayish. Color white, gray, green, red, yellow, black. In lumps is slowly soluble with effervescence in hydrochloric acid. Infusible. After ignition reacts alkaline. Composition: calcium carbonate 54.35, magnesium carbonate 45.65.

Domeykite (21, xiv.)—Massive and imitative forms. Fracture uneven. H=3—3.5. G=7—7.5. Lustre metallic, often dull. Streak white, gray. Color tin white, steel gray, brown; iridescent tarnish. Soluble in nitric acid. Fusible. Reacts for arsenic and copper. Composition: arsenic 28.3, copper 71.7.

Dufrenite.—See page 169.

Ekebergite (130).—Tetragonal, massive.

Fracture subconchoidal. H=5.5—6. G=2.74. Lustre vitreous, pearly, greasy. Streak uncolored. Color white, gray, greenish, bluish, reddish. Partly decomposed by hydrochloric acid. Fuses with intumescence. Composition: silica 51.7, alumina 26.3, lime 16.1, sodium oxide 5.9.

Enargite (54, xiv.)—Orthorhombic, massive, columnar. Fracture uneven. H=3. G=3.43—3.45. Lustre metallic. Streak grayish black, with powder of metallic lustre. Color grayish to iron black. Soluble in aqua regia. Fusible. Reacts for sulphur, arsenic, and copper; sometimes traces of antimony and zinc. Composition: sulphur 32.5, arsenic 19.1, copper 43.8.

Enstatite (100).—Orthorhombic, massive. H=5.5. G=3.1—3.3. Lustre pearly, vitreous. Streak uncolored, grayish. Color white with grayish, yellowish, or greenish tint. Insoluble in hydrochloric acid. Fus.=6. Composition: silica 60, magnesia 40. The variety Bronzite is green or brown, has an adamantine pearly to submetallic or bronze-like lustre, and contains iron.

Epidote (118).—Monoclinic, massive, fibrous or granular. Fracture uneven. H=6—7. G=3.25—3.5. Lustre vitreous, pearly, resinous. Streak uncolored, grayish. Color green, yellow, brown, black, red, gray. Partly decomposed by hydrochloric acid. Fuses with intumescence. Reacts for iron and sometimes manganese and water. One analysis gave silica 37.83, alumina 22.63, iron sesquioxide 15.05, iron monoxide 0.93, lime 23.27, water 2.05.

Epistilbite (163).—Orthorhombic, granular. Fracture uneven. H=4—4.5. G=2.249—2.363. Lustre pearly, vitreous. Streak uncolored. Color white, bluish, yellowish, reddish. Dissolves in concentrated hydrochloric acid. Fuses with intumescence. Reacts for water. Composition: silica 59.0, alumina 16.9, lime 7.3, sodium oxide 2.0, water 14.8. See remarks under Heulandite.

Epsomite (233, xxvii.)—Orthorhombic, botryoidal masses, fibrous crusts. Fracture uneven. H=2.25. G=1.751. Lustre vitreous, earthy. Streak and color white. Soluble in water. Bitter, saline taste. Fusible.

Reacts for magnesium, sulphur, and water. Composition: magnesia 16.3, sulphur trioxide 32.5, water 51.2.

Erythrite (205, xx.)—Monoclinic, imitative forms, earthy. Fracture not observable. Lustre pearly, adamantine, dull. H=1.5—2.5. G=2.948. Streak paler than color, powder lavender blue. Color violet rose, greenish gray. Soluble in hydrochloric acid, giving a rose-red solution. Easily fusible. Reacts for arsenic, cobalt, and water. Composition: arsenic pentoxide 38.40, cobalt oxide 37.56, water 24.04.

Eudialyte (109a).—Rhombohedral, massive. Fracture subconchoidal, splintery. H=5.5. G=2.9—3.01. Lustre vitreous. Streak uncolored. Color various shades of red. Gelatinizes in hydrochloric acid. Fus. =2.5. Reacts for iron, manganese, and sodium. Composition uncertain; one analysis gave silica 50.38, zirconia 15.60, tantalum pentoxide 0.35, iron oxide 6.37, manganese monoxide 1.61, lime 9.23, sodium oxide 13.10, chlorine 1.48, water 1.25.

Euphyllite (184).—Micaceous structure.

H=3.5—4.5. G=2.963—3.008. Lustre pearly, adamantine. Streak uncolored. Color white, grayish, greenish. Insoluble in acid. Fuses with difficulty, exfoliating. Reacts for water and gives traces of fluorine. Composition: silica 41.6, alumina 42.3, lime 1.5, potassium oxide 3.2, sodium oxide 5.9, water 5.5.

Fahlunite (182).—Prisms, from pseudomorphism after iolite. Fracture lamellar. H=3.5—5. G=2.6—2.8. Lustre pearly, waxy. Streak colorless. Color various shades of green and brown, also black. Not acted upon by acids. Fusible. Reacts for water. One analysis gave: silica 44.6, alumina 30.10, iron oxide 3.86, manganese monoxide 2.24, magnesia 6.75, lime 1.35, potassium oxide 1.98, water 9.35, trace of fluorine.

Fahlunite may be distinguished from margarite by color, crystallization, and cleavage. Fahlunite is grayish green to dark olive green and sometimes black. It occurs in six to twelve-sided prisms, with basal cleavage which is usually not perfect. Margarite is reddish white, grayish, or yellowish. It crystallizes in the orthorhombic system, but with monoclinic aspect and lateral planes striated. Cleavage is basal and always perfect. It occurs usually in aggregated laminæ, but sometimes massive with a scaly structure.

Fibrolite (140).—Monoclinic, fibrous or columnar massive. Fracture uneven. H=6—7. G=3.2—3.3. Lustre vitreous. Streak uncolored. Color brown, grayish white, green. Insoluble in acids. Infusible. Reacts for aluminum. For data to distinguish fibrolite from andalusite and cyanite, see remarks under Andalusite.

Fluorite (58, xxviii.)—Isometric, massive. Fracture flat, conchoidal, splintery. H=4. G=3.01—3.25. Lustre vitreous. Streak white. Color white, yellow, green, rose, red, blue, brown. In sulphuric acid gives fumes of hydrofluoric acid which corrode glass. Fusible. After fusing reacts alkaline. Reacts for fluorine. Composition: fluorine 48.7, calcium 51.3.

Forsterite (110).—Orthorhombic, granular, massive. Fracture conchoidal. H=6—7. G=3.21—3.33. Lustre vitreous. Streak uncolored. Color white, yellow, gray, bluish, greenish. Gelatinizes in hydrochloric acid. Infusible. Composition: silica 42.86, magnesia 47.14.

Franklinite (72, xxiii.)—Isometric, massive. Fracture conchoidal. H=5.5—6.5. G=5.069—5.091. Lustre metallic. Streak dark reddish brown. Color iron black. Soluble in hydrochloric acid, with evolution of chlorine in small quantities. Infusible. Reacts for iron, manganese, and zinc. One analysis gave: iron sesquioxide 67.42, iron monoxide 15.65, zinc oxide 6.78, manganese monoxide 9.53, alumina 0.65.

Gahnite (70, xxv.)—Isometric. Fracture conchoidal. H=7.5—8. G=4—4 6. Lustre vitreous, greasy. Streak grayish. Color green, black, brown, yellowish, bluish. Very slowly soluble in strong sulphuric acid. Infusible. Reacts for zinc. Composition: alumina 61.3, zinc oxide 38.7.

Galenite (25, xv.)—Isometric, tabular, granular, seldom fibrous. Fracture subconchoidal, even. H=2.5—2.75. G=7.25—7.7. Lustre metallic. Streak and color lead gray. Soluble in nitric acid. Fusible. Reacts for sulphur, lead, and sometimes arsenic and antimony. Composition: sulphur 13.4, lead 86.6.

Garnet (115).—Isometric, massive granular, lamellar. Fracture subconchoidal, uneven. H=6.5—7.5. G=3.15—4.3. Lustre vitreous, resinous. Streak white. Color red, brown, green, white, black, yellow. Some varieties partly decomposed by acids. Fuses readily to a brown or black glass. a few varieties excepted. Most kinds react for iron, some varieties for manganese and chromium. Composition varies widely, but all kinds are unisilicates of elements in the sesquioxide and protoxide states. There are three groups —alumina garnet, iron garnet, and chrome garnet, named from the nature of the predominating sesquioxide.

Gay-Lussite (255, xxxii.)—Monoclinic. Fracture conchoidal. H=2—3. G=1.92—1.99. Lustre vitreous. Streak uncolored, grayish. Color white, yellowish. Soluble in acids with effervescence; partly soluble in water. Fuses readily. Reacts for sodium and water. Composition: sodium carbonate 35.9, calcium carbonate 33.8, water 30.3.

Genthite (175).—Amorphous. H=3—4,

but sometimes very soft, yielding to the nail. G=2.409. Lustre resinous. Streak greenish white. Color green, yellowish. Decomposed by hydrochloric acid. Infusible. Reacts for nickel and water. One analysis gave: silica 35.36, nickel oxide 30.64, iron monoxide 0.24, magnesia 14.60, lime 0.26, water 19.09.

Geocronite (51, xv.)—Orthorhombic, massive, earthy. Fracture uneven. H=2—3. G=6.4—6.6. Lustre metallic. Streak and color lead gray, grayish blue. Soluble in hot hydrochloric acid, with evolution of hydrogen sulphide and separation of lead chloride. Fuses easily. Reacts for sulphur, lead, and antimony. Composition: sulphur 16.5, lead 66.8, antimony 16.7.

Gersdorffite (42, xxi.)—Isometric, massive. Fracture uneven. H=5.5. G=5.6—5.9. Lustre metallic. Streak grayish black. Color silver white, steel gray, tarnishes. Decomposed by nitric acid, with separation of sulphur and arsenic trioxide. Fusible. Reacts for arsenic, sulphur, iron, and, with successive additions of borax, for cobalt and nickel. Composition: arsenic 45.5, sulphur 19.4, nickel 35.1; iron and cobalt usually replace a part of the nickel.

Gibbsite (89, xxv.)—Hexagonal, imitative forms. H=2.5—3.5. G=2.3—2.4. Lustre pearly, vitreous. Streak white. Color white, grayish, greenish, reddish. Soluble in concentrated sulphuric acid. Infusible. Reacts for aluminum and water. Composition: alumina 65.6, water 34.4.

Glauberite (230, xxxii.) — Monoclinic. Fracture conchoidal. H=2.5—3. G=2.64—2.85. Lustre vitreous. Streak white. Color yellow, gray, red. Soluble in water. Taste slightly saline. Fusible. Reacts for sodium and sulphur. Composition: sulphur trioxide 57.5, lime 20.1, sodium oxide 22.4.

Glauconite (170).—Amorphous. H=2. G=2.2—2.4. Lustre dull, glistening. Streak and color various shades of green. Some varieties decomposed by hydrochloric acid, others not acted upon. Fusible. Reacts for iron and water. Is a hydrous silicate of iron and potassium, but always occurs impure.

Goethite (85, xxiii.)—Orthorhombic, massive, imitative forms. Fracture uneven, conchoidal. H=5—5.5. G=4—4.4. Lustre imperfect adamantine. Streak brownish yellow, ochre yellow. Color yellowish, reddish, blackish brown. Soluble in hydrochloric acid. Infusible. Reacts for iron, water, and often for manganese and phosphorus. Composition: iron sesquioxide 89.9, water 10.1.

Gold (1, ix)—Isometric, massive, flattened grains, scales. Fracture hackly. H=2.5—3. G=15.6—19.5. Lustre metallic. Color and streak yellow, sometimes inclining to silver white. Soluble in aqua regia. Fuses easily. Composition: gold, usually containing silver in greater or less proportions, and often traces of copper, iron, and other metals.

Gold Amalgam (6, ix.)—In four-sided prisms, amorphous, easily crumbling grains. Streak and color white or yellowish white. Partly soluble in nitric acid. Fusible. Partly volatilizes before the blow-pipe, leaving gold or an alloy of gold and silver. Reacts for mercury. One analysis gave: mercury 57.40, gold 38.39, silver 5.0; often contains no silver.

Graphite (15, viii.)—Hexagonal, massive. Fracture lamellar. H=1—2. G=2.089—2.229. Feels greasy. Streak black, shining. Color black, steel gray. Soils paper. Not acted upon by acids. Infusible. In fine powder burns before the blow-pipe. Composition: pure carbon, with usually a little iron sesquioxide.

Greenockite (34, xvii.)—Hexagonal. H=3 — 3.5. G=4.8. Lustre adamantine. Streak powder between orange yellow and brick red. Color yellow, orange yellow, bronze yellow. Soluble in hydrochloric acid, yielding hydrogen sulphide. Infusible. Reacts for sulphur and cadmium. Composition: sulphur 22.3, cadmium 77.7.

Gypsum (232, xxviii.)—Monoclinic, massive, granular, foliated. Fracture uneven. H=1.5 — 2. G=2.314 — 2.328. Lustre pearly, subvitreous, dull. Streak white. Color white, gray, yellow, red, blue, black, brown. Soluble in hydrochloric acid. Fusible. Reacts for sulphur and water. Composition: sulphur trioxide 46.5, lime 32.6, water 20.9.

Gyrolite (148).—In concretions with lamellar-radiate structure. H=3—4. Lustre vitreous, pearly. Streak and color white. Gelatinizes in hydrochloric acid. Fuses with difficulty, swelling up. Reacts for water. One analysis gave: silica 50.70, alumina 1.48, magnesia 0.18, lime 33.24, water 14.18.

Halite (55, xxxii.)—Isometric, massive. Fracture conchoidal. H=2.5. G=2.1—2.257. Lustre vitreous. Streak white. Color white, often tinted. Soluble in water. Taste saline. Heated with sulphuric acid it gives off hydrochloric acid gas. Fusible. Reacts for sodium. Composition: chlorine 60.7, sodium 39.3.

Halloysite (179).—Massive, earthy. Fracture conchoidal. H=1—2. G=1.8—2.4. Lustre pearly, dull. Streak white or lighter than color. Color white, yellowish, greenish, bluish, reddish. Decomposed by acids. Infusible. Reacts for aluminum and water. Composition: silica 43.3, alumina 37.7, water 19.00. See remarks under Pholerite.

Hausmannite (78, xxiv.) — Tetragonal, massive. Fracture. H=5 — 5.5. G=4.722. Lustre submetallic. Streak brown. Color brownish black. Soluble in hot hydrochloric acid, yielding chlorine. Infusible. Reacts for manganese. Composition: manganese 72.1, oxygen 27.9.

Hedenbergite.—See Pyroxene.

Hematite (67, xxiii.)—Rhombohedral, massive, lamellar, and imitative forms. Fracture subconchoidal, uneven. H=5.5 — 6.5. G=4.5—5.3. Lustre metallic, sometimes earthy. Streak cherry red to reddish brown. Color dark steel gray, iron black. Soluble in concentrated hydrochloric acid. Infusible. Reacts for iron. Composition: iron 70, oxygen 30.

Hessite (28, x.)—Orthorhombic, massive. Fracture even. H=2—3.5. G=8.3—8.6. Lustre metallic. Streak and color between lead gray and steel gray. Soluble in nitric acid. Fusible. Reacts for tellurium and silver. Composition: tellurium 37.2, silver 62.8.

Heulandite (164).—Monoclinic, globular

Fracture subconchoidal, uneven. H=3.5—4. G=2.2. Lustre pearly, vitreous. Streak white. Color white, red, gray, brown. Decomposed by hydrochloric acid. Before the blow-pipe exfoliates, curves into vermicular forms, and fuses to a white enamel. Reacts for water. Composition: silica 59.1, alumina 16.9, lime 9.2, water 14.8.

Heulandite, stilbite, and epistilbite are distinguished by their crystalline forms. Heulandite crystallizes in inclined rhombic prisms; occurs also in globular and granular forms. Stilbite crystallizes in right rhombic prisms, with usually the prism flattened parallel, with cleavage face and pointed at the extremities, often in sheaf-like aggregations, sometimes globular and thin lamellar columnar. Epistilbite is orthorhombic.

Hornblende.—See varieties of Amphibole.

Hubnerite (222, xxiv.) — Orthorhombic, foliated or columnar masses. Fracture uneven. H=4.5. G=7.14. Lustre adamantine, greasy. Streak yellowish brown. Color brownish red to black. Partly soluble in hydrochloric acid, leaving a yellow residue.

Fusible. Reacts for manganese and tungsten. Composition: tungsten trioxide 76.9, manganese monoxide 23.1.

Hudsonite.—See varieties of Pyroxene.

Hydrodolomite (257, xxviii.)—Massive, imitative forms, and crusts. Streak white or same as color. Color yellowish white, grayish, greenish. In warm acid readily dissolves with effervescence. Infusible. Reacts for magnesium and water. Composition: carbon dioxide 33.10, lime 25.22, magnesia 24.28, water 17.40.

Hydromagnesite (256, xxvii.)—Monoclinic, amorphous. Lustre vitreous, silky, earthy. H=3.5 (crystals). G=2.145—2.18. Streak and color white. Dissolves with effervescence in acids, especially if hot. Infusible. Reacts for magnesium and water. Composition: magnesia 43.9, carbon dioxide 36.3, water 19.8.

Hydrophite (174).—Massive, fibrous, crusts. Lustre subvitreous. H=2.5—3.5. G=2.65. Streak paler than color. Color green, blackish green. Decomposed by acids. Fusible. Reacts for iron, manganese, and wa ter. One analysis gave: silica 36.19, alumina 2.90, iron monoxide 22.73, manganese monoxide 1.66, magnesia 21.08, water 16.08.

Hydrotalcite (90, xxvii.) — Hexagonal, massive. H=2. G=2.04. Lustre pearly. Streak and color white. Soluble in hydrochloric acid. Infusible, but exfoliates. Reacts for magnesium and water. Composition: alumina 16.8, magnesia 39.2, water 44.00.

Hydrozincite (260, xvi.)—Massive, earthy, incrustations, imitative forms. Fracture fibrous, earthy. H=2—2.5. G=3.58—3.8. Lustre dull. Streak shining. Color white, grayish, yellowish. Dissolves with effervescence in hydrochloric acid. Infusible. Reacts for zinc and water. Composition: carbon dioxide 13.6, zinc oxide, 75.3, water 11.1.

Hypersthene (101).—Orthorhombic, massive. H=5—6. G=3.392. Lustre pearly, metalloid. Streak grayish, brownish gray. Color brownish green, black, brown. Partly decomposed by hydrochloric acid. Fusible. Reacts for iron. Composition: silica 54.2, iron monoxide 21.7, magnesia 24.1.

Iodyrite (57, x.)—Hexagonal, massive, in thin plates. Fracture conchoidal. H=1—1.5. G=5.5—5.71. Lustre resinous, adamantine. Streak yellow. Color yellow, green, brownish. Fusible. Reacts for iodine and silver. Composition: iodine 54, silver 46.

Iolite (123). — Orthorhombic, massive. Fracture subconchoidal. H=7—7.6. G=2.56—2.57. Lustre vitreous. Streak uncolored. Color blue, yellowish gray, brownish yellow. Partly decomposed by acid. Fuses with difficulty. Composition: silica 49.4, alumina 33.9, magnesia 8.8, iron monoxide 7.9.

Iridosmine (4, xii.)—Hexagonal, flattened grains. Fracture uneven. H=6—7. G=19.3—21.12. Lustre metallic. Streak and color tin white, light steel gray. Insoluble in acids. Infusible. Composition: iridium and osmium in different proportions.

Iron (8, xxiii.) — Isometric, in grains. Fracture hackly. H=4.5. G=7.3—7.8. Lustre metallic. Streak gray, shining. Color iron gray. Soluble in acids. Infusible before the blow-pipe.

Jarosite (240, xxii.)—Rhombohedral, massive, nodules, incrustations. H=2.5—3.5. G=3.24—3.26. Lustre dull. Color and streak yellow. Soluble in water. Taste astringent. Reacts for sulphur, iron, and water. Fusible. One analysis gives: sulphur trioxide 34.17, iron sesquioxide 46.89, potassium and sodium oxides 3.81, water 13.18, alumina and lime in small quantities.

Jefferisite (186).—In broad crystals or plates. Fracture lamellar. H=1.5. G=2.3. Lustre pearly. Streak white, gray. Color yellow, brown, yellowish brown. Decomposed by hydrochloric acid. Fuses and exfoliates. Reacts for silicon, iron, and water. An analysis by Brush gave: silica 37.10, alumina 17.57, iron sesquioxide 10.54, iron monoxide 1.26, magnesia 19.65, water 13.76, lime, sodium oxide, potassium oxide in small quantities.

Jeffersonite.—See varieties of Pyroxene.

Johannite (241, xxii.)—Monoclinic, imitative masses. H=2—2.5. G=3.19. Lustre vitreous. Color green. Streak paler than color. Soluble in water. Taste bitter.

Reacts for sulphur and water. Composition: sulphur trioxide 20.8, uranium oxide 66.1, copper oxide 6.9, water 6.2.

Kalinite (238, xxv.)—Isometric, massive, fibrous, crusts. Fracture conchoidal, uneven. H=2—2.5. G=1.75. Lustre vitreous. Color and streak white. Soluble in water Fuses with frothing. Reacts for aluminum, sulphur, and water. Composition: potassium sulphate 18.4, aluminum sulphate 36.2, water 45.5.

Kaolinite (178). — Orthorhombic, fan-shaped aggregations, clay-like masses. H=1—2.5. G = 2.4 — 2.63. Lustre pearly, earthy. Streak white or lighter than color. Color white, yellowish, greenish, bluish, reddish. Insoluble in acids. Infusible. Reacts for aluminum and water. Composition: silica 46.3, alumina 39.8, water 13.9. See remarks under Pholerite.

Labradorite (133).—Triclinic, massive. Fracture conchoidal, uneven. H=6. G=2.67—2.76. Lustre pearly, vitreous. Streak uncolored. Color gray, brown, greenish, glassy, white. Slowly and partially decomposed by hydrochloric acid. Fusible. Composition: silica 52.9, alumina 30.3, lime 12.3, sodium oxide 4.5.

Lanthanite (258, xxvi.)—Orthorhombic, granular, earthy. Cleavage micaceous. H=2.5—3. G=2.666. Lustre pearly, dull. Streak white. Color grayish white, pink, yellowish. Soluble in acid with effervescence. Reacts for water and is infusible. Composition: lanthanum oxide 52.6, carbon dioxide 21.3, water 26.1.

Laumonite (149).—Monoclinic, columnar. Fracture (when observable) uneven. H=3.5—4. G=2.25—2.36. Lustre vitreous, pearly. Color white, yellow, gray, red. Streak uncolored. Gelatinizes in hydrochloric acid. Fusible, swelling up. Reacts for water. Composition: silica 50.9, alumina 21.9, lime 11.9, water 15.3.

Lazulite (209, xxv.)—Monoclinic, massive. Fracture uneven. H=5—6. G=3.057—3.122. Streak white. Color blue. Not acted upon by acids. Infusible. Reacts for phosphorus, iron, aluminum, and water. Composition: phosphorus pentoxide 46.8, alumina 34, magnesia 13.2, water 6.0; iron monoxide always replaces some of the other oxides.

Leadhillite (228, xv.)—Orthorhombic, massive. Fracture conchoidal, but scarcely observable. H=2.5. G=6.26—6.44. Lustre pearly, resinous. Streak uncolored. Color white, yellow, green, gray. Partly soluble with effervescence in nitric acid. Easily fuses with intumescence. Reacts for lead and sulphur. Composition: lead sulphate 27.45, lead carbonate 72.55.

Lepidolite (127).—Orthorhombic, massive. Micaceous structure. H=2.5—4. G=2.84—3. Lustre pearly. Streak uncolored. Color red, gray, lilac, white, green. Partially decomposed by acids. Reacts for fluorine, lithium, and sometimes iron, manganese, and water. An analysis of one specimen gave: silica 50.43, alumina 28.07, manganese sesquioxide 0.88, magnesia 1.42, potassium oxide 10.58, sodium oxide 1.46, lithia 1.23, fluorine 4.86. "More chemical investigations are required before the species lepidolite can be correctly subdivided or comprehended. Physically it is hardly distinct from muscovite."—*Dana.*

Leucopyrite (44, xxiii.)—Orthorhombic, massive. Fracture uneven. H=5—5.5. G=6.8—8.71. Lustre metallic. Streak grayish black. Color silver white to steel gray. Decomposed by nitric acid. Fusible. Reacts for arsenic, iron, and sometimes faintly for sulphur. Composition: iron 27.2, arsenic 72.8.

Limonite (87, xxii.)—Massive, earthy, imitative forms. Fracture fibrous, earthy. H=5—5.5. G=3.6—4. Lustre silky, submetallic, earthy. Streak yellowish brown. Color brown, brownish yellow, ochre yellow. Soluble in hydrochloric acid. Infusible. Reacts for iron and water. Composition: iron sesquioxide 85.6, water 14.4.

Linnæite (40, xx.)—Isometric, massive. Fracture subconchoidal, uneven. H=5.5. G=4.8—5. Lustre metallic. Streak blackish gray. Color steel gray, tarnishing copper red. Dissolves in nitric acid, with separation of sulphur. Fusible. Reacts for sulphur, nickel, cobalt, iron, and sometimes arsenic. Composition: sulphur 42.0, cobalt 58.0, the cobalt usually being replaced by nickel and copper in varying proportions; iron is also generally present.

Magnesite (245, xxvii.)—Rhombohedral, massive. Fracture flat, conchoidal. H=3.5—4.5. G=3—3.08. Lustre vitreous, silky. Streak white. Color white, yellowish white, brown. Soluble with effervescence in hydrochloric acid; slowly in cold, readily in hot acid. Infusible. Reacts for magnesium. Composition: magnesia 47.6, carbon dioxide 52.4.

Magnetite (71, xxiii.)—Isometric, massive. Fracture subconchoidal. H=5.5—6.5. G=4.9—5.2. Lustre metallic, submetallic. Streak black. Color iron black. Soluble in hydrochloric acid. Fuses with great difficulty. Reacts for iron. Strongly magnetic. Composition: oxygen 27.6, iron 72.4.

Malachite (262, xiv.)—Monoclinic, massive. Fracture subconchoidal, uneven. H=3.5—4. G=3.7—4 01. Lustre adamantine, vitreous. Streak paler than color. Color green. Dissolves in acids with effervescence.

Easily fusible. Reacts for copper and water. Composition: carbon dioxide 19.9, copper monoxide 71.9, water 8.2.

Malacolite.—See varieties of Pyroxene.

Manganite (86, xxiv.)—Orthorhombic, columnar, stalactitic. Fracture uneven. H=4. G=4.2—4.4. Lustre submetallic. Streak reddish brown, black. Color steel gray, iron black. Soluble in hydrochloric acid, yielding chlorine. Infusible. Reacts for manganese and water. Composition: manganese sesquioxide 89.8, water 10.2.

Marcasite (43, xxiii.)—Orthorhombic, imitative forms, massive. Fracture uneven. H=6—6.5. G=4.678—4.847. Lustre metallic. Streak grayish or brownish black. Color bronze yellow, greenish, grayish. Liable to decomposition. Soluble in nitric acid, with separation of sulphur. Fusible. Reacts for sulphur and iron. Composition: sulphur 53.3, iron 46.7.

Margarite (192).—Orthorhombic, massive, micaceous, scaly. H=3.5—4.5. G=2.99. Lustre pearly, vitreous. Streak uncolored. Color white, grayish, reddish, yellowish.

Partially decomposed by sulphuric acid. Fuses with difficulty. Reacts for water. Composition: silica 30.1, alumina 51.2, lime 11.6, sodium oxide 2.6, water 4.5. See remarks under Fahlunite.

Margarodite (183).—Crystallization, physical properties and blow-pipe reactions like those of muscovite. Composition similar to that of muscovite, except that it contains from 3 to 5 per cent. water.

Massicot (64, xv.) — Massive, earthy. H=2. G=8—9.36. Lustre dull. Streak lighter than color. Color yellow, sometimes reddish. Soluble in nitric acid. Fusible. Reacts for lead. Composition: lead 92.83, oxygen 7.17.

Melaconite (65, xiv.)—Earthy, massive, in scales, pulverulent. H=3. G=5.952—6.25. Lustre metallic. Streak gray, black. Color iron gray to black. Soluble in hydrochloric or nitric acid. Infusible. Reacts for copper. Composition: oxygen 20 15, copper 79.85.

Melanterite (234, xxiii.)—Monoclinic, massive, fibrous, stalactitic, concretionary. Fracture conchoidal. H=2. G=1.832. Lustre vitreous. Streak uncolored. Color green to white. Soluble in water. Taste astringent and metallic. Fusible. Reacts for iron, sulphur, and water. Composition: sulphur trioxide 28.8, iron monoxide 25.9, water 45.3.

Menaccanite (68, xxiii.)—Rhombohedral, thin plates, loose grains. Fracture conchoidal. H=5—6. G=4.5—5. Lustre submetallic. Streak submetallic with black or brownish red powder. Color iron black. Very slowly soluble in hydrochloric acid. Infusible, or fusible with great difficulty. Reacts for iron and titanium. A specimen from Warwick, N. Y., gave titanium oxide 57.71, iron monoxide 26.82, manganese monoxide 0.90, magnesia 13.71.

Mercury (5, xiii.)—Isometric; occurs in small, scattered globules, liquid at ordinary temperature. G=13.568. Lustre metallic. Color tin white. Readily soluble in nitric acid. Volatilizes before the blow-pipe. Often contains a little silver.

Messolite (159).—Triclinic, crystals always in twins, massive, fibrous, columnar. H=5.

G=2.2 – 2.4. Lustre vitreous, silky. Streak white. Color white or colorless, grayish, yellowish. Gelatinizes in hydrochloric acid. Fuses easily, swelling up into vermicular forms. Reacts for water. Composition: silica 45.6, alumina 26.0, lime 9.5, sodium oxide 5.2, water 13.7.

Microlite (195, xxviii.)—Isometric; occurs only in small crystals. H=5.5. G=5.485—5.562. Lustre vitreous, resinous. Streak paler than color. Color yellow to brown. Insoluble in acids. Infusible. Composition: columbium pentoxide 75.70, lime 14 84, tungsten trioxide, yttria, uranium monoxide together 7.42, water 2.04, is given as the result of an analysis by Shepard.

Millerite (32, xxi.)—Rhombohedral, capillary crystals, columnar tufted coatings. Fracture uneven. H=3—3.5. G=4.6—5.65. Lustre metallic. Streak bright. Color brass to bronze yellow, sometimes tarnishes gray with iridescence. Soluble in aqua regia. Fusible. Reacts for sulphur, nickel, and often for copper, cobalt, and iron. Composition: sulphur 35.1, nickel 64.9.

Mimetite (200, xv.)—Hexagonal, massive. Fracture subconchoidal. H=3.5. G=7—7.25. Lustre resinous. Streak white. Color yellow, brown, white, or colorless. Soluble in nitric acid. Fuses very easily. Reacts for arsenic and lead. Composition: arsenic pentoxide 23.20, lead oxide 74.96, chlorine 2.39.

Minium (80, xv.)—Pulverulent. H=2—3. G=4.6. Lustre greasy, dull. Streak yellow. Color red, sometimes mixed with yellow. Soluble wholly or in part in nitric acid. Fusible. Reacts for lead. Composition: lead 90.66, oxygen 9.34.

Mirabilite (231, xxxii.)—Monoclinic, efflorescent crusts. Fracture uneven. H=1.5—2. G=1 481. Lustre vitreous. Streak and color white. Soluble in water. Taste cool, somewhat saline and bitter. Fusible. Reacts for sodium, sulphur, and water. Composition: sodium oxide 19.3, sulphur trioxide 24.8, water 55.9.

Molybdenite (20, ii.)—Sometimes in short or tabular hexagonal prisms of easy cleavage parallel to the base; system of crystallization in doubt, usually foliated, massive, in scales or granular. H=1—1.5. G=4.44—4.8. Lustre metallic. Streak lead gray or greenish. Color lead gray. Infusible. Reacts for sulphur and molybdenum. Composition: sulphur 41.0, molybdenum 59.0.

Molybdite (94, ii.)—Orthorhombic, capillary crystals, massive, earthy. Fracture earthy. H=1—2. G=4.49—4.5. Lustre silky, adamantine, earthy. Streak and color yellow, yellowish white. Fusible. Reacts for molybdenum. Composition: oxygen 34.29, molybdenum 65.71.

Monazite (201, xxvi.)—Monoclinic, massive. H=5—5.5. G=4.9—5.26. Lustre resinous. Streak lighter than color. Color brownish red, brown, yellowish brown. Soluble with difficulty in hydrochloric acid. Infusible. Reacts for phosphorus. Analysis shows it to be a phosphate of cerium, lanthanum, didymium, and thorium.

Montanite (242, vii.)—Incrusting. Soft, earthy. Lustre dull, waxy. Streak white. Color yellowish, white. Soluble in hydrochloric acid. Fusible. Reacts for bismuth, tellurium, and water. Composition: tellurium trioxide 26.1, bismuth trioxide 68.6, water 5.3.

Morenosite (235, xxi.)—Needle-like crystals, thin prisms, efflorescent. H=2—2.25. G=2.004. Streak white or lighter than color. Color green, greenish white. Soluble in water. Taste metallic. Reacts for nickel, sulphur, and water. Composition: sulphur trioxide 28.5, nickel monoxide 26.7, water 44.8.

Mountain Cork, *Mountain Leather*, *Mountain Paper*, *Mountain Wood.*—See varieties of Amphibole.

Muscovite (126).—Orthorhombic, micaceous structure, scales, scaly massive. H=2—2.5. G=2.75—3.1. Lustre pearly. Streak uncolored. Color white, gray, brown, green, violet, yellow, red. Insoluble in acid. Fuses with great difficulty. Reacts for fluorine, iron, and sometimes manganese. Composition varies: silica 44 to 47, alumina 31 to 37, and oxides of iron, magnesium, calcium, sodium, potassium, together with small quantities of fluorine and water. See Margarodite.

Natrolite (158).—Orthorhombic, massive, fibrous, granular, compact. Fracture conchoidal, uneven. H=5—5.5. G=2.17—2.25. Lustre vitreous, pearly. Streak uncolored. Color white, grayish, yellowish, red. Gelatinizes in acids. Fusible. Reacts for water. Composition: silica 47.2, alumina 27.0, sodium oxide 16 3, water 9.5.

Natrolite somewhat resembles analcite, but may be distinguished from it by its structure. Natrolite crystallizes in right rhombic prisms and has cleavage parallel to the prism. Crystals very rarely large, usually slender or acicular, and frequently interlacing or divergent. Also fibrous and massive, though almost always crystallized. Analcite crystallizes in the isometric system, showing only traces of cleavage parallel to the faces of the cube. Found also massive granular.

Natron (252, xxxii.)—Monoclinic. H=1—1.5. G=1.423. Lustre vitreous, earthy. Streak white. Color white, gray, yellow. Soluble in water. Taste alkaline. Soluble with effervescence in acids. Fusible. Reacts for sodium and water. Composition:

carbon dioxide 26.7, sodium oxide 18.8, water 54.5. In nature found only in solution.

Nephelite (131).—Hexagonal, massive, columnar. Fracture subconchoidal. H=5.5—6. G=2.5—2.65. Lustre vitreous, greasy. Streak colorless or same as color. Color white, colorless, gray, yellowish, green, brown, red. Gelatinizes in acid. Fusible. Composition: silica 44.2, alumina 33.7, sodium oxide 16.9, potassium oxide 5.2.

Niccolite (35, xxi.)—Hexagonal, massive, reniform. Fracture uneven. H=5—5.5. G=7.33—7.671. Lustre metallic. Streak pale brownish black. Color pale copper red, gray or blackish tarnish. Soluble in aqua regia. Fusible. Reacts for arsenic, nickel, and sometimes slightly for sulphur, iron, and cobalt. Composition: arsenic 55.9, nickel 44.1.

Nitre (214, xxxi.)—Orthorhombic, usually in thin crusts and in tufts. Fracture conchoidal. H=2. G=1.937. Lustre vitreous. Streak and color white. Soluble in water. Taste saline and cooling. Fuses and deflagrates on burning coal. Reacts for potassium. Composition: nitrogen trioxide 61.33, potassium 38.67.

Nitrocalcite (215, xxviii.)—In efflorescent tufts and masses. H=1. Lustre silky. Streak white. Color white, gray. Soluble in water. Taste sharp, bitter. Fuses and slightly deflagrates on burning coal. Reacts for water. Composition: calcium 21.98, nitrogen trioxide 68.13, water 9.89.

Nitromagnesite (216, xxvii.)—A magnesium nitrate. White, soluble, and of bitter taste. "The existence of this species as a natural product has not yet been clearly made out."—*Dana.*

Octahedrite (77, xix.)—Tetragonal. Fracture subconchoidal. H=5.5—6. G=3.82—3.95. Lustre metallic-adamantine. Streak uncolored. Color brown, blue, black. Insoluble in acids. Infusible. Reacts for titanium. Composition: titanium 61, oxygen 39. See remarks under Brookite.

Oligoclase (134).—Triclinic, massive, lamellar. Fracture conchoidal, uneven. H=6—7. G=2.56—2.72. Lustre pearly, waxy, vitreous. Streak uncolored. Color white tinged grayish, greenish, reddish, grayish green. Insoluble in acids. Fusibility=3.5. Composition: silica 62.1, alumina 23.7, sodium oxide 14.2. See remarks under Orthoclase.

Opal (99) —Massive, amorphous, imitative forms, earthy. Fracture conchoidal. H=5.5—6.5. G=1.9—2.3. Lustre vitreous, resinous, pearly. Streak white. Color white, yellow, red, green, brown, gray. Insoluble in acids. Infusible. Reacts for silicon and water. Composition: silica with from 2 to 21 per cent. of water, usually from 3 to 9 per cent.

Orpiment (16, v.)—Orthorhombic, massive, foliated, columnar, reniform. Somewhat sectile. H=1.5—2. G=3.4—3.48. Lustre pearly, resinous. Color yellow. Streak yellow, but usually paler than color. Soluble in aqua regia. Fusible and volatile. Reacts for arsenic and sulphur. Composition: sulphur 39, arsenic 61.

Orthoclase (136).—Monoclinic, massive, sometimes flinty. Fracture conchoidal, uneven. H=6—6.5. G=2.44—2.62. Lustre vitreous. Streak uncolored. Color white, gray, red, green. Insoluble in acids. Fuses with difficulty. Composition: silica 64.6, alumina 18.5, potassium oxide 16.9; sodium oxide sometimes replaces part of the potassium oxide, in which case it is more fusible.

It is often difficult to distinguish between albite, oligoclase, and orthoclase, especially if crystallization is absent, as their external characters are so nearly alike; moreover, albite and oligoclase crystals are triclinic and strongly resemble each other. Sometimes the only way to distinguish between them is by chemical analysis.

Palagonite (181).—Amorphous. Fracture granular. H=4—5. G=2.4—2.7. Lustre vitreous, greasy. Streak yellow, brownish yellow. Color yellow, brown, red, black. Decomposed by hydrochloric acid. Fuses easily. Reacts for iron and water. One analysis gave: silica 40.68, alumina 14.59, iron sesquioxide 14.24, magnesia 7.65, lime 6.95, sodium oxide 1.84, potassium oxide 0.45, water 13.60.

Partzite (97, vi.)—Massive. Fracture

conchoidal. H = 3 — 4. G = 3.8. Streak green. Color green, black. Soluble in hydrochloric acid. Infusible. Reacts for antimony and water. An analysis by Arents gave: antimony trioxide 47.65, copper oxide 32.11, silver oxide 6.12, lead oxide 2.01, iron monoxide 2.33, water 8.29.

Pectolite (147). — Monoclinic, massive. Fracture fibrous. H=5. G=2.68—2.78. Lustre silky, subvitreous. Streak colorless. Color white, gray, brown. Gelatinizes in hydrochloric acid. Fusibility=2. Reacts for water. Composition: silica 54.2, lime 33.8, sodium oxide 9.3, water 2.7.

Penninite (187).—Rhombohedral massive. Fracture lamellar. H=2—2.5. G=2.6—2.83. Lustre pearly, vitreous. Streak white. Color various shades of green, violet, red, pink, yellowish, white. Decomposed by sulphuric acid, partly so by hydrochloric acid. Fuses with difficulty, exfoliating. Reacts for iron, water, and sometimes chromium An analysis gave: silica 33.07, alumina 9.69, iron monoxide 11.36, magnesia 32.34, water 12.58.

Petalite (107). — Monoclinic, massive. Fracture conchoidal. H=5—6.5. G=2.39—2.5. Lustre pearly, vitreous. Streak uncolored. Color colorless, white, gray. Not acted upon by acids. Fuses with difficulty. Reacts for lithium. Composition: silica 77.7, alumina 17.8, lithia 3.3, sodium oxide 1.2.

Phlogopite (124). — Orthorhombic. Micaceous structure. H=2.5—3. G=2.78—2.85. Lustre pearly, submetallic. Streak uncolored. Color yellowish brown, brownish red, green, white. Decomposed by sulphuric acid. Fuses on the thin edges. Reacts sometimes for fluorine and water. Composition: silica 40.73, alumina 13.93, magnesia 32.57, potassium oxide 12.77.

Pholerite (177).—Orthorhombic, massive, clay-like. Fracture scaly. H=1—2.5. G=2.35—2.57. Lustre pearly, earthy. Streak white or lighter than color. Color white, yellowish, grayish, brown, violet. Insoluble in acids. Infusible. Reacts for aluminum and water. Composition: silica 39.3, alumina 45.0, water 15.7.

Halloysite, kaolinite, and pholerite very strongly resemble one another, and ordinarily can be distinguished only by analysis.

Pihlite (167).—Micaceous structure. H=1.5. G=2.72. Lustre pearly, satin. Streak white. Color white, silvery, yellowish. Insoluble in acids. Fus.=6. Reacts for aluminum and water at high temperature. One analysis gives: silica 61.21, alumina 28.01, potassium oxide 4.54, water 3.83, and small amounts of lime, lithia, and sodium oxide.

Pinite (180).—Amorphous, pseudomorphs. H=2.5—3.5. G=2.6—2.85. Lustre dull, waxy. Streak white or lighter than color. Color grayish white, green of various shades, brownish, reddish. Attacked by hydrochloric acid. Fusible, sometimes intumescing. Reacts for water. Is a hydrous alkaline silicate, but, being a result of alteration, it varies much in composition.

Platinum (3, xi.)—Isometric, in grains, sometimes in irregular lumps. Fracture hackly. H=4—4.5. G=16—19. Lustre metallic. Streak and color whitish steel gray. Soluble in hot aqua regia. Infusible.

Composition: platinum combined with iridium, osmium, and other metals.

Polybasite (53, x.)—Orthorhombic, massive. Fracture uneven. H=2—3. G=6.214. Lustre metallic. Streak and color iron black. Decomposed by nitric acid. Fuses with spurting. Reacts for sulphur, antimony, silver, and sometimes arsenic and copper. Composition: sulphur 14.8, antimony 9.7, silver 75.5, but often contains copper and arsenic.

Prehnite (152).—Orthorhombic, imitative forms. Fracture uneven. H=6—6.5. G = 2.8 — 2.953. Lustre vitreous, pearly. Streak uncolored. Color green, white, gray. Decomposed by hydrochloric acid. Fuses easily with intumescence. Reacts for water. Composition: silica 43.6, alumina 24.9, lime 27.1, water 4.4.

Prochlorite (189).—Hexagonal, fan-shaped, spheroidal. Fracture lamellar. H=1—2. G=2.78—2.96. Lustre pearly. Streak white or greenish. Color various shades of green. Decomposed by sulphuric acid. Fuses with difficulty. Reacts for iron and water. Composition: silica 26.8, alumina 19.7, iron monoxide 27.5, magnesia 15.3, water 10.7.

Proustite (48, x.)—Rhombohedral, massive. Fracture conchoidal, uneven. H=2—2.5. G=5.422—5.56. Lustre adamantine. Streak and color cochineal red. Decomposed by nitric acid, with separation of sulphur. Fuses easily. Reacts for silver, sulphur, and arsenic. Composition: sulphur 19.4, arsenic 15.2, silver 65.4.

Pseudomalachite (207, xiv.)—Orthorhombic, reniform, massive. Fracture conchoidal, uneven. H=4.5—5. G=3.8—4.4. Lustre adamantine, vitreous. Color dark green. Streak paler than color. Soluble in nitric acid. Fuses easily. Reacts for copper, phosphorus, and water. Composition varies, probably owing to mixture; one computation gives: phosphorus pentoxide 21.1, copper 70.9, water 8.0.

Psilomelane (91, xxiv.)—Massive, imitative forms. Fracture uneven. H=5—6. G=3.7—4.7. Lustre submetallic. Color iron black, steel gray. Streak brownish black. Soluble in hydrochloric acid, with evolution of chlorine. Infusible. Reacts for manganese, and most varieties for water. Composed of the oxides of manganese and baryta in varying proportions, many varieties containing water and potassium oxide.

Pyrargyrite (47, x.)—Rhombohedral, massive. Fracture conchoidal. H=2—2.5. G=5.7—5.9. Lustre metallic, adamantine. Streak cochineal red. Color black to cochineal red. Decomposed by nitric acid, with separation of sulphur. Fusible. Reacts for sulphur, antimony, and silver. Composition: sulphur 17.7, antimony 22.5, silver 59.8.

Pyrite (37, xxiii.)—Isometric, imitative forms, amorphous. Fracture conchoidal, uneven. H=6—6.5. G=4.83—5.2. Lustre metallic. Streak greenish or brownish black. Color brass yellow. Decomposed by nitric acid. Fusible. Reacts for iron and sulphur. Composition: sulphur 53.3, iron 46.7.

Pyrolusite (82, xxiv.)—Orthorhombic, columnar, massive, reniform. Fracture uneven. H=2—2.5. G=4.82. Lustre metallic. Streak black, bluish black, sometimes submetallic. Color iron black, dark steel gray, sometimes bluish. Soluble in hydrochloric acid, with evolution of chlorine. Infusible. Reacts for manganese. Composition: manganese 63.3, oxygen 36.7.

Pyromorphite (199, xv.)—Hexagonal, imitative forms. Fracture subconchoidal, uneven. H=3.5—4. G=6.5—7.1. Lustre resinous. Streak white, yellowish. Color green, yellow, brown, white. Soluble in nitric acid. Fuses easily. Reacts for lead and phosphorus. Composition: lead phosphate 89.8, lead chloride 10.2.

Pyrophyllite (166).—Orthorhombic, foliated, granular, compact, sometimes slaty. Fracture scaly, earthy. H=1—2. G=2.75—2.92. Lustre pearly, dull, glistening. Streak white or lighter than color. Color white, green, yellow, grayish white. Partially decomposed by sulphuric acid. Fuses with difficulty; some varieties exfoliating and swelling up many times the original volume. Reacts for aluminum and water. Composition: silica 65.0, alumina 34.2, water 5.9.

Pyroxene (103).—Monoclinic, granular,

fibrous. Fracture conchoidal, uneven. H=5—6. G=3.23—3.5. Lustre vitreous, resinous, pearly. Streak white, gray, grayish green. Color white through green to black. Some varieties slightly acted upon by acids, most varieties not. Fusibility varies greatly, some varieties being almost infusible, while others fuse readily. Composition (and consequently reactions) varies widely in the different varieties.

Varieties: 1. Malacolite (lime-magnesia pyroxene); color white yellowish or greenish white to pale green. 2. Sahlite (lime-magnesia-iron pyroxene); color grayish green, deep green, black. 3. Hedenbergite (lime iron pyroxene); color black: crystals usually radiated around a centre. 4. Jeffersonite (lime-iron-manganese-zinc pyroxene); color greenish black; before the blow-pipe on charcoal with soda gives reaction for manganese and zinc. 5. Augite (aluminous-lime-magnesia-iron pyroxene); color deep green to black—is nearly always a volcanic product. 6. Hudsonite (aluminous-iron lime pyroxene); color black; streak green; often with bronze tarnish. 7. Asbestus; a finely fibrous variety; most asbestus belongs to the species amphibole.

To distinguish pyroxene from amphibole see remarks under Amphibole.

Pyrrhotite (33, xxiii.)—Hexagonal, massive, amorphous. Fracture subconchoidal. H=3.5—4.5. G=4.4—4.68. Lustre metallic. Streak dark grayish black. Color bronze yellow, copper red; tarnishes. Decomposed by hydrochloric acid, yielding hydrogen sulphide. Fusible. Reacts for sulphur and iron. Composition: sulphur 39.5, iron 60.5.

Quartz (98).—Rhombohedral, massive; mammillary, stalactitic, and concretionary forms. Fracture conchoidal. Lustre vitreous, resinous. Streak white; sometimes same as, but paler than, color when impure. Color colorless, white, yellow, red, brown, blue, green, black. Not acted upon by acids. Infusible. Reacts for silicon. Composition: oxygen 53.33, silicon 46.67.

Remingtonite (259, xx.)—Incrustations. Soft and earthy. Rose-colored. Streak paler than color. Soluble with slight effervescence in hydrochloric acid. Infusible. Reacts for cobalt, iron, and water. Precise composition not ascertained, but is known to be a hydrous cobalt carbonate, and to contain iron.

Rhodonite (104). — Triclinic, massive. Fracture conchoidal, uneven. H=5.5—6.5. G=3.4—3.68. Lustre vitreous. Streak white. Color various shades of red, greenish or yellowish when impure, surface sometimes black from exposure. Partly soluble in hydrochloric acid, with effervescence if mixed with calcium carbonate. Fusible. Reacts for manganese; one variety (Fowlerite) reacts also for zinc. Composition: silica 45.9, manganese monoxide 54.1.

Ripidolite (188). — Monoclinic, massive, scaly or granular. Fracture lamellar. H=2—2.5. G=2.65—2.78. Lustre pearly. Streak greenish white, uncolored. Color green, rose red. Decomposed by sulphuric acid. Fuses with difficulty. Reacts for water, iron, and sometimes chromium. Composition: silica 32.5, alumina 18.8, magnesia

36.0, water 12.9; iron often replacing a part of the magnesia.

Rutile (76, xix.)—Tetragonal, massive. Fracture subconchoidal, uneven. H=6—6.5. G=4.18—4.25. Lustre metallic, adamantine. Streak pale brown. Color reddish brown, red, yellowish, bluish, violet, black. Insoluble in acids. Infusible. Reacts for titanium and often for iron. Composition: oxygen 39.0, titanium 61.0. See remarks under Brookite.

Sahlite.—See Pyroxene, of which it is a variety

Saponite (176).—Massive; nodules or filling cavities. Soft and somewhat plastic when moist, but brittle on drying. G=2.266. Lustre greasy. Color white, green, yellowish, bluish, reddish. Decomposed by sulphuric acid. Fuses with difficulty, and blackens. Reacts for water. Is a hydrous silicate of magnesium and aluminum, but of varying compositions.

Sassolite (217, iv.)—Triclinic; in scales, stalactitic. H=1. G=1.48. Lustre pearly. Streak white. Color white, sometimes tinged with yellow or gray. Feels smooth and unctuous. Soluble in water. Taste slightly acid, saline, and bitter. Fusible. Reacts for boron and water, and sometimes sulphur. Composition: boron trioxide 56.4, water 43.6.

Schorlomite (146). — Massive. Fracture conchoidal. H=7–7.5. G=3.745—3.783. Lustre vitreous. Streak grayish black. Color black, tarnishing blue. Gelatinizes in hydrochloric acid. Fusible. Reacts for iron and titanium. Composition: silica 24.9, iron oxide 21.9, lime 30.7, titanium dioxide 22.5.

Schrötterite (156). — Amorphous, sometimes gum-like; in incrustations, stalactitic. H=3—3.5. G=1.95—2.05. Lustre vitreous, subresinous. Streak uncolored. Color green, white, yellowish. Decomposed by acids. Infusible. Reacts for aluminum and water. One analysis gives: silica 10.53, alumina 46.48, water 41.9, with small amounts of oxides of zinc, iron, and magnesium, and sulphur trioxide.

Scorodite (208, xxiii.) — Orthorhombic. Fracture uneven. H=3.5—4. G=3.1—

3.3. Lustre vitreous, subadamantine, subresinous. Streak white. Color green, brown. Soluble in hydrochloric acid. Fusible. Reacts for arsenic, iron, and water. Composition: arsenic pentoxide 49.8, iron sesquioxide 34.7, water 15.5.

Serpentine (171). — Pseudomorphous; sometimes foliated or fibrous, usually massive. Fracture conchoidal, splintery. H=2.5—4. G=2.5—2.65. Lustre subresinous, greasy, pearly, earthy. Streak white, gray. Color green, brownish red, brownish yellow; yellowish gray from exposure. Decomposed by hydrochloric acid. Fusibility=6. Reacts for water and sometimes iron. Composition: silica 44.14, magnesia 42.97, water 12.89.

Seybertite (194).—Orthorhombic, massive; foliated or micaceous structure. H=4—5. G=3—3.1. Lustre pearly, submetallic. Streak uncolored, yellowish, grayish. Color brown, yellowish, copper red. Insoluble, but acted upon when in powder by strong acids. Infusible. Reacts for water. An analysis by Brush gave: silica 20.24, alumina 39.13, iron sesquioxide 3.27, magnesia 20.84, lime 13.69, water 1.04, sodium oxide 1.43, zirconia 0.75.

Siderite (246, xxiii.)—Rhombohedral, imitative forms, massive. Fracture uneven. H=3.5—4.5. G=3.7—3.9. Lustre vitreous, pearly. Streak white. Color various shades of gray, brown, brownish red, rarely green or white. Soluble with effervescence in hydrochloric acid, especially if hot. Fuses with difficulty. Reacts for iron and usually for manganese. Blackens, and evolves carbon monoxide and dioxide when heated in a closed tube. Composition: carbon dioxide 37.9, iron monoxide 62.1.

Silver (2, x.)—Isometric, massive, in plates or coatings. Fracture hackly. H=2.5—3. G=10.1—11.1. Lustre metallic. Streak silver white. Color silver white, sometimes tarnishes to grayish black. Soluble in nitric acid. Fusible. Composition: silver often alloyed with other metals.

Smaltite (41, xx.)—Isometric, massive, imitative forms. Fracture granular, uneven. H=5.5—6. G=6.4—7.2. Lustre metallic.

Streak grayish black. Color tin white, steel gray; tarnishes, becoming iridescent or grayish. Decomposed by nitric acid, forming a pink solution. Fusible. Reacts for arsenic, cobalt, iron, and nickel. Composition: arsenic 72.1, cobalt 9.4, nickel 9.5, iron 9.

Smectite (168).—Massive. Soft. G=1.9—2.1. Lustre dull. Streak colorless. Color white, gray, green, brownish. Decomposed by hydrochloric acid. Fusible. Reacts for water. Has a soapy feel. Is a hydrous silicate of aluminum of varying composition.

Smithsonite (247, xvi.)—Rhombohedral, imitative shapes. Fracture uneven. H=5. G=4—4.45. Lustre vitreous, pearly. Streak white. Color white, gray, green, brown. Soluble in hydrochloric acid with effervescence. Infusible. Reacts for zinc. Composition: carbon dioxide 35.2, zinc oxide 64.8.

Sodalite (132).—Isometric, massive. Fracture conchoidal, uneven. H=5.5—6. G=2.136—2 26. Lustre vitreous. Streak uncolored. Color gray, white, blue, red. Decomposed by hydrochloric acid, with separation of gelatinous silica. Fuses with intumescence. Composition: silica 37.1, alumina 31.7, sodium oxide 19.2, sodium 4.7, chlorine 7.3.

Sphalerite (27, xvi.)—Isometric, imitative shapes, massive. Fracture conchoidal. H=3.5—4. G=3.9—4.2. Lustre resinous, adamantine. Streak white, reddish brown. Color white, yellow, brown, black, red, green. Soluble in hydrochloric acid, with evolution of sulphuretted hydrogen. Fuses with difficulty. Reacts for zinc and sulphur. Composition: sulphur 33, zinc 67.

Spinel (69, xxv.)—Isometric. Fracture conchoidal. H=8. G=3.5—4.1. Lustre vitreous. Streak white. Color red, blue, green, yellow, brown, black. Slowly soluble in concentrated sulphuric acid. Infusible. The black varieties react for iron. Composition: alumina 72, magnesia 28; the magnesia usually being replaced in part by lime, iron monoxide, or manganese monoxide, and the alumina in part by iron sesquioxide.

Spodumene (106).—Monoclinic, massive. Fracture uneven. H=6.5—7. G=3.13—

3.19. Lustre pearly, vitreous. Streak uncolored. Color grayish green, white, reddish. Not acted upon by acids. Fusible. Reacts for lithium. Composition: silica 64.2, alumina 29.4, lithia 6.4.

Staurolite (145).—Orthorhombic. Fracture conchoidal. H=7—7.5. G=3.4—3.8. Lustre subvitreous, resinous. Streak uncolored. Color reddish or yellowish brown, black. Partly decomposed by sulphuric acid. Infusible. Reacts for iron. Composition: silica 28.3, alumina 51.7, iron monoxide 15.8, magnesia 2.5, water 1.7.

Stephanite (52, x.)—Orthorhombic, massive. Fracture uneven. H=2—2.5. G=6.269. Lustre metallic. Streak and color iron black. Decomposed by nitric acid. Fusible. Reacts for sulphur, antimony, and silver. Composition: sulphur 16.2, antimony 15.3, silver 68.5.

Stibnite (17, vi.)—Orthorhombic, columnar, granular. Fracture subconchoidal. H=2. G=4.516. Lustre metallic. Streak lead gray. Color lead gray, often becoming blackish or iridescent by tarnishing. Soluble in hydrochloric acid when pure. Fuses easily. Reacts for sulphur and antimony. Composition: sulphur 28.2, antimony 71.8.

Stilbite (162). — Orthorhombic, sheaf-like aggregations, globular, columnar. Fracture uneven. H = 3.5—4. G = 2.094 — 2.205. Lustre vitreous, pearly. Streak uncolored. Color white, yellow, brown, red. Decomposed by hydrochloric acid. Fuses, exfoliating and swelling up into vermicular forms. Reacts for water. Composition: silica 57.4, alumina 16.5, lime 8.9, water 17.2. See remarks under Heulandite.

Stilpnomelane (169). — Foliated plates, fibrous, velvety coating. H=3–4. G=3—3.4. Lustre pearly, vitreous, brassy. Streak greenish. Color black, greenish, bronze. One variety (chalcodite) decomposed by hydrochloric acid. Fuses easily. Reacts for iron and water. Is a hydrous iron silicate.

Stromeyerite (30, x.)—Orthorhombic, massive. Fracture subconchoidal. H=2.5—3. G=6.2—6.3. Lustre metallic. Streak shining. Color dark steel gray. Soluble in nitric acid. Fusible. Reacts for sulphur, copper, and silver. Composition: sulphur 15.8, silver 53.1, copper 31.1.

Strontianite (250, xxx.)—Orthorhombic, columnar, globular. Fracture uneven. H=3.5—4. G=3.605—3.713. Lustre vitreous, resinous. Streak white. Color green, white, gray, yellow, brown. Soluble with effervescence in hydrochloric acid. Fuses with difficulty and reacts alkaline after ignition. Reacts for strontium. Composition: carbon dioxide 29.8, strontia 70.2; a small part of the strontium often replaced by calcium.

Sulphur (13, i.)—Orthorhombic, massive. Fracture conchoidal. H=1.5—2.5. G=2.072. Lustre resinous. Streak and color yellow, sometimes reddish or greenish. Insoluble in acids. Fuses easily, and burns with a bluish flame. Composition: sulphur, but often impure from presence of earthy matter.

Talc (165).—Orthorhombic, massive, foliated, or granular. Fracture scaly, earthy. H=1—1.5. G=2 565—2.8. Lustre pearly. Streak white or lighter than color. Color green of various shades, white, brown, reddish. Insoluble in acids. Fuses with difficulty, exfoliating. Reacts for magnesium, and most varieties for water. Composition: silica 62.0, magnesia 33.1, water 4.9.

Tephroite (112).—Orthorhombic, massive. Fracture conchoidal. H=5.5—6. G=4—4.12. Lustre adamantine. Streak pale gray. Color various shades of red, brown, or gray. Gelatinizes in hydrochloric acid. Fusible. Reacts for manganese and iron. Composition: silica 29.8, manganese monoxide 70.2.

Tetradymite (19, vii)—Hexagonal, massive. Fracture uneven. H=1.5—2. G=7.2—7.9. Lustre metallic. Color and streak steel gray. Soluble in nitric acid, with separation of sulphur, if present. Fusible and volatile. Reacts for tellurium and bismuth. Composition: tellurium 48.1, bismuth 51.9, but often contains sulphur and selenium.

Tetrahedrite (50, xiv.)—Isometric, massive. Fracture subconchoidal, uneven. H=3—4.5. G=4.5—5.11. Lustre metallic. Streak same as color, or reddish or brownish. Color steel gray, iron black. Decomposed by nitric acid. Fusible. Reacts for sulphur, antimony, iron, copper, and sometimes arsenic, zinc, and mercury. Is a sulphide of copper and antimony, a part of the copper often being replaced by iron, zinc, silver, or mercury, and a part of the antimony by arsenic, and rarely bismuth.

Thermonatrite (253, xxxii.)—Orthorhombic; an efflorescence. H=1—1.5. G=1.5—1.6. Lustre vitreous. Streak white. Color white, grayish, yellowish. Soluble in water and in acids with effervescence. Reacts for sodium and water. Composition: carbon dioxide 35.5, sodium oxide 50.0, water 14.5.

Thomsonite (157).—Orthorhombic, columnar, globular, amorphous. Fracture uneven. H=5—5.5. G=2.3—2.4. Lustre vitreous, pearly. Streak uncolored. Color white, brown when impure. Gelatinizes in hydrochloric acid. Fuses easily with intumescence. Reacts for water. Composition: silica 36.9, alumina 31.6, lime 12.9, sodium oxide 4.8, water 13.8.

Thuringite (193).—Massive, scaly. Fracture subconchoidal. H=2.5. G=3.186. Lustre pearly, dull. Streak paler than color.

Color green. Gelatinizes in hydrochloric acid. Fusible. Reacts for iron and water. An analysis by Rammelsberg gave: silica 22.35, alumina 18.39, iron sesquioxide 14.86, iron monoxide 34.34, magnesia 1.25, water 9.81.

Tin (9, xviii.) — Tetragonal, in grains. Fracture hackly. H = 3. G = 7.14—7.3. Lustre metallic. Streak tin white, shining. Color tin white. Soluble in hydrochloric acid, with evolution of hydrogen. Fusible. Composition: tin, often with some lead.

Titanite (144). — Monoclinic, massive. Fracture subconchoidal, uneven. H=5.—5.5. G = 3.4 — 3.56. Lustre adamantine, resinous. Streak white. Color brown, red, yellow, white, gray, green, black. Decomposed by sulphuric acid. Fuses with intumescence. Reacts for titanium. Composition: silica 30.61, titanium dioxide 40.82, lime 28.57.

Topaz (142).—Orthorhombic, columnar. Fracture subconchoidal, uneven. H = 8. G=3.4 — 3.65. Lustre vitreous. Streak uncolored. Color yellow, white, greenish, bluish, reddish. Attacked but not dissolved by sulphuric acid. Infusible. Reacts for aluminum and fluorine. Composition: silicon 15.17, aluminum 29.58, oxygen 34.67, fluorine 20.58.

Tourmaline (138).—Rhombohedral, massive, columnar. Fracture subconchoidal, uneven. H=7—7.5. G=2.94—3.3. Lustre vitreous. Streak uncolored. Color black, blue, green, red, white. Not acted upon by acids. Fusibility varies widely in the different varieties, the red being infusible. Reacts for boron. Composition varies in different varieties; one analysis gives: silica 38.85, boric oxide 8 35, alumina 31.32, iron oxide 1.14, magnesia 14.89, lime 1.60, sodium oxide 1.28, potassium 0.26, water 2.31.

Tremolite.—See varieties of Amphibole.

Triphylite (202, xxiv.)—Orthorhombic, massive. H=5. G=3.54—3.6. Lustre subresinous. Streak grayish white. Color greenish gray, bluish, brownish black. Soluble in hydrochloric acid. Fuses easily. Reacts for phosphorus, lithium, iron, manganese. One analysis gives: phosphorus pent oxide 44.19, iron oxide 38.21, manganese monoxide 5.63, magnesia 2.39, lime 0.76, lithia 7.69, sodium oxide 0.74, potassium oxide 0.04, silica 0.40.

Trona (254, xxxii.) — Monoclinic, massive. H=2.5—3. G=2.11. Lustre vitreous. Streak white. Color yellowish white, gray. Soluble in water or acid, effervescing in the latter. Taste alkaline. Fusible. Reacts for sodium and water. Composition: carbon dioxide 40.2, sodium oxide 37.8, water 22.0.

Tungstite (95, iii.) — Earthy, crumbles, rarely in cubes. Color yellow, yellowish green. Insoluble in acids. Infusible. Reacts for tungsten. Composition: oxygen 20.7, tungsten 79.3.

Turgite (83, xxiii.) — Massive, imitative forms, earthy. H=5—6. G=3.56—3.74. Lustre submetallic, dull. Streak red. Color red, reddish black. Soluble in hydrochloric acid. Infusible. Reacts for iron and water; flying to pieces when the test for the latter is made. Composition: iron sesquioxide 94.7, water 5.3.

Turquois (212, xxv.)—Imitative forms. Fracture conchoidal. H=6. G=2.6—2.83. Lustre waxy. Streak white, greenish. Color blue, green. Soluble in hydrochloric acid. Infusible. Reacts for phosphorus, water, and with tin for copper. Composition: phosphorus pentoxide 32.6, alumina 46.9, water 20.5.

Ulexite (219, xxviii.)—Masses, usually rounded, and made up of acicular crystals. H=1. G=1.65. Lustre silky. Streak and color white. Slightly soluble in hot water, also in acids. Fuses easily with intumescence. Reacts for sodium, boron, and water. Composition: boron trioxide 45.6, lime 12.3, sodium oxide 6.8, water 35.3.

Vermiculite (185a).—Hexagonal, massive, scaly. Micaceous structure. H=1—2. G=2.756. Lustre pearly. Streak uncolored. Color grayish, brownish. Gelatinizes in hydrochloric acid. Fuses, exfoliating in a remarkable manner, forming long, worm-like threads, whence its name. Reacts for iron and water. Composition according to Crossley: silica 35.74, alumina

16.42, iron monoxide 10.02, magnesia 27.44, water 10.30.

Vesuvianite (117).—Tetragonal, massive. Fracture subconchoidal, uneven. H=6.5. G=3.349—3.45. Lustre vitreous, resinous. Streak white. Color brown, green, blue, yellow. Decomposed, in part, by hydrochloric acid. Fuses with intumescence. Reacts for iron. An analysis by Rammelsberg gives: silica 37.32, alumina 16.8, oxides of iron 6.66, magnesia 2.11, lime 35.34, sodium oxide 0.16, water 2.08.

Vivianite (204, xxiii.)—Monoclinic, imitative shapes, incrustations, earthy. H=1 5—2. G=2.58—2.68. Lustre pearly, vitreous. Streak colorless, blue. Color white, blue, green. Soluble in hydrochloric acid. Fuses easily. Reacts for iron, phosphorus, and water. Composition: phosphorus pentoxide 28.3, iron monoxide 43.0, water 28.7.

Wad (92, xxiv.)—Amorphous, reniform, and earthy masses. Fracture uneven. H=0.5—6. G=3—4.26. Lustre metallic, earthy. Streak brown. Color black, bluish or brownish black. Soluble in hydrochloric acid, with evolution of chlorine. Infusible. Reacts for manganese, also water from most varieties. Is a mixture of different oxides, mainly those of manganese.

Warwickite (220, xxvii.) — Monoclinic. Fracture uneven. H=3—4. G=3.19—3.43. Lustre submetallic, vitreous, pearly. Streak bluish black. Color brown, black, sometimes tinged copper red on cleavage surface. Decomposed by sulphuric acid. Infusible. Reacts for boron, titanium, iron, and water. One analysis gives: boron trioxide 27.80, titanium dioxide 23.82, iron sesquioxide 7.02, magnesia 36.80, silica 1.00, alumina 2.21.

Wavellite (210, xxv.)—Orthorhombic, concretions more or less globular. Fracture uneven. H=3—4. G=2.316—2.337. Lustre vitreous, pearly, resinous. Streak white. Color white, yellow, green, gray, brown, black. Soluble in hydrochloric acid. Infusible. Reacts for phosphorus, aluminum, and water, some varieties for iron and manganese. Composition: phosphorus pentoxide 35.1, alumina 38.1, water 26.8.

Wernerite (129) — Tetragonal, massive, columnar. Fracture subconchoidal. H=5—6. G=2.63—2.8. Lustre vitreous, resinous, pearly. Streak uncolored. Color white, gray, bluish, greenish, reddish. Attacked by hydrochloric acid. Fuses easily with intumescence. Composition: silica 48.4, alumina 28.5, lime 18.1, sodium oxide 5.0.

Whitneyite (23, xiv.)—Massive, malleable. H=3.5. G=8.246—8.471. Lustre dull, submetallic; metallic on fresh surface. Streak reddish white. Color reddish white, grayish white, tarnishing to bronze, brown, and black on exposure. Soluble in nitric acid. Fusible. Reacts for arsenic and copper. Composition: arsenic 11.64, copper 88.36.

Willemite (113).—Rhombohedral, massive. Fracture conchoidal. H=5.5. G=3.89—4.18. Lustre rather weak but somewhat vitreo-resinous. Streak uncolored. Color white, green, yellow, red, brown. Gelatinizes in hydrochloric acid. Fuses with difficulty. Reacts for zinc. Composition: silica 27.1, zinc oxide 72.9.

Witherite (249, xxix.) — Orthorhombic, amorphous, imitative forms. Fracture uneven. H=3—4. G=4.29—4.35. Lustre vitreous, resinous. Streak white. Color white, yellowish, grayish. Soluble in hydrochloric acid with effervescence. Fuses easily, and afterwards reacts alkaline. Reacts for barium. Composition: carbon dioxide 22.3, baryta 77.7.

Wolframite (221, xxiii.) — Orthorhombic, massive, lamellar, columnar. Fracture uneven. H=5—5.5. G=7.1—7.55. Lustre submetallic. Streak reddish brown, black. Color brownish black. Decomposed by aqua regia. Fusible. Reacts for tungsten, iron, and manganese. Composition: tungsten trioxide 76.47, iron monoxide 9.49, manganese monoxide 14.04.

Wollastonite (102).—Monoclinic, massive. Fracture uneven. H=4.5—5. G=2.78—2.9. Lustre vitreous, pearly. Streak white. Color white, gray, yellow, red, brown. Gelatinizes sometimes with effervescence in hydrochloric acid. Fusible. Composition: silica 51.7, lime 48.3.

Wulfenite (223, xv.)—Tetragonal, massive. Fracture uneven. H=2 5—3. G=6.03—7.01. Lustre resinous, adamantine. Streak white. Color yellow, green, gray, white, brown, red. Decomposed by hydrochloric acid. Fuses easily, decrepitating. Reacts for lead and molybdenum. Composition: lead oxide 61.5, molybdenum trioxide 38.5.

Xenotime (197, xxvi.)—Tetragonal. Fracture uneven, splintery. H=4—5. G=4.45—4.56. Lustre resinous. Streak pale brown, yellowish, reddish. Color brown, red, yellow, white. Insoluble in acids. Infusible. Reacts for phosphorus. Composition: phosphorus pentoxide 37.86, yttria 62.14.

Yttrocerite (59, xxvi.)—Massive, earthy. Fracture uneven. H=4—5. G=3.447. Lustre vitreous, pearly. Streak white. Color blue, gray, white, reddish brown. Soluble, when pulverized, in hot hydrochloric acid. Infusible. Reacts for water and fluorine. Contains the fluorides of calcium, cerium, and yttrium in different proportions.

Zincite (65, xvi.)—Hexagonal, in grains and masses. Fracture subconchoidal. H=4—4.5. G=5.43—5.7. Lustre subadamantine. Streak orange yellow. Color red, orange yellow. Soluble in acids. Infusible. Reacts for zinc. Composition: oxygen 19.74, zinc 80.26.

Zircon (116).—Tetragonal. Fracture conchoidal. H=7.5. G=4.05—4.75. Lustre adamantine. Streak uncolored. Color colorless, yellow, red, brown, green, pink. By concentrated sulphuric acid is attacked if in fine powder, otherwise not acted upon by acids. Infusible, but if colored becomes colorless or white before the blow-pipe. Composition: silica 33, zirconia 67.

Zoisite (120).—Orthorhombic, massive. Fracture uneven. H=6—6.5. G=3.11—3.38. Lustre pearly, vitreous. Streak uncolored. Color white, gray, yellow, brown, green, red. Insoluble in acids. Fuses with intumescence. Composition: silica 39.9, alumina 22 8, lime 37.3.

CHAPTER IV.

CHEMICAL CLASSIFICATION.

THE general divisions in this classification of minerals are as follows:

I. Elements:

Series I. Native elements distinctively basic or electro-positive.

Series II. Native elements which may act as acidic elements and are generally electro-negative.

Series III. Elements, not native (except oxygen in air), distinctively acidic and electro-negative. Group I., Chlorine, Bromine, Iodine; Group II., Fluorine; Group III., Oxygen.

II. Compounds: The electro-negative an element of Series II.

(*A*) Binary: Sulphides and Tellurides of the elements of the Sulphur and Arsenic Groups.

(*B*) Binary: Sulphides, Tellurides, Arsenides, and Antimonides of the metals of the Gold, Iron, and Tin Groups.

(*C*) Ternary: Sulpharsenites, Sulphantimonites, and Sulphobismuthites.

III. Compounds: The electro-negative an element of Series III., Group I., Chlorides, Iodides.

IV. Compounds: The electro-negative an element of Series III., Group II., Fluorides.

V. Compounds: The electro-negative an element of Series III., Group III., Oxygen Compounds.

(*A*) Binary:

(*a*) Oxides of the metals of the Gold and Iron and Tin Groups.

1. Anhydrous. 2. Hydrous.

(*b*) Oxides of the elements of the Arsenic and Sulphur Groups.

(*c*) Oxides of the elements of the Carbon-Silicon Group.

(*B*) Ternary:

(*a*) Silicates.

1. Anhydrous.
   Bisilicates.
   Unisilicates.
   Subsilicates.
2. Hydrous.
   General Section.
   Zeolite Section.
   Margarophyllite Section.

(*b*) Tantalates, Columbates.

(*c*) Phosphates, Arsenates, Nitrates.

1. Anhydrous Phosphates and Arsenates.
2. Hydrous Phosphates and Arsenates.
3. Nitrates.

(*d*) Borates.

(*e*) Tungstates, Molybdates.

(*f*) Sulphates, Tellurates.

1. Anhydrous Sulphates.
2. Hydrous Sulphates.
3. Hydrous Tellurates.

(*g*) Carbonates.
1. Anhydrous.
2. Hydrous.

Classification of Species.

I. NATIVE ELEMENTS.

SERIES I.

Gold Group.

1. Gold.
2. Silver.

Iron Group.

3. Platinum.
4. Iridosmine.
5. Mercury.
6. Gold-amalgam.
7. Copper.
8. Iron.

Tin Group.

9. Tin.

SERIES II.

Arsenic Group.

10. Arsenic.
11. Antimony.
12. Bismuth.

Sulphur Group.

13. Sulphur.

Carbon-Silicon Group.

14. Diamond.
15. Graphite.

II. SULPHIDES, TELLURIDES, ARSENIDES, ANTIMONIDES.

(*A*) SULPHIDES AND TELLURIDES OF THE METALS OF THE SULPHUR AND ARSENIC GROUPS.

Orpiment Group.

16. Orpiment.
17. Stibnite.
18. Bismuthinite.

Tetradymite Group.

19. Tetradymite.

Molybdenite Group.

20. Molybdenite.

(*B*) Sulphides, Tellurides, Arsenides, Antimonides of the Metals of the Gold, Iron, and Tin Groups.

BASIC OR DYSCRASITE DIVISION.

21. Domeykite.
22. Algodonite.
23. Whitneyite.

PROTO OR GALENA DIVISION.

Galena Group.

24. Argentite.
25. Galenite.
26. Bornite.

Blende Group.

27. Sphalerite.

Chalcocite Group.

28. Hessite.
29. Chalcocite.
30. Stromeyerite.

Pyrrhotite Group.

31. Cinnabar.
32. Millerite.
33. Pyrrhotite.
34. Greenockite.
35. Niccolite.
36. Breithauptite.

DEUTO OR PYRITE DIVISION.

Pyrite Group.

37. Pyrite.
38. Chalcopyrite.
39. Barnhardtite.
40. Linnæite.
41. Smaltite.
42. Gersdorffite.

Marcasite Group.

43. Marcasite.
44. Leucopyrite.
45. Arsenopyrite.

(*C*) Sulpharsenites, Sulphantimonites, Sulphobismuthites.

46. Berthierite.
47. Pyrargyrite.
48. Proustite.
49. Aikinite.
50. Tetrahedrite.
51. Geocronite.
52. Stephanite.
53. Polybasite.
54. Enargite.

III. CHLORIDES, IODIDES.

Halite Group.

55. Halite.
56. Cerargyrite.

Iodyrite Group.

57. Iodyrite.

IV. FLUORIDES.

Fluorite Group.

58. Fluorite.
59. Yttrocerite.

Cryolite Group.

60. Cryolite.

V. OXYGEN COMPOUNDS.

(*A*) Binaries.

(*a*) Oxides of the Elements of the Iron and Tin Groups.

1. Anhydrous.

PROTOXIDES.

Cuprite Group.

61. Cuprite.

Zincite Group.

62. Water.
63. Zincite.

Massicot Group.

64. Massicot.
65. Melaconite.

SESQUIOXIDES.

Corundum Group.

66. Corundum.
67. Hematite.
68. Menaccanite.

COMPOUNDS OF PROTOXIDES AND SESQUIOXIDES.

Spinel Group.

69. Spinel.
70. Gahnite.
71. Magnetite.
72. Franklinite.
73. Chromite.

Chrysoberyl Group.

74. Chrysoberyl.

DEUTOXIDES.

Rutile Group.

75. Cassiterite.
76. Rutile.

77. Octahedrite.
78. Hausmannite.
79. Braunite.
80. Minium.

Brookite Group.

81. Brookite.
82. Pyrolusite.

2. Hydrous Oxides.

83. Turgite.
84. Diaspore.
85. Goethite.
86. Manganite.
87. Limonite.
88. Brucite.
89. Gibbsite.
90. Hydrotalcite.
91. Psilomelane.
92. Wad.

(*b*) Oxides of the Elements of the Arsenic and Sulphur Groups.

Arsenolite Group.

93. Arsenolite.

Valentinite Group.

94. Molybdite.
95. Tungstite.

Cervantite Group.

96. Cervantite.
97. Partzite.

(*c*) Oxides of the Elements of the Carbon-Silicon Group.

98. Quartz.
99. Opal.

(*B*) Ternaries.

(*a*) Silicates.

1. Anhydrous.

BISILICATES.

Amphibole Group.

100. Enstatite.
101. Hypersthene.
102. Wollastonite.
103. Pyroxene.
104. Rhodonite.
105. Babingtonite.
106. Spodumene.
107. Petalite.
108. Amphibole.

Beryl Group.

109. Beryl.
109*a*. Eudialyte.

UNISILICATES.

Chrysolite Group.

110. Forsterite.
111. Chrysolite.
112. Tephroite.

Phenacite Group.

113. Willemite.

Helvite Group.

114. Danalite.

Garnet Group.

115. Garnet.

Vesuvianite Group.

116. Zircon.
117. Vesuvianite.

Epidote Group.

118. Epidote.
119. Allanite.
120. Zoisite.

Axinite Group.

121. Axinite.
122. Danburite.

Iolite Group.

123. Iolite.

Mica Group.

124. Phlogopite.
125. Biotite.
126. Muscovite.
127. Lepidolite.
128 Cryophyllite.

Scapolite Group.

129. Wernerite.
130. Ekebergite.

Nephelite Group.

131. Nephelite.

Leucite Group.

132. Sodalite.

Feldspar Group.

133. Labradorite.
134. Oligoclase.
135. Albite.
136. Orthoclase.

SUBSILICATES.

Chondrodite Group.

137. Chondrodite.

Tourmaline Group.

138. Tourmaline.

Andalusite Group.

139. Andalusite.
140. Fibrolite.
141. Cyanite.
142. Topaz.

Euclase Group.

143. Datolite.

Titanite Group.

144. Titanite.

Staurolite Group.

145. Staurolite.

Schorlomite Group.

146. Schorlomite.

2. Hydrous Silicates.

GENERAL SECTION.

BISILICATES.

Pectolite Group.

147. Pectolite.
148. Gyrolite.
149. Laumonite.

Dioptase Group.

150. Chrysocolla.

UNISILICATES.

Calamine Group.

151. Calamine
152. Prehnite.
153. Chlorastrolite.

Apophyllite Group.

154. Apophyllite.

SUBSILICATES.

155. Allophane.
156. Schrötterite.

ZEOLITE SECTION.

UNISILICATES.

Mesotype Group.

157. Thomsonite.
158. Natrolite.
159. Mesolite.

BISILICATES.

Analcite Group.

160. Analcite.

Chabazite Group.

161. Chabazite.

Stilbite Group.

162. Stilbite.
163. Epistilbite.
164. Heulandite.

MARGAROPHYLLITE SECTION.

BISILICATES.

Talc Group.

165. Talc.
166. Pyrophyllite.
167. Pihlite.

Sepiolite Group.

168. Smectite.

Chloropal Group.

169. Stilpnomelane.
170. Glauconite.

UNISILICATES.

Serpentine Group.

171. Serpentine.
172. Deweylite.
173. Cerolite.
174. Hydrophite.
175. Genthite.
176. Saponite.

Kaolinite Group.

177. Pholerite.

178. Kaolinite.
179. Halloysite.

Pinite Group.

180. Pinite.
181. Palagonite.

Margarodite Group.

182. Fahlunite.
183. Margarodite.
184 Euphyllite.
185. Cookeite.

SUBSILICATES.

Chlorite Group.

185*a*. Vermiculite.
186. Jefferisite.
187. Penninite.
188. Ripidolite.
189. Prochlorite.

Chloritoid Group.

190. Corundophyllite.
191. Chloritoid.
192. Margarite.
193. Thuringite.

Seybertite Group.

194. Seybertite.

(*b*) Tantalates and Columbates.

Pyrochlore Group.

195. Microlite.

Tantalate Group.

196. Columbite.

(*c*) Phosphates, Arsenates, Nitrates.

1. Anhydrous Phosphates, Arsenates.

Xenotime Group.

197. Xenotime.

Apatite Group.

198. Apatite.
199. Pyromorphite.
200. Mimetite.

Wagnerite Group.

201. Monazite.

Triplite Group.

202. Triphyllite.

Amblygonite Group.

203. Amblygonite.

2. Hydrous Phosphates, Arsenates.

BASES IN THE PROTOXIDE STATE.

Vivianite Group.

204. Vivianite.
205. Erythrite.
206. Annabergite.

Liroconite Group.

207. Pseudomalachite.

BASES WHOLLY OR IN PART IN THE SESQUIOXIDE STATE.

208. Scorodite.
209. Lazulite.
210. Wavellite.
211. Childrenite.
212. Turquois.
213. Autunite.
213*a*. Dufrenite.

3. Nitrates.

214. Nitre.
215. Nitrocalcite.
216. Nitromagnesite.

(*d*) Borates.

217. Sassolite.
218. Borax.
219. Ulexite.
220. Warwickite.

(*e*) Tungstates, Molybdates.

221. Wolframite.
222. Hubnerite.
223. Wulfenite.

(*f*) Sulphates, Tellurates.

1. Anhydrous Sulphates.

Celestite Group.

224. Barite.
225. Celestite.
226. Anhydrite.
227. Anglesite.
228. Leadhillite.

Caledonite Group.

229. Caledonite.

Glauberite Group.

230. Glauberite.

2. Hydrous Sulphates.

231. Mirabilite.
232. Gypsum.
233. Epsomite.
234. Melanterite.
235. Morenosite.
236. Chalcanthite.
237. Alunogen.
238. Kalinite.
239. Bosjemanite.
240. Jarosite.
241. Johannite.

3. Hydrous Tellurates.

242. Montanite.

(*g*) Carbonates.

1. Anhydrous.

Calcite Group.

243. Calcite.
244. Dolomite.
245. Magnesite.
246. Siderite.
247. Smithsonite.

Aragonite Group.

248. Aragonite.
249. Witherite.
250. Strontianite.
251. Cerussite.

2. Hydrous Carbonates.

252. Natron.
253. Thermonatrite.
254. Trona.
255. Gay-Lussite.
256. Hydromagnesite.
257. Hydrodolomite.
258. Lanthanite.
259. Remingtonite.
260. Hydrozincite.
261. Aurichalcite.
262. Malachite.
263. Azurite.
264. Bismutite

CHAPTER V.

CLASSIFICATION BY BASIC ELEMENTS AND ORES.

In this classification the minerals are so arranged in groups that the members of each group are under the head of the most prominent metal in their constitution. It is found impracticable to classify the silicates in this way, because of the great number of basic elements which they so often contain; moreover, such a classification would be of very little practical value, as there are so very few workable ores among them. Silica and the silicates make a division in this classification which it is not necessary to give in full in this chapter, as it would only be repeating the arrangement of the species numbered from 98 to 194 in Chapter IV.

The general divisions in this classification of minerals are as follows:

I. Acidic Division—Elements which are acidic and, relative to the elements of Division II., electro-negative, together with compounds with one another (silica excepted).

II. Basic Division—Elements which are basic and, relative to elements of Division I., electro-positive, together with all compounds of the basic elements (silicates excepted).

III. Silica and the silicates.

Classification of Species.

I. Acidic Division.

I. SULPHUR.
Sulphur.

II. MOLYBDENUM.
Molybdenite.
Molybdite

III. TUNGSTEN.
Tungstite.

IV. BORON.
Sassolite.

V. ARSENIC.
Arsenic.
Orpiment.
Arsenolite.

VI. ANTIMONY.
Antimony.
Stibnite.
Berthierite.
Cervantite.
Partzite.

VII. BISMUTH.
Bismuth.
Bismuthinite.
Tetradymite.
Aikinite.
Montanite.
Bismutite.

VIII. CARBON.
Diamond.
Graphite.

II. Basic Division.

IX. GOLD.

Gold.
Gold-Amalgam.

X. SILVER.

Silver.
Argentite.
Stromeyerite.
Hessite.
Pyrargyrite.
Proustite.
Stephanite.
Polybasite.
Cerargyrite.
Iodyrite.

XI. PLATINUM.

Platinum.

XII. IRIDOSMINE.

Iridosmine.

XIII. MERCURY.

Mercury.
Cinnabar.

XIV. COPPER.

Copper.
Chalcocite.
Chalcopyrite.
Barnhardtite.
Bornite.
Domeykite.
Algodonite.
Whitneyite.
Tetrahedrite.
Enargite.
Cuprite.
Melaconite.
Chalcanthite.
Pseudomalachite.
Malachite.
Azurite.
Chrysocolla.

XV. LEAD.

Galenite.
Geocronite.
Minium.
Massicot.
Anglesite.
Caledonite.
Wulfenite.
Leadhillite.
Pyromorphite.
Mimetite.
Cerussite.

XVI. ZINC.

Sphalerite.
Zincite.
Smithsonite.
Hydrozincite.
Aurichalcite.

XVII. CADMIUM.

Greenockite.

XVIII. TIN.

Cassiterite.

XIX. TITANIUM.

Rutile.
Octahedrite.
Brookite.

XX. COBALT.

Linnæite.
Smaltite.
Erythrite.
Remingtonite.

XXI. NICKEL.

Millerite.
Niccolite.
Breithauptite.
Gersdorffite.
Annabergite.
Morenosite.

XXII. URANIUM

Autunite.
Johannite.

XXIII. IRON.

Iron.
Pyrite.
Marcasite.
Pyrrhotite.
Arsenopyrite.
Leucopyrite.
Hematite.
Menaccanite.
Magnetite.
Franklinite.
Chromite.
Limonite.
Goethite.
Turgite.
Melanterite.
Jarosite.
Wolframite.
Columbite.
Vivianite.
Dufrenite.
Scorodite.
Siderite.

XXIV MANGANESE.

Pyrolusite.
Hausmannite.
Braunite.
Manganite.
Psilomelane.
Wad.
Triphylite.
Hubnerite.

XXV. ALUMINUM.

Corundum.
Diaspore.
Gibbsite.
Spinel.
Gahnite.
Chrysoberyl.
Cryolite.
Alunogen.
Kalinite.
Bosjemanite.
Amblygonite.
Lazulite.
Turquois.
Childrenite.
Wavellite.

XXVI. { CERIUM. YTTRIUM. LANTHANUM. DIDYMIUM.

Yttrocerite.
Monazite.
Xenotime.
Lanthanite.

XXVII. MAGNESIUM.

Brucite.
Hydrotalcite.
Hydromagnesite.
Epsomite.
Warwickite.
Nitromagnesite.
Magnesite.

XXVIII. CALCIUM.

Fluorite.
Gypsum.
Anhydrite.
Ulexite.
Apatite.
Microlite.
Calcite.
Aragonite.
Dolomite.
Hydrodolomite.
Nitrocalcite.

XXIX. BARIUM.

Barite.
Witherite.

XXX. STRONTIUM.

Celestite.
Strontianite.

XXXI. POTASSIUM

Nitre.

XXXII. SODIUM.

Halite.
Mirabilite.
Glauberite.
Borax.
Natron.
Trona.
Thermonatrite.
Gay-Lussite.

III. Silica and the Silicates.

(See Chapter IV., species numbered from 98 to 194.)

(*Inserted from page* 86.)

Dufrenite (213*a*, xxiii). Orthorhombic, massive, nodules, radiated fibrous. H=3.5—4. G=3.2—3.4. Lustre silky. Color dark leek-green, blackish green, olive, becoming brown or yellow on exposure. Streak green. Soluble in hydrochloric acid. Fuses easily. Reacts for iron, phosphorus, and water. Composition: phosphorus pentoxide 27.5, iron sesquioxide 62, water 10.5.

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