DESCRIPTIVE CATALOGUE
(WITH NOTES)

OF THE

GENERAL COLLECTION OF MINERALS

IN THE

AUSTRALIAN MUSEUM,

BY

A. FELIX RATTE,
“*Ingénieur des Arts et Manufactures*” *(Paris)*,
METALLURGIST.

PRINTED BY ORDER OF THE TRUSTEES,
E. P. RAMSAY, F.R.S.E., CURATOR.

SYDNEY : THOMAS RICHARDS, GOVERNMENT PRINTER.

1885.

5e 34—84

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PRELIMINARY REMARKS.

The order adopted in the arrangement of the present collection in the Australian Museum is only conventional; it has been made to suit the space, and will not be found to agree altogether with any theoretical or systematical classification. Further additions to the Collection will shortly necessitate the publication of Supplementary Catalogues.

However, the minerals have been arranged as far as possible in such an order as to suit practical purposes.

Two large divisions have therefore been distinguished—

Non-Metallic Minerals.
Metallic Minerals.

These are followed by appendices including Gems, Ornamental Specimens, &c.

Dana's system of Mineralogy has been used as a guide for the classification of the Silicates, and Roscoe's Chemistry for the classification of the Metallic Minerals, but these authors' systems have not been entirely followed, especially when rare mineral products are concerned.

THE SUPPLEMENT.

In the Supplement are included Minerals which have been placed in the Museum since the present Catalogue was begun. It also contains some additions to numbers actually quoted in the Catalogue. A red star added to the number on the label will indicate that this number is mentioned in the Supplement. As a rule, simple numbers (without *a*, *b*, &c.) in the Supplement are those also represented in the Catalogue.

ERRATA.

(The most important.)

Page 6, line 13 *Instead of* "heat" *read* "gas."
" 35, " 9. *Instead of* "2140 *bis*" *read* "2152.,'
" 50, No. 591. *Instead of* "amorphous" *read* "isomorphous."
" 95, bottom of page. *Before* "**Helvite**" *add* "1123 *bis.*"
" 96, line 10. *Before* "**Leucophanite**" *add* "1123 *ter.*"
" 102, " 1157. *After* "1157," *add* "1157 *bis*" *and* "1157 *ter.*"
" 138, line 13. *Omit* "WOLFRAMITE."
" 179, " 26. *Omit* "and of the cleavages of the stone."
" 179, " 27. *Instead of* "cleavages" *read* "faces."

(Of minor importance.)

Page 8, line 8. *Instead of* "Sable" *read* "Sablé."
" 26, " 13. *Instead of* "Dolomien" *read* "Dolomieu."
" 27, No. 302. *Instead of* "Sicilia" *read* "Sicily."
" 34, " 412. *Instead of* "Bodenmaiz" *read* "Bodenmais."
" 36, line 20 *Instead of* "Torquois" *read* "Turquoise."
" 38, No. 433. *Instead of* "Ivikaet" *read* "Ivigtok."
" 44, " 539. *Instead of* "Sibethen" *read* "Libethen."
" 47, line 23. *Instead of* "Andoulousite" *read* "Andalusite."
" 57, No. 68. *Instead of* "*Cut*" *read* "*best cutting stones.*"
" 60, No. 733 *bis.* *Instead of* "Orijerfoir" *read* "Orijerfvi."
" 92, line 4. *Instead of* "Τοπαζιος" *read* "Θοπαζιος."
" 93, " 16. *Instead of* "οδμη" *read* "οσμη."
" 105, " 18. *Instead of* "ores are" *read* "ores of zinc are."
" 113, " 5. *Instead of* "*Pyrites*" *read* "*Limonite.*"
" 114, " 6. *Instead of* "Oberstein" *read* "Oberneisen."
" 129, " 26. *Instead of* "CLASS" *read* "MINERALS."
" 148, three lines from bottom. *Instead of* "ores" *read* "minerals."
" 151, bottom of page. *Instead of* "**Mimetesite**" *read* "**Mimetite.**"
" 159, line 14. *Instead of* "waste" *read* "decomposition."
" 161, last line. *Instead of* "wrought" *read* "worked."
" 175, line 8. *After* "gangue" *substitute comma for full point.*
" 178, " 3. *Instead of* "**Silvanite**" *read* "**Sylvanite.**"
" 178, " 18. *Instead of* "In flattened" *read* "Platinum occurs in flattened."
" 178, No. 2046. *Instead of* "Moask" *read* "Miask."
" 179, line 4. *Instead of* "made" *read* "paid."

PART I.—NON-METALLIC MINERALS.

DIVISION A.—METALLOIDS.

I. CARBON AND HYDROCARBONS.—Carbonates to be found in the various subdivisions of Alkaline, Earthy, and Metallic Minerals.

II. BORON AND SILICON (Borates included).—Silica and the Silicates to be found in the special divisions of Silica and Silicates, and in the various subdivisions of the Metallic Minerals.

III. SULPHUR.—Sulphides to be found in the various subdivisions of the Metallic Minerals, and Sulphates in the various subdivisions of the Alkaline, Earthy, and Metallic Minerals.

OBSERVATION.—*Oxygen,* which forms about the fifth part of the air in volume, exists in all the oxidized minerals.

Nitrogen, which forms about the four-fifths in volume of the air, exists in only a limited number of minerals, either as ammonia or as nitric acid; these minerals are mostly found in the subdivision of the alkaline metals.

Phosphorus, as phosphoric acid, forms a tolerably large number of natural phosphates, to be found distributed in the different subdivisions of metals.

Arsenic has been placed close to Antimony for some reasons given. It exists in nature in the metallic state and combined. Its combinations with metals are to be found in the subdivisions of the metallic minerals.

Selenium and Tellurium, though they exist in nature in the free state, are very rare, and occur mostly in combination with silver and other metals. Tellurium is the only metalloid which is known to be found, in nature, in combination with gold. Tellurium and Selenium will be found in metallic minerals, mostly in the silver and gold subdivisions.

Chlorine, Bromine, Iodine, and Fluorine, which do not exist in nature, in the free state, will be found in the various subdivisions of metals with which they occur combined.

Lastly, *Hydrogen,* which occurs free only in small proportion in certain volcanic gases, and also exists absorbed in certain specimens of meteoric iron, is to be found more frequently in nature in combination with carbon forming various hydrocarbons, and with oxygen forming water. As hydrocarbons it will be found in the first subdivision, and as water it will be found in combination with a large number of non-metallic and metallic minerals, which will be, for this reason, distinguished into *Anhydrous* and *Hydrous.*

DIVISION B.—ALKALIES AND EARTHS.

I. ALKALINE SALTS (Roscoe's Class I, and some other Soluble Salts).—Including Ammonia, Potash, Soda, and Lithia.

II. ALKALINE-EARTHY SALTS (Roscoe's Class II, *plus* Magnesia).—Including Baryta, Strontia, Lime (Oxide of Calcium), and Magnesia.

III. ALUMINA AND SALTS (Roscoe's Class III).—Including Alumina, Aluminates, Silicio-Aluminates, and Salts of Alumina.

DIVISION C.—SILICA AND SILICATES.

I. SILICA.

II. SILICATES.—In which Silica only is the acid; with few exceptions, Alumina, Magnesia, Iron, Alkalies are the predominating bases in these compounds.

III. SILICATES.—In which there is another acid besides Silica, as Sulphuric Acid, Boric Acid, Hydrochloric, Hydrofluoric Acid, &c. Some of these are Gems.

IV. SILICATES.—In which Glucinium and Zirconium play a greater part. Mostly gems.

DIVISION D.—ZIRCON-SYENITE MINERALS.

I. SILICATES.—And exceptionally other salts in which the rare metals Cerium, Yttrium, and Thorium play the greater part as bases. (Roscoe's Class IV and VII, *partly.*)

II. NIOBATES, &C.—In which the rare metals Tantalum and Niobium form the acids, whilst the bases are those of the above subdivision or others. (Class IX of Roscoe, *partly.*)

PART II.—METALLIC MINERALS.

DIVISION A.—ZINC CLASS.

(Roscoe's Class V, partly ; Magnesium among Alkalies and Earths ; Glucinium among Silicates.)

ZINC AND CADMIUM MINERALS.

DIVISION B.—IRON CLASS.

(Roscoe's Class VI.)

I. MANGANESE MINERALS.
II. IRON MINERALS.
III. COBALT MINERALS.
IV. NICKEL MINERALS.

DIVISION C.—TIN CLASS.

(Roscoe's Class VII, partly ; Zirconium and Thorium among Silicates.)

I. TIN MINERALS.
II. TITANIUM MINERALS.

DIVISION D.—CHROMIUM CLASS.

(Roscoe's Class VIII.)

I. CHROMIUM MINERALS.
II. MOLYBDENUM MINERALS.
III. TUNGSTEN MINERALS.
IV. URANIUM MINERALS.

DIVISION E.—ANTIMONY CLASS.

(Roscoe's Class V, partly, plus Arsenic ; Vanadium is to be found as Vanadate of other metals ; Niobium and Tantalum after the Silicates.)

I. ARSENIC MINERALS.
II. ANTIMONY MINERALS.
III. BISMUTH MINERALS.

DIVISION F.—LEAD CLASS.

(Roscoe's Class X.)

LEAD AND THALLIUM MINERALS.

Division G.—SILVER CLASS.

(Roscoe's Class XI.)

I. Copper Minerals.
II. Mercury Minerals.
III. Silver Minerals.

Division H.—GOLD CLASS.

(Roscoe's Class XII; Selenium, Tullurium, and their compounds, to be found among Silver and Gold Minerals.)

I. Gold Minerals.
II. Platinum and allied Metals.

APPENDICES.

I. Gems and Precious Stones.
II. Ornamental and Exceptional Specimens.
(Placed in special cases.)

PART I.

NON-METALLIC MINERALS.

Division A.—METALLOIDS.

SUBDIVISION I.—CARBON AND HYDROCARBONS.

Diamond as a precious stone, the hardest of all, used in consequence for cutting and polishing all the hardest stones, including itself,—**Black Diamond**, used for boring in hard rocks,—and **Graphite**,—are the three varieties of Carbon in its pure state. Graphite has also very important applications when sufficiently pure (that is to say, not mixed with earthy matters, &c.), namely, the manufacture of pencils and crucibles.

The importance of combustibles need not be insisted upon. Details will be found hereafter.

The oxygenated hydrocarbon compounds include the well-known **Amber**, of some value when of good quality. Rosin or Kaori Gum is often manufactured into small ornamental articles, sold as Amber; but Rosin is very brittle, and is not to be mistaken for the more valuable product.

CARBON AND VARIETIES.

DIAMOND.

Αδάμας, *untamable*, being the hardest body.

Chemical composition—Carbon.

In octahedrons, tetrahedrons, dodecahedrons, and forms related to these; the faces of the crystals sometimes curved. Transparent. Colourless, yellow, red, green, blue, white, brown, or black. Lustre, adamantine. Breaks with smooth cleavage planes parallel to the octahedral faces. Specific gravity, 3·5; loses 10-35ths of its weight in water. Hardness, 10. It is the hardest substance known, and scratches all other minerals and gems. Infusible. It burns, and is consumed at a high temperature.

1. **Diamond**—Bingera, N.S.W.

(See also Gems and Precious Stones.)

These specimens are accompanied with gem-sand, pebbles, boulders, conglomerates, and wash-dirt, illustrating Professor A. Liversidge's paper on the Bingera Diamond Field, N.S.W., delivered before the Royal Society, 1873. As well as in other diamond fields, the Bingera diamonds are found with other alluvial gem-stones, such as zircons, sapphires, topaz, &c., together with some heavy metallic minerals, such as titanic iron, wood-tin, gold, &c.

2. **Diamonds**—*in octahedrons*—CAPE COLONY.

These Diamonds are accompanied with separate specimens of the rock or matrix in which they are found in their original deposit at the Cape.

(See also Gems and Precious Stones.)

3. **Black Diamond**—*as used for boring*—BRAZIL.

GRAPHITE or *Black Lead* or *Plumbago*.

Γραφειν, *to write*.

Chemical composition—Carbon.

In six-sided prisms; but usually in uncrystallized, wavy layers. Opaque. Black. Lustre, metallic. Specific gravity, 2. Hardness, 1 to 2. Very easily cut with a knife. Has a greasy feel; marks paper like a lead-pencil. Infusible. Burns slowly away. Molybdenite and Foliated Tellurium resemble Graphite; the former has a paler colour than Graphite, and the latter is very easily fusible. Occurs in Gneiss and Slate. Valuable for lead-pencils and crucibles.

4. **Graphite**—Borrowdale, Cumberland, ENGLAND.
5. ,, ,, ,, ,,
6. ,, ,, ,, ,,
7. ,, (See large specimens)—CEYLON.
8. ,, Passau, Bavaria, GERMANY.

HYDROCARBONS.

COAL.

Coal is vegetable matter which has become mineralized by certain chemical changes which it has undergone, and by subsequent solidification by compression under the weight of the strata which have been accumulated above it since it was originally deposited. It appears to be composed of terrestrial and aquatic plants and trees (the decay of which probably reduced them to peat), which grew in a warm and moist climate of equable temperature, on the areas it now occupies, close to, or perhaps in, the margin of a shallow sea; and the clay (*Underclay*), with the roots of plants (*Stigmaria*, &c.) supporting each bed of coal, is the soil on which the vegetation grew of which it is formed. Each separate bed of coal, on this supposition, denotes the former existence of an adjoining surface of land, on the depression of which, beneath a sea of moderate depth, the vegetable matter growing upon it became covered up by a deposit of sediment, which, in its turn, by the further deposit of sediment and oscillation of level, supported a fresh growth of vegetation. In this manner, by a series of depressions of moderate amount, each bed of coal was formed in succession, while its interstratification with beds of limestone, shale, clay, sandstone, and ironstone, indicates alternations of marine, estuary, and lagoon conditions. Although coal for the most part appears to have been formed in the above-mentioned manner, it is probable that other conditions may have occasionally prevailed, as, for instance, in the north of England and in the south of Russia, where some of the coal-beds are stated to be apparently composed of the remains of broken and drifted plants carried into the sea by inundations and the freshets of rivers.

Coal is composed of Carbon, Hydrogen, Nitrogen, Oxygen, Sulphur, and earthy matter or Ash, in variable proportions. The greater the proportions of Carbon and Hydrogen the better is the coal, while sulphur and ash tend to render the coal both unpleasant to use and prejudicial in its effects, especially in the smelting of iron and steel.

Coals may be divided into two classes—bituminous, and non-bituminous or anthracite. These change gradually, and merge one into the other, and in the South Wales coal-field the bituminous coal passed into anthracite in a westerly direction. The conversion of the vegetable matter into coal was apparently produced by a kind of moist putrefaction, accompanied by the exclusion of all access of air. Under those circumstances the oxygen escaped in the form of carbonic acid, while the hydrogen being disengaged in the form of carburetted hydrogen, the carbon became in consequence more concentrated. In this manner, by the removal of all the hydrogen, bituminous coal becomes converted into anthracite. S.G. 1·20 to 1·59; mean S.G of thirty-one samples, 1·3.

Analysis[*] from Graigola in S. Wales (S.G. 1·3) :—

Carbon	84·87
Hydrogen	3·84
Nitrogen	0·41
Sulphur	0·45
Oxygen	7·19
Ash...	3·24
	100·00

Coke left by the Coal, 85·5 per cent.

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[*] Report on the Coals suited to the Steam Navy, by Sir Henry T. De la Beche and Dr. Lyon Playfair; Memoirs of the Geological Survey of Great Britain, vol. ii, part 2. For analysis of Australian Coals, see "Mineral Products of New South Wales," &c., a series of Reports, Department of Mines, Sydney, 1882, in which are to be found numerous analyses of Australian Coals by Prof. A. Liversidge and by Prof. W. A. Dixon; see also Annual Reports of the Department of Mines, Sydney, from 1875 to 1880, especially the last one published, for the year 1879, with a Report on the Coals of New South Wales by Prof. W. A. Dixon.

The above remarks and the example of analysis given have been taken from the old Catalogue of Minerals.

It is to be observed that this analysis is what is called an "*ultimate analysis*" (*analyse élémentaire*, French), as, with the exception of the ashes, the proportions of the *simple* or *elementary* bodies only are given.

In order to understand practically such an analysis, one should bear in mind that the greater the proportion of carbon in a coal, the greater is the proportion of coke produced; that the greater the proportion of hydrogen, the greater is the proportion of bituminous matter; that the smaller the proportion of oxygen, the smaller will be the proportion of water given off: sulphur and ashes in the said analysis are in relatively small proportions; a greater proportion would be objectionable and detrimental, especially if used for certain purposes, as metallurgical operations, &c. But if we attempt to base a classification of coal on ultimate analysis, serious difficulties will arise, and it will be found that some anomalies take place, in consequence of the various modes of combinations in which the elements carbon, hydrogen, and oxygen exist in different coals. The rules of relation between the quantity of coke produced and that of carbon contained, in the coal, as given above, are consequently not absolutely true, and it is necessary to let the basis of a classification rest upon more practical grounds.

The "*proximate analysis*" ("*analyse immediate*," French) separates the bodies from each other in such a state of combination as their relative proportions are in a more direct relation with their special properties and uses, and consequently are more likely to be understood by those who have to utilize them as combustibles or reagents. For instance, the so-called *proximate analysis* corresponds better with the calorific power than the *ultimate analysis*. The coals which give after distillation (retorting) the most fixed carbon or coke are also those which give the greatest amount of heat. In fine, the best way of ascertaining the value of coals, and of classifying them, is to distil them in a retort, in order to determine the relative proportions of water, bituminous matter, and coke. This mode of classifying coals will be found to agree well enough with their practical uses, and even to a certain extent with their external appearance.

As far as industrial combustibles are concerned, **Anthracite** is one of the last results of the natural distillation of vegetable matter, to which it has been submitted during the long periods of geological ages, in the great laboratory of the earth. **Graphite**, nearly pure carbon, but of no use as a combustible, is really the ultimate product of the natural distillation of vegetable matter, and the only remaining trace of plants that existed in the earliest formations of the earth crust, much altered by the so-called metamorphic agencies.

As the diamond or pure carbon in this Catalogue begins the set of the Carbon Minerals; in the same manner, Anthracite among the Hydrocarbon Minerals will be considered first; the natural series of transformation of vegetable matter into pure carbon being as follows:—Undecomposed vegetable matter, Peat, Woody-Lignite or Fossil Wood, Lignite or Brown Coal, Black Coal, Anthracite, Graphite.

Let us consider as types of reference in the classification the three coals—Anthracite, Black Coal, and Brown Coal; they can be characterized by the following:—

	Anthracite.	**Black Coal.**	**Brown Coal.**
Carbon, per cent.	94	84	74
Hydrogen ,, ...	2½	5½	7½
Oxygen ,, ...	1	8 (*bit. coal*)	14 (*or more*)
Specific gravity	1·40–1·80	1·25–1·40	1·15–1·25

Taking the Brown Coal or Lignite and the type of Anthracite as limits, the mineral coals form between these two extremes a perfect and continuous series, as above stated. Within these limits there is an insensible passage, and certain samples could be called as well Lignites as Coals, and some others may be called as well Coals as Anthracites.

It will be remarked that the ratio represented by the sum of the Oxygen and the Nitrogen, divided by the quantity of Hydrogen, plays a great part in the characters of the classes. This ratio will be expressed as follows, $\frac{O+N}{H}$, and will be found to vary from 4 to 1 within the above limits, being for Anthracite between ½ and 1.

In a similar way, the proportions of the elements vary as follows:—

Coke	from 50 to 90	per cent.
Carbon	,, 75 to 95	,,
Hydrogen	,, 6 to 4	,,
Oxygen, with 1 or 2 per cent. of Nitrogen	,, 19 to 2	,,

Between these extremes it is easy to distinguish five well characterized types of **Black Coal**, and it is what we will endeavour to clearly show in the following.* If we include the typical Anthracite itself, there are six varieties of coals which we will have to consider here. They will, in our arrangement, be termed as follows:—

1. **Anthracite proper** } *Non-caking Coals.*
2. **Anthracite Coal** }
3. **Coke Coal proper** }
4. **Caking Coal proper** } *Caking Coals.*
5. **Gas Coal proper** }
6. **Splint Coal**—*Non-caking Coal.*

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* The Museum is constantly increasing its collections, and as soon as it will be found possible, suitable specimens of coal, arranged according to this classification, will be exhibited.

They can be distinguished, not *absolutely*, but *generally*, by three principal classes of characters:—

Their appearance *(external physical properties).*
The way they burn *(fire assay and use).*
Their composition *(by proximate analysis).*

These particulars are appended in a tabular form.

1. ANTHRACITE (Proper).

Appearance—Pure black or grayish; lustre, metallic. Hard. Fracture, conchoidal. The heaviest of the series. Impure coals with an unusual amount of ash, and consequently very heavy, being out of the question.

Fire Assay, Uses.—Burns with great difficulty; gives no smoke, but produces the maximum of heat. Decrepitates. Coke in powder, 90 to 92 per cent. Produces the minimum quantity of heat.

2. ANTHRACITE COAL.

Appearance.—Black with dull striæ.

Fire Assay, Uses.—Burns with difficulty; flame short, clear, and of no duration. Often decrepitates. Does not cake, or very slightly (*dry coals*). If lumps are used, the coke is undeformed; if dust is used, it does not agglomerate. Coke produced, 82 to 90 per cent.

3. COKE COAL (Proper).

Appearance.—Black; lustre, rather shining; alternate layers of dull and bright laminæ. Lamellar or scaly. Very friable.

Fire Assay, Uses.—Burns with a short flame, clear, somewhat bluish; smoke scarce. *Cakes* and agglomerates very well, giving a hard and compact coke, this coal being the richest in carbon among the caking varieties (however, it loses this valuable property if not used for making coke when new). Gives the best metallurgical coke for blast furnaces, at the rate of 74 to 82 per cent.

4. CAKING COAL (Proper).

Appearance.—Bright shining black. In alternate layers; more or less lamellar or scaly. Not hard.

Fire Assay, Uses.—Burns with a long and bright flame, moderately smoky.

Cakes and agglomerates, being the most suitable for blacksmith work. Good coke, 68 to 74 per cent.

5. GAS COAL (Proper).

Appearance.—Black; not very dull nor very bright. Moderately hard and tough. Fracture more or less laminar.

Fire Assay, Uses.—Burns with a long flame, not so bright as in the last variety. Smoke abundant.

Cakes and agglomerates, giving a coke at the rate of 60 to 68 per cent. Produces more gas than the last at the rate of 17 to 20 per cent., being the best for that purpose.

6. SPLINT COAL.

Appearance.—Brown or black, the dust always brown. Fracture smooth or conchoidal; more or less scaly, hence the name *Splint Coal.* It is the lightest of the series.

Fire Assay, Uses.—Burns without caking at all (*dry coal*); with a long smoky flame, evolving the maximum of volatile matters and giving the least amount of heat of the series.

Coke unaltered in form and not agglomerated at the rate of 50 to 60 per cent. This Coal is used for blast furnaces, especially in Scotland.

When two or three of these varieties of coals are found in the same pit, the seams being in their natural relative position, the nearer they are to the bottom the nearer they are to the Anthracite.

Generally speaking, the same may be said of the properties of coals compared to their geological ages: the older they are, the richer in carbon, the poorer in gas; and the more recent they are the more they approach Lignite proper, evolving much volatile matter, but of no value as gas in consequence of the quantity of oxygen and nitrogen they contain.

The chief source of this valuable mineral in Australia is at present confined to the Colony of New South Wales. About the Coal found in Victoria, Mr. Selwyn, the late Director of the Geological Survey of that Colony, and at present Director-General of the Geological Survey of Canada, remarks :—" It is chiefly from these formations (absent in Victoria) that the richest and most valuable mineral products, viz., Coal, Iron, Copper, Silver, Lead, Salt, Mineral Oils, Marbles, &c., are obtained in large quantities; and thus, though nearly all the above and many others are known to occur in Victoria, few of them have been found in sufficient quantities to be profitably worked. This will probably be considered an unnecessary gloomy view to take respecting the mineral products of Victoria, but I think it useless to close our eyes to probable facts because they are unpleasant and perhaps not in accordance with our wishes and preconceived theories." *Notes on the Physical Geography, Geology, and Mineralogy of Victoria; by Alfred R. C. Selwyn, Director of Geological Survey, and George H. F. Ulrich, Field Geologist.*

As to the age of the Cape Paterson Coal-field, the same eminent geologist remarks :—" I am inclined to believe that the Victorian 'Carbonaceous' series is newer than and above the Sydney Sandstone."—*Ib., p.* 20.*

9. **Anthracite**—Schonefeld, Saxony, GERMANY.
10. ,, Sable, Sarthe, FRANCE.
11. **Caking Coal or Pitch Coal**—Zwickau, Saxony, GERMANY.
12. **Cannel Coal**—Wigan, Lancashire, ENGLAND.
13. **Mineral Coal**—*large block showing the thickness of the seam* " EIGHT FEET IN HEIGHT "—From the Wallsend Company's Mine, Newcastle, N.S.W.

NOTE.—It is impossible to remove this specimen into its proper place. At present it is exhibited in front of the Museum, to the left of the entrance-gate.

14. **Coal**—Cape Paterson, VICTORIA.
15. **Lower Coal**—Tuggerah Beach, County Northumberland, N.S.W.
16. **Top Coal**—Stony Creek, Bourne Russell, N.S.W.
17. **Mineral Coal**—Black Creek, Hunter River, N.S.W.
18. ,, Deloraine, TASMANIA.
19. **Coal**—*Upper seam, Telegraph seam*—Newcastle, N.S.W.
20. ,, *Second seam*—Burwood, N.S.W.
21. ,, Mangullia, County Bligh, N.S.W.
22. **Coal**—Newcastle, N.S.W.
23. **Surface Coal**—Port Stephens, N.S.W.

LIGNITE, or *Brown Coal.*

Lignite from *lignum*, wood. Brown Coal, in which the form and woody structure of the original tree is preserved.

According to the researches of Mons. M. E. Fremy, Lignite may be divided into two classes. 1st. *Lignite xyloïde et fibreux*, or *bois fossile*, Lignite still displaying woody structure ; 2nd, *Lignite compacte et parfait*, or Lignite exhibiting the aspect and compactness of Coal.

The compact Lignites with the black and shining appearance of Coal are entirely soluble in alkaline hypochlorites, and are attacked by nitric acid with the greatest rapidity, producing a yellow resin. Lignite xyloïde and compact Lignite generally differ in the more combustible variety not being acted upon by concentrated potash ; and M. Fremy has invariably observed that those Lignites which resist the action of potash are those which are derived from

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* See also on that subject, "On the Coal Plants of Australia," by Rev. J. E. T. Woods, in the "Journal and Proceedings of the Linnean Society of New South Wales, 1883."

beds whose stratigraphical position most nearly approaches the true Coal Measures.

Lignites may, therefore, be distinguished, on the one hand, from mere wood by their complete solubility in nitric acid and in hypochlorites, and by the above-mentioned characters from Coals, which last are insoluble in hypochlorites, and are only slowly attacked by nitric acid.

The following are, according to M. Fremy, the degrees of alteration of woody tissue:—

1. *Turf* and *Peat.* Characterized by the presence of Ulmic Acid, and also by the woody fibres or the cellules of the medullary rays, which may be purified and extracted in notable quantity by means of nitric acid or hypochlorites, in which they are insoluble.
2. *Fossil Wood* or *Woody Lignite.* This, like the preceding, is partially soluble in alkalies, but its alteration is more advanced, for it is nearly wholly dissolved by nitric acid and hypochlorites.
3. *Compact* or *Perfect Lignite.* This substance is characterized by its complete solubility in hypochlorites and in nitric acid. Alkaline solutions do not in general act on perfect Lignite. Reagents in this variety show a passage of the organic matter into Coal.
4. *Coal.* Insoluble in alkaline solutions and hypochlorites.
5. *Anthracite.* An approximation to Graphite, resists the reagents which act on the above-mentioned combustibles, and is only acted upon by nitric acid with extreme slowness.

Analysis of Lignite, from Tasmania, by *C. Tookey*:—

Carbon	59·90
Hydrogen	4·66
Oxygen	15·99
Nitrogen	1·08
Sulphur	0·30
Ash...	4·64
Water (hygroscopic)	13·43
	100·00

24. **Lignite or Brown Coal**—Meissner, Hesse, GERMANY.
25. „ „ Cologne, PRUSSIA.
26. „ „ Lal Lal, VICTORIA.
27. „ „ VICTORIA.
28. „ „ „
29. „ „ „
30. „ „ „

DYSODYLE or *Paper Coal.*

In very thin leaves or folia, flexible, slightly elastic. Specific gravity, 1·14 to 1·25. Very inflammable, burning with a bright flame and an odour like that of asafœtida, leaving an ash in the form of laminæ, consisting largely, as shown by Ehrenberg, of the silicious shells of Infusoria, especially of Naviculæ. Originally from Sicily; it is also found in New Zealand, and comes near the resiniferous shale called Tasmanite, from Tasmania. The Tasmanian product is found on the Mersey, and is known to the colonists as Combustible Shale.

31. **Dysodile or Paper Coal**—New Zealand.

ELATERITE or *Mineral Caoutchouc.*

From Ελατη, *pine.*

Chemical composition.—Carbon, 85·470; hydrogen, 13·283.

32. **Elaterite**—Castleton, Derbyshire.
33. „ „ „
34. „
35. „
36. „ Bellevue, Westmoreland, New Brunswick.

MINERAL WAX.

The best known of the various species is **Ozokerite**, which has nearly the same composition as Elaterite; the proportion of hydrogen being a little greater in Ozokerite. It is a solid Petroleum, with 14 to 15 per cent. of hydrogen.

The name is from Οζω, *I smell*, and Κηρος, *wax.*

37. **Ozokerite or Ozocerite**—Boryslaw, Galicia.
37 *bis.* „ „ *cut in small slices to show the transparency*—Boryslaw, Galicia.

OIL SHALES.

"The most common oil-bearing rocks were originally the fine mud of deep or shallow seas; and the limestones were the same, only the mud was calcareous in nature, like the coral mud of many a coral lagoon."—Dana.

Professor Dana thinks that the Shales were derived from microscopic vegetable and infusorial animal life.

Petroleum, which comes in this class, contains from 12 to 15 per cent. of hydrogen. The oil shale of New South Wales is a kind of **Torbanite,** which is commonly known here under the name of *kerosene shale*, though very improperly, this substance breaking with large smooth conchoidal surfaces and not possessing the characters of a shale. Like *cannel coal*, it burns with a luminous smoky flame. By distillation it gives off a mixture of gaseous and liquid hydrocarbons. New South Wales Torbanite, when of good quality, yields from 150 to 180 gallons of oil per ton.

In speaking of the kerosene mineral from Joadja Creek, near Berrima, Mr. Dixon says: "This mineral resembles the boghead mineral from Scotland, but is considerably lighter, having a specific gravity of 1·098 against 1·20. The yield of volatile hydrocarbons is much greater than from even picked specimens of boghead, whilst the ash is only half as great as in that mineral."

The following is the average of the proximate analysis of ten samples of kerosene rock from different localities: Greta (2), Hartley (2), Joadja Creek (5), and Murrurundi (1), N.S.W.:—

Moisture about 1 %, and volatile hydrocarbons	74·22 (from 53·80 to 83·86 %).
Fixed carbon	12·21 (from 5 to 28 %).
Ash	13·17 (from 7 to 22 %).
Sulphur	0·40
	100·00

Under the title of "Notes on the quality of Hartley and Greta shale for the manufacture of gas, &c.," Mr. A. K. Smith, C.E., &c., published in the "Journal of the Royal Society of Victoria," vol. x., 1874, an elaborate article concluding from two experiments made on a large scale:—

"That the shale produced marketable gas at the rate of from 11,280 to 14,136 cubic feet per ton; and that in the first instance the illuminating power of the gas was at the rate of 1,992 lbs. of standard sperm candles per ton of shale, and 1,823 lbs. in the second instance. In the first experiment the coke produced was at the rate of 32½ per cent., and the volatile hydrocarbons 67½ per cent.

"In the same circumstances of experiments the Boghead Cannel Coal or Torban Hill mineral of Scotland gave 13,500 cubic feet of gas per ton, corresponding to 1,967 standard sperm candles."*

Two large blocks of Oil Shale (at the entrance of the hall of the first floor, new wing, room No. 7 of the plan)—Hartley, N.S.W.

37 *ter.* **Torbanite**—variety of oil shale related to Cannel Coal—Torban Hill, Scotland. (See large specimens, Appendix II.)

OXYGENATED HYDROCARBON COMPOUNDS.

AMBER, SUCCINITE, or *Bernstein.*

Amber is found in irregular masses, of all shades of yellow, from the palest primrose to the deepest orange—sometimes brown.

Composition.—Carbon, 78·96; hydrogen, 10·52; oxygen, 10·52.

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* See also "Mineral Products of New South Wales," published, together with other Reports, by the Department of Mines, Sydney, 1882, including "Description of the Minerals of New South Wales," by Prof. A. Liversidge, with analysis of coals, torbanite, &c.

Burns readily with a yellow flame, emitting an agreeable odour, and leaves a black shining light and carbonaceous residue. Becomes negatively electric by friction. Soluble in alcohol.

38. **Amber**—Baltic Provinces, Prussia, Germany.
39. „ *with insects*—Coast of the Baltic.
40. „ „ „
41. „ „ „
42. „ *made into a necklace*—Coast of the Baltic.
43. „ *cut into oak-nuts* „
44. „ *collection of 100 specimens in a box*—Coast of the Baltic.

APPENDIX TO HYDROCARBONS.

ALBERTITE.

Proximate analysis by W. A. Dixon, F.C.S. :—

Volatile Hydrocarbons, &c.	57·490
Fixed carbon	42·086
Ash	·424
	100·000

Differ from ordinary asphaltum in being only partially soluble in oil of turpentine. Lustre brilliant, pitch-like; colour, jet-black. Occurs filling an irregular fissure in rocks of the sub-carboniferous age (or lower carboniferous).

45. **Albertite**—Hillsborough, Albert Co., New Brunswick.

SALTS OF ORGANIC ACIDS.

MELLITE or *Honeystone.*

A Mellate of Alumina.

46. **Mellite**—*in Lignite*—Tula, Russia.
47. „ *a beautiful crystal, in Lignite*—Artern, Thuringia.

Subdivision II.—Boron.

Boron is not very common in nature. Its chief sources are the "lagoni" and "suffroni" of Tuscany, in which it is in the state of Boracic Acid. Borax is mostly used as a flux.

ANHYDROUS BORATES, &c.

BORACITE.

Borate of Magnesia with Chloride of Magnesium. Cubes, tetrahedrons, rhomboidal, dodecahedron, and combinations of these shapes. Hardness, 7. Specific gravity, 2·83 to 2·98. Small crystals in gypsum.

48. **Boracite**—*small tetrahedrons and dodecahedrons*—Legeberg, Holstein.
49. „ *a fine crystal*—Lüneburg, Hanover.
50. „ Lüneburg, Hanover.
51. „ *in Gypsum*—Lüneburg, Hanover.
52. „ „ „ GERMANY.

(See Silicio-Borates, Datholite, Damburite, &c.)

HYDROUS BORATES, &c.

BORAX or TINKAL.

Borax is from an Arabic name; *Tinkal*, from an Indian name.

Hydrous Borate of Soda. Monoclinic Isomorphous with Pyroxene. Used as a flux.

53. **Borax**—*in perfect crystals, from lakes*—Thibet, ASIA.

ULEXITE.

Dedicated to the chemist Ulex.

Hydrous Borate of Lime and Soda, with Chlorides and Sulphates. Used in the manufacture of Borax.

54. **Ulexite**—Iquique, PERU.

SUBDIVISION III.—SULPHUR.

Sulphur, besides its numerous applications in the arts, is sometimes also used for taking the negative impression of medals, bas-reliefs, &c., as it melts easily, and in cooling and solidifying it expands slightly, so as to take the finest details of the object.

NATIVE SULPHUR.

Crystallized or massive. Yellow. Resinous lustre. Specific gravity, 2·1; Hardness, 1·5 to 2·1. Fusible. Burns with a blue flame and well-known odour. Occurs in volcanic regions, and in beds of Gypsum.

55. **Native Sulphur**—*in large crystals*—Girgenti, Sicily.
56. „ „ „ „
57. „ „ „ „
58. „ „ „ „
59. „ „ „ „
60. „ *with Aragonite* „ „
61. „ „ „ „
62. „ „ „ „

63. **Native Sulphur**—*with Aragonite*—Pernice, Sicily
64. „ „ Roccalmato, Sicily.
65. „ *with Celestite* „ „
66. „ Girgenti, Sicily, ITALY.
67. „ *with Calcite*—Girgenti, Sicily, ITALY.
68. „ *with Gypsum*—Lüneburg, Hanover, GERMANY.
69. „ Solfatara de Puzzoli, ITALY.
70. „ White Island, NEW ZEALAND.
71. „ *in acicular crystals*—Rotorua Lake, NEW ZEALAND.
71 *bis*. „ Tana, NEW HEBRIDES.

Division B.—ALKALIES AND EARTHS.

SUBDIVISION I.—ALKALINE SALTS.

(Salts of Ammonia, Potash, and Soda.)

All the minerals included in this subdivision are soluble. The most important of them are—**Rock Salt**, for its numerous uses, and chiefly the manufacture of soda and hydrochloric acid; **Carnallite**, for the manufacture of potash; and **Nitratine**, which is imported from Peru for the manufacture of nitric acid.

ANHYDROUS ALKALINE CHLORIDES.

Sodium Chloride.

ROCK SALT.

Rock Salt has the character of ordinary table salt, but is more or less impure. Occurs in beds interstratified with sandstones and clays, which are usually of a red colour and associated with Gypsum. In the county of Cheshire in England, where salt mines are worked, the surface indications are brine springs, supporting a vegetation like that near the sea-coast; also, occasional sinking of the soil, caused by the removal of the subterranean bed of salt, by spring water in some cases, and by mining operations in others. Small and unimportant quantities of salt are often found encrusting various rocks in dry weather.

72. **Rock Salt.**
73. **Permian Rock Salt**—*blue*—Stassfurth.
74. **Rock Salt.**
75. **Fibrous Rock Salt.**
76. **Pseudomorph of Rock Salt**—*into clay*—Schlucht, near Burfenich, Eifel.
77. **Rock Salt**—Varengeville, near Nancy, FRANCE.
78. **Red Rock Salt**—Hallstadt, AUSTRIA.
79. **Rock Salt**—Tuscany, ITALY.

79 *bis.* **Blue Rock Salt**—Stassfurth.

Potassium Chloride, &c.

LEOPOLDITE or SYLVITE.

Found at Leopoldshall.

It is the *Sal digestivus Sylvii* of early chemistry, hence the name *Sylvite.* Taste like that of common salt. Found in Carnallite.

80. **Leopoldite**—*in large crystals*—Stassfurth, near Magdebourg.

SAL AMMONIAC.

Muriate and Sulphate of Ammonia, mostly Muriate. Octahedrons, dodecahedrons, or massive. In volcanoes.

81. **Sal Ammoniac**—*earthy*—Vesuvius, 1872.

HYDROUS ALKALINE CHLORIDES.

CARNALLITE.

Dedicated to Von Carnall.

Chemical composition.—Chlorine, magnesia, potash, soda, &c.

Orthorhombic prism. Generally in masses, in granular or in large globules. Used in the manufacture of potash.

82. **Carnallite**—*red*—Stassfurth.
83. „ „ „
84. „ „ „

TACHHYDRITE.

Named in allusion to its ready deliquescence, from ταχύς, *quick*, and ὕδωρ, *water.*

Chemical composition.—Chlorine, lime, magnesia, and water.

Occur in their seams with Carnallite and Kieserite (Hydrated Sulphate of Magnesia) in Anhydrite.

85. **Tachhydrite**—*yellow*—Stassfurth.

This mineral is included here, though not containing alkalies, because all the minerals in this subdivision are soluble salts, and because its occurrence is similar to some of them—Carnallite, for instance.

ANHYDROUS NITRATES.

NITRATINE, *Nitre Cubique* (Fr.)

Nitre or Saltpetre is a soluble mineral. It has a cooling taste. It can easily be distinguished by the vivid manner in which it activates the combustion when put on red-hot charcoal.

86. **Nitratine**—Tarapaca, Peru, South America.

ANHYDROUS ALKALINE SULPHATES.

THENARDITE (*Sulphate of Soda*).

Dedicated to the French chemist Thénard.

Orthorhombic prism, long octahedrons.

87. **Thenardite**—Stassfürth.
88. „ *in fine crystals*—Caracoles, Bolivia.

ARCANITE or APHTHITALITE (*Sulphate of Potash*).

From one of its alchemistic names, *Arcanum duplicatum*; the other name from ἄ-φθιτος, *unalterable*, and ἅλς, *salt.*

GLAUBERITE.

Dedicated to the German chemist Glauber.

Chemical composition—Sulphate of Soda and Lime.

Monoclinic. In crystals in rock-salt. Colourless, greyish white, yellowish white, red.

89. **Glauberite**—Villa Rubia, Spain.

HYDROUS ALKALINE SULPHATES.

MIRABILITE or *Glauber Salt.*

Sal mirabile is Glauber's expression of admiration at the formation of this salt when operating with sulphuric acid and common salt.

Chemical composition—Hydrous Sulphate of Soda.

Monoclinic. Usually in afflorescent crusts. Taste cool, then feebly saline and bitter.

90. **Mirabilite**—Alt Aussee, Styria.
90 *bis.* „ Bavaria.

KAINITE or PICROMERITE.

From καινός, *recent*; *Picromerite*, in allusion to the magnesia present; πικρός, *bitter.*

Chemical composition—Hydrous Sulphates of Potash and Magnesia.

Monoclinic. In crystals and crystalline crusts.

91. **Kainite**—*yellowish*—Stassfürth.
92. „ *white* „

BLŒDITE, ASTRAKANITE.

From the name of the chemist Blöde; and the other name from the locality, Astrakan.

Chemical composition—Hydrous Sulphate of Soda and Magnesia.

In imperfect crystals or massive. Colour—white, orange, reddish. Very soluble.

93. **Blœdite**—Stassfurth.

SIMONYITE.

A Hydrous Sulphate of Soda and Magnesia of same composition as Blœdite. Bluish-green.

94. **Simonyite**—Hallstadt, GERMANY.

HYDROUS PHOSPHATE OF MAGNESIA AND AMMONIA.

STRUVITE.

Dedicated to the Minister Struve.

Orthorhombic prism. Twin crystals. Colour—yellowish-brown, white. Brittle. Hardness, 2. Specific gravity, 1·65 to 1·7. Tasteless, being but slightly soluble. Found under an old church in Hamburg, where quantities of cattle dung existed in the soil above a bed of peat which contained the crystals. Also in guano.

95. **Struvite**—St. Nichols Church, Hambourg.

It will be remarked that the solubility of the above minerals is due to the alkalies present.

Magnesia, which in Roscoe's classification will come close to zinc, was long considered as an alkaline-earth. It forms also many more or less soluble salts which are included here as containing some alkalies—(Kainite, Blœdite, Simonyite, Struvite), or as better placed here than among the metals (Tachhydrite).

SUBDIVISION II.—ALKALINE-EARTHY SALTS.

(Salts of Baryta, Strontia, Lime, Magnesia.)

Of the three above earths, lime is the most abundant in the earth's crust. It occurs mostly in combination with carbonic acid, forming **Limestone.** The importance of this material in various states for building and ornamental purposes is so well known that it need not be insisted upon. (See Ornamental Specimens.)

It has been remarked that gold is very rarely found in connection with rocks containing lime. A few instances however of this occurrence are to be mentioned in Australia—at Gympie, Queensland; at the Try-again Reef, Northern District, New South Wales; and at the Lucky-hit Reef, Tuena, New South Wales. (See specimens in the collection.)

Among other compounds of lime, the hydrous sulphate, **Gypsum,** is well known for its uses in building; when burnt it loses its water, and in this anhydrous state is powdered and is able to undergo a new combination with water. This material, known under the name of *plaster of Paris*, possesses three principal properties which explain its extensive uses—hardening, expanding slightly in solidifying, and its pure white colour.

Another compound of Lime, **Phosphate of Lime,** is found crystallized as well as in the state of organic remains in sedimentary deposits. In the crystallized state it occurs in metamorphic rocks and in eruptive rocks. A very large crystal from Canada is to be seen in the Museum. When this product is found in large deposits, as in many parts of Europe, it is very valuable as manure.

Baryta and especially **Strontia** are of rare occurrence comparatively to lime. Salts of Strontia are mostly used for red fireworks. Baryta, as a sulphate, plays a great part in some metalliferous deposits, and especially in deposits of Galena or Lead ore. In some cases it is taken advantage of as a flux in metallurgical operations.

Magnesia is present in a large number of minerals and rocks, mostly silicates. Some of the soluble salts in which it enters are in the above subdivision. Therefore only a small number of Magnesia minerals are left here. **Giobertite** is a Carbonate of Magnesia. **Dolomite,** which is very abundant, contains it in the state of Carbonate, together with Lime. But the metal used for its bright light is mostly extracted from the chlorides. Chlorides of Magnesium occur in the salt water of the sea and in various natural compounds such as Carnallite.

ANHYDROUS CARBONATES OF BARYTA.

WITHERITE.

Dedicated to Dr. Withering, who discovered it.

Generally in double hexagonal pyramid. The crystals are not simple, but mascled. Transparent or translucent. Lustre vitreous, somewhat greasy, white, yellowish, grayish. Hardness, 3 to 3·5. Specific gravity, 4·2 to 4·3. Fusible. Used for the manufacture of the Salts of Baryta for fireworks.

96. **Witherite**—Fallowfield, near Hexham, ENGLAND.
96 *bis.* " " " "
96 *ter.* " " " "

BARYTOCALCITE and ALSTONITE.

Carbonate of *Baryta* and Lime (Oxide of *Calcium*). Alstonite. Found near Alston Moor, Cumberland. Barytocalcite is orthorhombic like Aragonite, whilst Alstonite or Bromlite is monoclinic. Barytocalcite: Hardness, 4 to 4·5. Specific gravity, 3·63 to 3·66. Alstonite: Hardness, 4. Specific gravity, 3·718. (Dana.) Both infusible.

97. **Barytocalcite**—Bleagill, near Alston, Cumberland, ENGLAND.
98. **Asltonite** or **Bromlite**—*with Calcite, Witherite, Galena, &c.*—Bromley Hill, near Alston, Cumberland, ENGLAND.

ANHYDROUS SULPHATE OF BARYTA.

BARYTES or *Heavy Spar.*

βαρύς, heavy.

Chemical composition—Sulphuric Acid, Baryta.

In tabular glassy crystals; also in dull masses. Transparent or opaque. White or tinted. Specific gravity, 4·3 to 4·8; its great comparative weight readily distinguishes it. Hardness, 2·5 to 3·5. Splinters fly off the crystals when heated in the blow-pipe flame. Fusible with difficulty. Not acted upon by acids. Occurs with various ores. Used as a white paint.

99. **Barytes**—Cornwall.
100. " *beautiful large crystals*—Dufton, Westmoreland, ENGLAND.
101. " Dufton, Westmoreland, ENGLAND.
102. " Hexham, Northumberland, ENGLAND.
103. " *red variety*—Keswick, ENGLAND.
104. " *with Orpiment*—Kremnitz, Hungary.
105. " *in Aragonite* " "
106. " " " "
106 *bis.* " " " "
107. " Felsöbanya, Hungary, AUSTRIA.
108. " Schemnitz, " "
109. " Hungary, AUSTRIA.
110. " Przibram, Bohemia, AUSTRIA.
111. " " " "
112. " Kinsigthal, Baden.
113. " Siegen, Prussia, GERMANY.

114. **Barytes**—Münsterthal, Baden, Germany.
115. „ Freiberg, Saxony, „
116. „ „ „ „
117. „ Marienberg, „ „
118. „ Freiberg, „ „
119. „ Schapbach, Baden, „
120. „ Braunsdorf, Saxony, „
121. „ Glashütte, „ „
122. „ Münsterthal, Baden, „
123. „ Schapbach, „ „
124. „ *with Quartz*—Joachimsthal, Bohemia, Austria.
125. „ Vosges, France.
126. „ Auvergne, „
127. „ Sion, Valais, Switzerland.
128. „ *Pseudomorphous, with Calcite*—Valais, Switzerland.
129. „ *with Blende, Grey Copper, and Quartz*—Mexico, Southern North America.
130. „ *Stalactitic.*

ANHYDROUS CARBONATE OF STRONTIA.

STRONTIANITE.

From Strontian, Argyleshire, where discovered first.

Rhomboidal prism, isomorphous with aragonite. Crystals generally small or acicular; transparent or translucent. Lustre vitreous, a little greasy in the fracture. White, yellowish, greenish. Hardness, 3·5. Specific gravity, 3·68 to 3·71. Same use as Celestite.

131. **Strontianite**—*with Barytine*—Clausthal, Hartz, Germany.
131 *bis.* „ *light green*—Strontian, Scotland.
132. „ Brensteinfurth, Westphalia.
133. „ „ „
134. „ „ „

ANHYDROUS SULPHATE OF STRONTIA.

CELESTITE.

Cœlestis, *heaven blue*, in consequence of the colour of some varieties.

Rhomboidal prism; crystals resembling Barytes. Transparent or translucent. Lustre vitreous, somewhat nacreous on cleavage. White, blue, &c. Hardness, 3 to 3·5. Specific gravity, 3·9 to 4. Used in the manufacture of nitrate and chloride of strontia for fireworks.

135. **Celestite**—*with Sulphur*—Girgenti, Sicily.
136. „ *with Aragonite and Sulphur*—Rocalmato, Sicily
137. „ *with Sulphur*—Sicily.
138. „ „ Girgenti, Sicily.
139. „ „ Rocalmato, Sicily.
140. „ *with Aragonite and Sulphur*—Sicily.
141. „ *with Sulphur*—Sicily.
142. „ „ Sicily, Italy.
143. „ „ Girgenti, Sicily, Italy.
144. „ „ Girgenti, Italy.
145. „ *fibrous*—Dornberg, near Iena.
146. „ *blue variety, with Calcite*—Salzburg, Austria.
147. „ *on Limestone*—Seisseralp, Tyrol, Austria.
148. „ Bristol, England.
149. „ Auteuil, Paris, France.
150. „ Montmartre, Paris, France.
151. „ „ „
152. „ *in large crystals*—Wadi el Thib, Egypt.
153. „ Pyle Hill, Bristol.
153 *bis*. „ *a fine crystal*—Rhode Island, Lake Erie.

CALCITE, *Calcspar*, *Iceland-spar*.

Chemical composition—Carbonic Acid, Lime.

In rhombohedrons and other crystalline forms. Also massive, earthy, or fibrous. Transparent or opaque. White when pure; often tinted. Lustre glassy or dull. Breaks with smooth cleavage planes parallel to the rhombohedral faces. Specific gravity, 2·5 to 2·8. Hardness, 3. Easily scratched with a knife; streak white. Infusible before the blowpipe, but emits a strong light. When burned, as in a kiln, it forms quicklime. Effervesces when vinegar is poured upon it. It completely dissolves in nitric, sulphuric, and muriatic (hydrochloric) acid, with rapid effervescence. Calc-spar is one of the most abundant minerals; it occurs in cavities and veins in all kinds of rock. The term Calc-spar or Calcite is restricted to crystallized variety. In an imperfectly crystallized and compact form it exists in large rocky masses and beds; all Marbles and Limestones consist of it, mixed more or less with impurities. Chalk and Stalactites are nearly pure carbonate of lime. All varieties of carbonate of lime may be easily distinguished by being scratched with a knife, giving a white streak whatever the colour of the mass may be, by effervescing with an acid, and by being infusible.

154. **Calcite**—*modified crystals*—ICELAND.
155. „ *showing double refraction*—Rodefiord, ICELAND.
156. „ *Iceland-spar*—Iceland, DANISH PROVINCE.
157. „ Munsterthal, Baden.
158. „ *crystals built up of alternate opaque and transparent layers*—Andreasberg, Hartz.
159. „ „ „
160. „ *pink*—Schneeberg, Saxony.
161. „ Auerbach, Hesse, GERMANY.
162. „ Schwarzenberg, Saxony, GERMANY.
163. „ *with Quartz*—Tharand, Saxony, GERMANY.
164. „ *with Limonite*—Hartz, GERMANY.
165. „ Sinsheim, Baden, GERMANY.
166. „ *with Pyrites*—Westphalia, GERMANY.
167. „ Iberg, Hartz, GERMANY.
168. „ *with Quartz, Mispickel, Chrysolite, and Serpentine*—Reichenstein, Silesia, Prussia, GERMANY.
169. „ *with Quartz, Galena, and Siderose*—Schneeberg, Saxony, GERMANY.
170. „ *with Siderite*—Münsterthal, Baden, GERMANY.
171. „ Münsterthal, Baden, GERMANY.
172. „ *with Quartz*—Andreasberg, Hartz, GERMANY.
173. „ „ „ „ „
174. „ „ „ „ „
175. „ Andreasberg, Hartz, GERMANY.
176. „ Zwickau, Saxony, „
177. „ Schneeberg, Saxony, „
178. „ *with Pyrites*—Saxony, „
179. „ *with Galena*—Andreasberg, Hartz, GERMANY.
180. „ Johann-Georgenstadt, Saxony, GERMANY.
181. „ Borna, Saxony, GERMANY.
182. „ or **Schieferspath**—Schwarzenberg, Saxony, GERMANY.
183. „ **Rogenstein, Roe-stone**—Thuringia, Prussia, „
184. „ or **Stalactite**—Gailenreuth, Bavaria, GERMANY.
185. „ *Schaumkalk, pseudo morphous Gypsum*—Thuringia, GERMANY.
186. „ Baden.
187. „ *with small Crystals of Chalcopyrites*—Redruth, Cornwall.
188. „ *with Fluor-spar*—Alston, Cumberland.
189. „ *with small Black Crystals (blende?)*—Alston, Cumberland.
190. „ *with Fluor-spar*—Derbyshire, ENGLAND.
191. „ Old Matlock, Derbyshire, „
192. „ *with Blende*—Alston, Cumberland, ENGLAND.

193. **Calcite**—*with Quartz and Fluorite*—Alston, Cumberland, ENGLAND.
194. ,, *with Barytes*—Alston, Cumberland, ENGLAND.
195. ,, Matlock, Derbyshire, ENGLAND.
196. ,, Derbyshire, ENGLAND.
197. ,, ,, ,,
198. ,, Dudley, near Birmingham.
199. ,, or **Satin-spar**—*polished*—Alston, Cumberland, ENGLAND.
200. ,, *with Chalcopyrites*—Przibram, Bohemia.
201. ,, Töplitz, Bohemia, AUSTRIA.
202. ,, Bohemia, AUSTRIA.
203. ,, *blue variety*—Oravitza, Banat, AUSTRIA.
204. ,, Silverleike, ICELAND.
205. ,, Tenfelsgrund, Münsterthal.
206. ,, ,, ,,
207. ,, *with Barytes*—Mount Narba, SARDINIA.
208. ,, Mount Narba, SARDINIA.
209. ,, *rose*—Nordmarken, SWEDEN.
210. ,, Milhau, Aveyron, FRANCE.
211. ,, ,, ,, ,,
212. ,, Porte de France, Grenoble, FRANCE.
213. ,, Tonnerre, Yonne, FRANCE.
214. ,, Dijon, FRANCE.
215. ,, Grenoble, ,,
216. ,, Flogny. Yonne, FRANCE.
217. ,, *with Pearl-spar*—Framont, Vosges, FRANCE.
218. ,, Grenoble, FRANCE.
219. ,, *with Quartz*—Bourg d'Oisans, Isère, FRANCE.
220. ,, Lyon, FRANCE.
221. ,, *with Pyrites, Barytes*—Bretagne, FRANCE.
222. ,, Périgueux, Dordogne, FRANCE.
223. ,, Grenoble, FRANCE.
224. ,, Ilot Table, NEW CALEDONIA.
225. ,, Monte Uliveto, Tuscany, ITALY.
226. ,, ,, ,, ,,
227. ,, *with Quartz*—Biella, Piedmont.

228. **Calcareous Sinter**—Adelsberger Grotto.

229. **Calcite**—*with Brown-spar*—Pyrenées, SPAIN.
230. ,, **Stalactite**—Valais, SWITZERLAND.
231. ,, *with Pyrites*—Mexico, NORTH AMERICA.
232. ,, **Tufa**—Kansas, U.S.
233. ,, *with Chalcopyrites.*

234. **Calcite.**
235. „ *with Chabasite.*
236. „
237. „ *with quartz.*

ARAGONITE.

From the province of Aragon, Spain.

Chemical composition—Same as Calc-spar.

It differs from Calc-spar in its crystalline form, which is usually difficult to discern. It often occurs in fibrous clusters or in tangled branches. Hardness, 3·5 to 4·0. Specific gravity, 2·9. It has the general characters of Calc-spar, but may be distinguished from it by falling to powder in the blowpipe flame, as well as by its superior hardness.

238. **Aragonite**—*in Lava*—Somma, Vesuvius.
239. ” *a twin crystal*—Monte Somma, Vesuvius, ITALY.
240. ” Herrengrund, Hungary.
241. ” ” ”
242. ” Hungary.
243. ” Herrengrund, Hungary, AUSTRIA.
244. ” **or Igloite**—Iglo, Hungary, AUSTRIA.
245. ” Bilin, Bohemia, AUSTRIA.
246. ” Karlsbad, Bohemia, AUSTRIA.
247. ” Schams, Tyrol, AUSTRIA.
248. ” *crystallized.*
249. ” ”
250. ” ”
251. ” ”
252. ”
253. ” *a large crystal, broken and cemented again by natural process.*
254. ” Molina, SPAIN.
255. ” *and Pearl-spar*—Marienberg, Saxony, GERMANY.
256. ” Marienberg, Saxony, GERMANY.
257. ” *on Carbonate of Iron*—Siegen, Prussia, GERMANY.
258. ” *on Dolerite*—Kaiserstuhl, Baden, GERMANY.
259. ” Meissner, Hesse, GERMANY.
260. ” Zittau, Saxony, GERMANY.
261. ” Zorge, Hartz, GERMANY.
262. ” *fibrous*—Teplitz, GERMANY.
263. ” *fibrous and radiated*—Kaiserstuhl, Baden, GERMANY.

264. **Lumachelle,** *on Toad-stone*—Gergovia, Puy de Dôme, FRANCE.
265. „ *fibrous*—St. Nectaire, Auvergne, FRANCE.
266. „ *fibrous and radiated*—Alston, Cumberland, ENGLAND.
267. „ *or fire marble*—a limestone containing fragments of iridescent fossil shells.
268. **Stalactites of Aragonite**—*Californian marble*—California.
269. „ „ *polished.*
270. **Anthraconite**—*impure Carbonate of Lime*—NORWAY.
271. **Landscape Marble**—*an argillaceous limestone*—Bristol.

(See ornamental specimens.)

CARBONATE OF LIME AND MAGNESIA.

DOLOMITE, PEARL-SPAR, BROWN-SPAR.

Dedicated to Dolomien, French Geologist and Mineralogist.

Chemical composition—Carbonic Acid, Lime, Magnesia.

In rhombohedrons, faces often curved. Often granular or massive. White or dull tinted. Glassy or pearly Specific gravity, 2·8 to 2·9. Hardness, 3·5 to 4. Infusible. Effervesces in nitric acid, and dissolves more slowly than Calc-spar. Yields quicklime when burnt. Occurs in extensive beds of various ages like limestone. Used as a building-stone, and in the manufacture of Epsom Salts. Difficult to distinguish from Calcite without chemical analysis.

The German name, *Bitterspath* (Bitter-spar), alludes to the bitterness of the soluble salts of Magnesia.

272. **Dolomite**—Traversella, Piedmont, ITALY.
273. **Miemite**—*a variety of Dolomite*—Tuscany, ITALY.
274. **Dolomite**—Traversella, Piedmont, ITALY.
275. „ *in chlorite-slate*—Pfitch, Tyrol, AUSTRIA.
276. „ Joachimsthal, Bohemia, AUSTRIA.
277. „ Plauen, Saxony, GERMANY.
278. „ *on Ferruginous Slate*—Tharand, Saxony, GERMANY.
279. „ Freiberg, Saxony, GERMANY.
280. „ Blankenstein, Saxony, GERMANY.
281. „ „ „ „
282. „ Valais, SWITZERLAND.
283. „ *and Green-earth*—Framont, Vosges, FRANCE.
284. „ *Quartz and Copper Pyrites*—Alston, Cumberland, ENGLAND.
285. „ Niagara, New York, U.S.
286. „ *on Iron Pyrites*—Mexico, NORTH AMERICA.

ANHYDROUS SULPHATE OF LIME.

ANHYDRITE.

Ἅνυδρος, *without water.*

Orthorhombic. Transparent or translucent. Lustre vitreous, nacreous on the cleavages. White, yellow, red, blue, violet, &c. Hardness, 3 to 3·5. Specific gravity, 2·85 to 2·96. Fusible.

287. **Anhydrite**—Durrenberg, Salzburg.
288. „ „ „
289. „ *in small transparent crystals*—Stassfurth.

HYDROUS SULPHATE OF LIME.

SELENITE or *Gypsum.*

Σελήνη, *the moon ;* λίθος, *a stone ;* Γύψος, *the stone called Gypsum.*

Chemical composition—Sulphuric Acid, Lime, Water.

In prisms with oblique terminations; sometimes resembling an arrowhead. Transparent or opaque. White or dull-tinted. Glassy, pearly, or satin lustre. Cleavage occurs easily in one direction. Specific gravity, 2·3. Hardness, 2. Very easily cut with a knife. Fusible with difficulty. In the blow-pipe flame it becomes white and opaque without fusing, and can be easily crumbled between the fingers. Nitric acid does not cause effervescence. Occurs in fissures and in stratified rocks, often forming extensive beds. When burnt it forms Plaster of Paris; it is also used for ornaments, and as a manure.

290. **Arrow-shaped crystal of Selenite**—near Paris.
291. „ „ „
292. „ „ „
293. „ „ „
294. **Selenite or Gypsum**—*in thin cleaved sheets*—near Paris.
295. „ „ Paris, France.
296. „ „ „
297. „ „ „
298. „ „ „
299. „ „ Nevers, France.
300. „ „ Paris, France.
301. „ „ Lunsberg, Hanover.
302. „ „ Tavarra, Sicilia.
303. **Fibrous Selenite** *or Satin-spar*—Catanzaro.
304. **Selenite**—Vesuvius.

305. **Selenite or Gypsum**—Tuscany, ITALY.
306. „ „ *Alabaster*—Tuscany, ITALY.
307. „ „ Mt. Donato, Bologna.
308. „ „ Schemnitz, HUNGARY.
309. „ „ *in cuneiform rose-shaped crystals*—NEW CALEDONIA.
310. „ „ „ „
311. „ „ Black Forest, Baden, GERMANY.
312. „ „ Eisleben, Thuringia, GERMANY.
313. „ „ *fibrous*—Derbyshire, ENGLAND.
314. „ „ Rheinhardsbrunn, near Gotha, GERMANY.
315. „ „ Tuscany, ITALY.
316. „ „ Pyrenées, SPAIN.

HYDROUS SULPHATE OF LIME, POTASH, MAGNESIA, &c.

POLYHALITE.

Πολὺς, *many;* ἅλς, *salt.*

Generally in fibrous masses. Translucent. Lustre greasy. Red, various shades. Bitter and salty.

317. **Polyhalite**—Varengeville, near Nancy, FRANCE.

ANHYDROUS PHOSPHATE OF LIME.

APATITE.

Ἀπᾱτάω, *to deceive*, having been mistaken for other minerals.

Chemical composition—Phosphoric Acid, Lime, Fluorine.

In six-sided prisms. Also in masses. Transparent or opaque. Usually green. Sometimes white, yellow, blue, red, brown. Lustre resinous. Fracture conchoidal or uneven. Specific gravity, 3·2. Hardness, 5. Can be scratched with a knife, using pressure. Infusible, except on very thin edges. Some kinds phosphoresce when heated. The pure mineral in powder dissolves slowly in nitric acid without effervescence. The crystals may resemble Beryl, which, however, is too hard to be scratched with a knife. Occurs in Gneiss, Slate, Limestone. Of increasing interest from its use in the manufacture of artificial manures. (See the exceptionally large crystal from Canada, exhibited on a pedestal; also large specimen of Hydroapatite from Suarum, in special show-case.

318. **Apatite**—*crystallized*—CANADA.
319. „ „ „
320. „ „ „
321. „ *green, rolled.*
322. „ *with mica*
323. „ *crystallized, with Felspar.*
324. „ *in lava*—Somma, Vesuvius.
325. „ *crystallized*—Ehrenfriedersdorf, Saxony, GERMANY.
326. „ *grey, with Fluorine*—Altenberg, „ „
327. „ *with Quartz*—Johann-Georgenstadt, Saxony, GERMANY.
328. „ *Phosphorite*—Amberg, Bavaria, GERMANY.
329. „ *violet*—Saxony.
330. „ *white, with Amphibole*—Knappenwald.
331. „ Schlackenwald, Bohemia, AUSTRIA.
332. „ Massachusetts, U.S.
333. „ or **Moroxite**—*with Granite, Epidote*—Arendal, NORWAY.
334. „ Arendal, NORWAY.
335. **Staffelite**—*a var. of Apatite*—Nassau.

HYDROUS PHOSPHATE OF LIME.

336. **Hydroapatite**—*a large specimen*—Snarum, NORWAY.
337. „ Snarum, NORWAY,
338. „ „
339. „ „

FLUOR-SPAR OR FLUATE OF LIME.

Chemical composition—Fluoride of Calcium.

In cubes or octahedrons ; also in masses. Transparent or opaque. White or light violet, blue, green, or yellow ; sometimes layers of different tints in the same piece. Lustre glassy. Breaks with smooth cleavage planes parallel to the octahedral faces. Specific gravity, 3·0 to 3·2. Hardness, 4. Can be scratched with a knife, but not so easily as Calcite. Fusible with difficulty ; generally flies to pieces when heated. Some varieties phosphoresce. Occurs in veins with Lead and Silver ores, and called Blue John by the miners. Used for preparing hydrofluoric acid in etching glass, and as a flux in smelting ; sometimes for ornaments, but is very brittle. Abundant in many countries, and of little value.

(See large specimen Vases and Ornaments in special show-cases.)

340. **Fluorite**—*green, octahedron*—Beeralston, Devonshire.
341. ,, *with edges of the cubes replaced by four-faced cubes*—Cumberland.
342. ,, ,, ,, ,,
343. ,, *with Quartz and Galena*—Alston, Cumberland.
344. ,, ,, ,, ,, ,,
345. ,, *the crystals of Fluor-spar being destroyed, a frame of quartz crystals which covered them being left*—Alston, Cumberland.
346. ,, *with Blende, Pearl-spar*—Alston, Cumberland, ENGLAND.
347. ,, Alston, Cumberland, ENGLAND.
348. ,, ,, ,, ,,
349. ,, *green*—Derbyshire.
350. ,, *of amber colour*—Derbyshire.
351. ,, ,, ,,
352. ,, *with Siderite* ,,
353. ,, ,, ,,
354. ,, *cut and polished* ,,
355. ,, Derbyshire.
356. ,, ,,
357. ,, *with Quartz and Calcite*—Derbyshire, ENGLAND.
358. ,, Castleton ,, ,,
359. ,, ,, ,, ,, ,,
360. ,, *with Galena*—Alston, Cumberland ,,
361. ,, *yellow with Siderite*—Badenweiler, Schwartzwald.
362. ,, Schlackenwald, Bohemia, AUSTRIA.
363. ,, *rose variety, with Quartz*—St. Gotthardt, SWITZERLAND.
364. ,, *green*—Auvergne, FRANCE.
365. ,, Ville Franche, near Lyon, FRANCE.
366. ,, *green*—Wierdale, Durham.
367. ,, Wierdale, Durham, ENGLAND.
368. ,, Stolberg, Hartz, GERMANY.
369. ,, Marienberg, Saxony, GERMANY.
370. ,, Münsterthal, Baden ,,
371. ,, *white variety, with Barytine*—Freiburg, Saxony, GERMANY.
372. ,, *with Quartz*—Schneeberg, Saxony, GERMANY.
373. ,, *with Chalcopyrites*—Neiderpoebel, Saxony, GERMANY.
374. ,, Stolberg, Hartz, GERMANY.
375. ,, *with Barytine*—Broterode, Hartz, GERMANY.
376. ,, *compact variety*—Hartz, GERMANY.
377. ,, *blue and white, polished*—Tuscany, ITALY.
378. ,, *green octahedron*—Liskeard, Cornwall, ENGLAND.

379. **Fluorite**—*with Blende and Galena.*
380. „ *green with Siderite and Pyrites.*
381. „ *in large crystals covered with Quartz crystals and Galena.*
382. „ *covered with Quartz crystals.*
383. „ *yellow.*
384. „ *polished.*

(See also ornamental Stones, Vases, and trophy of Specimens.)

MAGNESIA OR OXIDE OF MAGNESIUM.

Anhydrous Magnesia.

PERICLASITE.

Περί, *about ;* κλάσις, *cleavage.*

Isometric. Cleavage, cubic ; perfect. Also in grains. Hardness, nearly 6. Specific gravity, 3·674. Colour, grayish to dark green. Transparent to translucent.

385. **Periclasite**—*small octahedrons, deep red, in Limestone*—Somma, Vesuvius.

Hydrous Magnesia.

BRUCITE.

Dedicated to Dr. Bruce, of New York.

Rhombohedrons of a tabular appearence. Translucent. Lustre, nacreous. White or greenish. Thin laminæ flexible. Crystals or scaly laminæ.

386. **Brucite**—Woodsmine, Pennsylvania.
387. **Brucite**—Hoboken, New Jersey, U.S.A.

CARBONATE OF MAGNESIA.

GIOBERTITE or *Magnesite.*

Rhombohedrons. Translucent. Lustre, vitreous. White, yellowish, reddish, rose red, green, gray, black. Infusible. Occur often in serpentines.

388. **Breunerite** (a variety of Giobertite)—*in Chlorite-slate*—Pfitsch, Tyrol, AUSTRIA.
389. **Giobertite**—Kosemitz, Silesia, GERMANY.
390. „ Kaiserstuhl, Baden, „
391. „ Grochberg, Saxony, „

392. **Gurhofite** (a variety of Dolomite)—Gurhof, AUSTRIA.
393. **Tharandite** „ „ Tharand, SAXONY.
393 *bis.* **Giobertite**—Frankenstein, SILESIA.
393 *ter.* „ Tumut, N.S.W.

PHOSPHATE OF MAGNESIA.

WAGNERITE.

Dedicated to the Bavarian Mining Director Wagner.

Chemical composition—Phosphate of Magnesia with Chloride of Magnesium.

Rhomboidal prisms. Translucent. Lustre, vitreous. Yellowish. Hardness, 5 to 5·5. Specific gravity, 2·98 to 3·13. Fusible with difficulty. Very rare.

394. **Wagnerite**—Salzburg, AUSTRIA.

SUBDIVISION III.—ALUMINA.

A very valuable gem is **Corundum,** or pure Alumina, known, according to its colour, as Ruby, Sapphire, and Oriental Topaz, its principal varieties. (See Gems.)

Under the name of **Emery,** Granular Corundum forms a natural mixture with Magnetite or Hematite, and is used for polishing steel implements and for cutting stones of a lesser degree of hardness.

Another series of compounds which include gems are compounds of Alumina acting as an acid, and bases such as Magnesia, Glucina. Under Aluminates of Magnesia come the different varieties of **Spinel,** including the valuable *Ruby Spinel* or *Balas Ruby* (see Gems), and under Aluminates of Glucina come the **Alexandrite, Chrysoberyl** or **Cymophane,** the hardest stone after Diamond and Corundum.

Turquoise, a hydrous Phosphate of Alumina, is also a gem. (See Gem Stones.)

Among the products of the minerals of Alumina used in the arts is Aluminium, a metal used for some special purposes in its pure state, or as an alloy with copper, in consequence of its low specific gravity. It is extracted chiefly from **Cryolite,** a fluorid of Sodium and Aluminium.

The various kinds of Alum so extensively used in the arts are chiefly extracted from Aluminous Schists (see the Rocks), but are also occasionally derived from other sources, such as **Alunite,** a Sulphate of Alumina and Potash occurring in volcanic regions.

ALUMINA OR OXYDE OF ALUMINIUM.

CORUNDUM.

Corundum is from an Italian name. Sapphire is from the Grecian name given by Theophrastus to Lapis Lazzuli.

Chemical composition—Alumina.

In six-sided prisims, often irregularly shaped. Sometimes in granular masses. Transparent or opaque. Blue, black; also red, green, yellow, white. Glassy lustre; sometimes pearly. Fracture uneven or conchoidal. Specific gravity, 3·9 to 4·2. Hardness, 9. Easily scratches Topaz and Quartz. In hardness it is only inferior to the Diamond. Infusible. Occurs in river sands; in Granite, Feldspar, Magnetic Iron, Basalt. As a gem it stands next in value to the Diamond, but its tint must be brilliant and clear. The blue variety is called *Sapphire*, the most esteemed shade being deep velvet blue; the blood-red variety is the *Oriental Ruby*, which can be easily distinguished from other red gems by its superior hardness; the bright yellow variety is the *Oriental Topaz*, distinguished by its hardness from the Topaz, Yellow Tourmaline, and False Topaz; the bright green is the *Oriental Emerald;* the bright violet, *Oriental Amethyst;* these varieties readily scratch the Emerald and Amethyst; one variety exhibits a six-rayed star inside the prism, and it is called the *Asterias*. Dull crystals are called *Corundum*, and gray or black granular varieties, *Emery*; these two kinds are used for polishing-powder. Ruby is the most highly prized form of this mineral. (See Gems.)

395. **Crystallized Sapphires**—Ceylon.
396. **Sapphire**—*in Micaceous Rock*—Newton, New Jersey, U.S.
397. ,, *in Protogyne*—Mont Blanc, Switzerland.
398. **Ruby**—*with Clintonite, Amphibole, &c.*—Warwick, New York, U.S.
399. **Corundum**—Biella, Piedmont, Italy.
400. **Emery**—Schwartzenberg, Saxony, Germany.

DIASPORE.

Διασπέιρω, *to scatter*—alluding to the usual decrepitation before the blowpipe.

Orthorhombic prism. Rarely crystallized. Often in fibrous and lamellar masses. Translucent. Lustre vitreous. Grayish, yellow, violet, pink. Hardness, 5·5. Specific gravity, 3·36.

401. **Diaspore**—*with Chloritoid*—Katherinenburg, Ural, Russia.

HYDRARGILLITE, GIBBSITE.

Ὕδωρ, *water;* ἄργιλλος, *clay.*

Chemical composition—Hydrate of Alumina.

Small crystals resembling hexagonal tables. Colourless or rose white. Hardness, 3. Specific gravity, 2·43.

402. **Felsobanyite or Gibbsite**—Felsobanya, HUNGARY.

ALUMINATE OF MAGNESIA, &c.

SPINEL.

Chemical composition—Alumina, Magnesia.

In octahedrons, occurring only crystallized. Usually red and transparent; also white, blue, green, yellow, brown, black; the dark shades usually opaque. Lustre glassy. Fracture conchoidal. Specific gravity, 3·5 to 4·0. Hardness, 8. Scratches Quartz. Infusible, and thus distinguished from Garnet, which it may resemble. Colour altered transiently by heat. Distinguished from Zircon by its superior hardness and inferior specific gravity. Occurs in river sand; in igneous rocks, Gneiss, Limestone. The bright transparent varieties are used in jewellery. When red it forms the *Common*, or *Spinel*, or *Balas-Ruby*, which is distinguished from the Oriental Ruby by its inferior hardness; bright green, *Chlorospinel*; orange, *Rubicelle*; violet, *Almandine-Ruby*; black, *Pleonaste*. (See Gem Stones.)

403. **Spinel**—Orange County, New York.
404. ,, Mte. Somma, Vesuvius.
405. ,, Newton, New Jersey, U.S.
406 ,, *with Pyroxene*—Monzoni, Tyrol, AUSTRIA.
407. ,, *with Chrondrodite and Graphite*—Warwick, New York, U.S.
408. ,, *with Serpentine, Mica, and Calcite*—Franklin, New Jersey, U.S.
409. ,, **or Pleonaste**—Warwick, New York, U.S.
410. ,, *with Pyroxene*—Stirling, New Jersey, U.S.
411. ,, Edenville, New York, U.S.

GAHNITE or *Zinciferous Spinel.*

Dedicated to the Swedish chemist Gahn.

Mascled octahedrons. Lustre vitreous, somewhat resinous. Deep green, blackish green. Hardness, 8. Specific gravity, 4·23 to 4·60.

412. **Creittonite**—*with Pyrrhotite*—Bodenmaiz, Bavaria.

ALUMINATE OF GLUCINA.

CYMOPHANE, CHRYSOBERYL.

Κῦμα, *wave*; φαίνω, *appear*; χρυσός, *golden*; βήρυλλος, *beryl.*

Orthorhombic prisms. Occur often in granular masses or in rolled fragments in the alluvials. The Russian variety, called *Alexandrite*, occurs in large crystals or in twins, either six-sided or six-rayed.

Transparent or translucent. Lustre vitreous. Greenish white, asparagus green or olive green, greenish gray, &c.; often opalescent. Trichroic. Hardness, 8·5. Specific gravity, 3·72 to 3·75. Infusible. Occurs with Beryl in river sand, Gneiss, and Granite. Pellucid and opalescent varieties are used as gems.

413. **Alexandrite**—*In broken Crystals.*
414. **Chrysoberyl**—Brazil.
415. „ Haddam, Connecticut, U.S.

(See Precious Stones, No. 2,140 *bis*).

SILICIO-ALUMINATES.

SISMONDINE,

Chemical composition—Silica, Alumina, Iron, a little Magnesia and Water.

Usually coarsely foliated, massive. Hardness, 5·5 to 6. Specific gravity, 3·5 to 3·6. Colour, dark gray, greenish gray, black, often grass-green in very thin plates.

416. **Sismondine**—St. Marcel, Piedmont.

Sismondine is considered by Dana as a variety of Chloritoid, and placed in the Margarophyllite section.

CHAMOISITE and BERTHIERINE.

From the locality Chamoison, Valais.

Chemical composition—Silica, Alumina, Protoxyde of Iron (60 and 74 per cent.), Water.

Amorphous, compact or oolitic. Deep greenish gray or blackish. Slightly magnetic. Easily fusible in a black magnetic slag. Occurs in beds in the Inferior Oolite (Upper Lias of some geologists).

(See collection of Fossils, Brown Jura, specimen 1,138.)

HYDROUS SULPHATE OF ALUMINA.

WEBSTERITE or ALUMINITE.

Dedicated to Webster, who discovered it in England.

In uniform or globular masses. Opaque. Lustre dull, earthy. Hardness, 1. Specific gravity, 1·6 to 1·7. Infusible.

417. **Websterite**—Hall, New Haven, Sussex Co., U.S.A.
418. „ „ „ „

ALUNITE.

Chemical composition—Sulphuric Acid, Alumina, Potash, Water.

Small rhombohedrons. Colourless, yellowish, red, gray, &c. Infusible. Occur in volcanic regions. Used for the manufacture of Alum.

419. **Alunite**—Muzay, Hungary.

NATIVE ALUM or KALINITE.

Octahedrons, usually fibrous or massive. Transparent or translucent. Hardness, 2 to 2·5. Specific gravity, 1·9. Taste well known. Generally in efflorescence or argillaceous schists.

420. **Native Alum**—*massive.*

HYDROUS PHOSPHATE OF ALUMINA.

WAVELLITE.

Dedicated to Dr. Wavell, who discovered it.

Acicular, often radiated crystals. Lustre vitreous or nacreous. Colourless, gray, yellowish, green, &c. Hardness, 3·5 to 4. Specific gravity, 2·3 to 2·4. Infusible.

421. **Wavellite**—Longenstriegis, Saxony.
422. " " "
423. " " "

TORQUOIS.

From *Turkey*, the true gem having come into Europe, through Turkey.

Chemical composition—Phosphoric Acid, Alumina, Copper, and Water.

Reniform, stalactitic or incrusting. Hardness, 6. Specific gravity, 2·6 to 2·83. "Most of the turquois (not artificial) used in jewellery in former centuries, as well as the present and that described in the early works on minerals, was *bone turquois* (called also *odontolite*, from ὀδοὐς, *tooth*) which is fossil-bone, or tooth, coloured by a phosphate of iron." (Dana.)

(See Gems.)

EVANSITE.

Named after Brooke Evans, of Birmingham, who brought it from Hungary.

It is an amorphous phosphate of alumina. Massive, reniform, or botryoidal.

424. **Evansite**—Zeleznik, Hungary.

KLAPROTHITE or LAZULITH.

Not to be mistaken for Ultramarine, or Lapis Lazzuli or Lazulite.

Dedicated to Klaproth, and named Lazulith, in consequence of its blue colour.

This last name (Lazulith) ought to disappear, as it creates confusion with Ultramarine. Whilst Klaprothite is a Phosphate of Alumina, with Magnesia, Iron, and Lime, Ultramarine is a Silicate of Alumina and Alkalies, with Sulphur and Chlorine. Rhomboidal prisms. The ordinary shape is an oblique octahedron with a rhombic base. Azure blue. Hardness 5 to 5·5. Specific gravity, 3 to 3·12.

425. **Klaprothite**—*crystallized*—Graves Mount, Georgia, U.S.A.
426. „ *in rock* „ „
427. „ Mount Rose, SWITZERLAND.

Some crystals from Horrsjöberg, Wermland, are 6 inches long and 2 inches in diameter.

HYDROUS PHOSPHATE OF ALUMINA, IRON, &c.

CHILDRENITE.

Dedicated to the English chemist Children.

Chemical composition—Phosphoric acid, alumina, iron, manganese, water.

Orthorhombic prisms. The ordinary shape is that of a octahedron. Translucent. Lustre, vitreous, somewhat resinous. Yellow or yellowish brown. Infusible.

428. **Childrenite**, Tavistock.

DUFRENITE.

Dedicated to the French mineralogist Dufrenoy.

Chemical composition—Phosphorie Acid, Alumina, Iron, and Water.

Fibrous, globular, or botryoidal. Deep green, dust green.

428 *bis.* **Dufrenite**—Rockbridge Co., Virginia.

PHOSPHATE OF ALUMINA WITH FLUORINE.

AMBLYGONITE, MONTEBRASITE.

Ἀμβλύς, *blunt ;* γωνία, *angle ;* also from the locality where a variety is found, *Montebras*, France.

Chemical composition—Phosphoric Acid, Alumina, Lithia, Soda, Fluorine, &c.

Triclinic. Laminar masses with three cleavages. Lustre, nacreous on the easy cleavage, vitreous on both others. Pale green, grayish white, pink white (amblygonite), pale green, grayish white or yellowish (Montrebrasite). Hardness, 6. Specific gravity, 3·04 to 3·11 (Amblygonite), 3·01 to 3·03 (Montebrazite).

429. **Amblygonite or Montebrasite**—Montebras, FRANCE.

ARSENIATE OF ALUMINA, &c., WITH FLUORINE.

DURANGITE.

From Durango (Mexico).

Chemical composition.—Arsenic Acid, Alumina, Iron, Soda, &c., and Fluorine.

Rhomboidal prism. Small crystals. Colour, orange red. Very rare.

430. **Durangite**—Durango, MEXICO.

FLUORIDE OF SODIUM AND ALUMINIUM.

CRYOLITE or *Icestone.*

Κρύος, *ice ;* λίθος, *a stone*, in consequence of its fusibility.

Prisms. Translucent. Lustre, vitreous, rather nacreous. White, yellowish. Hardness, 2·5 to 3. Specific gravity, 2·95 to 2·97. Very fusible. Generally in cleavable masses. Used for the manufacture of aluminium and soda.

431. **Cryolite**—*crystals*—Kalush, GALICIA.
432. ,, *massive*—Ivigtok, W. GREENLAND.
433. ,, *on Gneiss, with Siderose, Quartz, Chalcopyrite, Limonite, &c.* —Ivikaet, near Arksutfiord, GREENLAND.

Division C.—SILICA AND SILICATES.

SUBDIVISION I.—SILICA.

ANHYDROUS SILICA.

QUARTZ *and its varieties.*

Perhaps no other mineral presents such a great variety of forms and colours as quartz, and no mineral occurs in greater abundance. When pure it consists of silica only, but it is usually contaminated with other ingredients, principally alumina, iron, and clay. The impure varieties of quartz compose most of the pebbles and sand of the soil.

Chemical composition—Silica.

Crystallized in six-sided prisms, terminated by pyramids. Sides of the crystal often marked across with fine parallel lines. Transparent or opaque. Colourless or of various colours. Glassy lustre. Fracture irregular, conchoidal. Specific gravity, 2·6. Hardness, 7. Cannot be scratched with a knife; scratched by topaz, zircon, sapphire, and diamond, and thus easily distinguished from these gems. Quartz scratches glass with facility; feldspar and many other minerals can also be scratched by quartz. The irregular fracture, the fine parallel markings, and the hardness generally, suffice to distinguish quartz. Infusible in the *blow-pipe flame.*

Quartz crystals occasionally occur of enormous size. A group in the Museum of the University of Naples weighs nearly half a ton. A crystal belonging to Sig. Rafelli, of Milan, measures 3¼ ft. in length, and 5½ ft. in circumference, and its weight is estimated at 870 lbs.; another, in Paris, is 3 ft. in diameter, and weighs 8 cwt. About a century since a drusy cavity was opened at Zinken, which afforded 1,000 cwt. of rock crystal, and at that early period brought $300,000. One crystal weighed 800 lbs.

Coloured quartz of various colours, chiefly violet, deep yellow, light yellow, under the names of *Amethyst*, *Cairngorm*, *Citrine Quartz*, are used as gemstones. Agate, besides its use as an ornamental stone, is used for making the knife-edges of delicate balances, mortars, for grinding hard substances, &c.

Among the other minerals of silica, green **Jasper** *with red spots,* or **Bloodstone,** or **Heliothrop,** and **Opals** which are composed of hydrous silica, are also used as gem-stones.

The following are the chief varieties of quartz ; the differences are due either to their mode of formation or the presence of impurities. They have the same general characters as pure quartz :—

1. *Transparent varieties :—*

Rock crystal.—Pure, transparent, colourless quartz. Used for spectacle-glasses and ornaments.

Amethyst.—Transparent. Of a rich violet or purple colour. Used as a gem.

Rose quartz.—Seldom perfectly transparent. Of a rosy tint.

Cairngorm or smoky quartz is transparent, with a smoky tinge.

False topaz has a yellow pellucid colour, distinguished from topaz and Oriental topaz by its inferior hardness.

2. *Semi-transparent varieties :—*

Chalcedony.—Pale colour and waxy lustre. Resembling icicles in some instances ; the frothy surface of a liquid in others.

Carnelian and sard have red tints.

Agate exhibits cloudy or moss-like patches, or a number of lines arranged in circular and angular patterns.

Onyx or sardonyx is made up of regular layers, one above another, of different colours, often white and red. It is much used for cameos.

Flint or hornstone.—Common dull varieties.

3. *Opaque varieties :—*

Jasper is quartz rendered opaque by clay, iron, and other impurities ; it is of a red, yellow, or green colour ; sometimes the colours are arranged in ribands, or in other fantastic forms. It is used for ornamental work.

Bloodstone is green jasper, with splashes of red resembling blood spots.

434. **Quartz**—Bahia, BRAZIL.
435. „ *faces covered with Chlorite*—Huasco, Chili.
436. **Amethyst**—BRAZIL.
437. „ „

438. **Amethyst**—Uruguay, South America.
439. **Quartz**—Lungenstiez, Uri, Switzerland.
440. ,, St. Gothard, Switzerland.
441. ,, *faces covered with Chlorite*—Grisons, Switzerland.
442. **Smoky Quartz**—Madraner Thal, Uri, ,,
443. ,, *faces covered with Chlorite*—Grisons, Switzerland.
444. ,, *with Calcite*—St. Gothard, ,,
445. **Quartz**—Oisans, Dauphiné, France.
446. ,, *in Calcite*—Dauphiné, France.
447. ,, *with Dolomite*—Traversella, Piedmont, Italy.
448. ,, *on white marble*—Carrara, ,,
449. ,, Elba Island, ,,
450. ,, *with cavities containing liquid*—Paretta, ,,
451. ,, *with specular iron*—Whitehaven, Cumberland, England.
452. ,, *with Calcite, on Fluor-spar*—Alston, ,, ,,
453. ,, *on Hematite*—Whitehaven, ,, ,,
454. ,, *cast on Fluor-spar cube, the substance of which has been removed*—Alston, Cumberland, England.
455. ,, *Geode in Hematite*—Alston, Cumberland, England.
456. ,, Lauterberg, Hartz, Germany.
457. ,, *with Dolomite*—Freyberg, Saxony, Germany.
458. ,, *with Silver Ore (?)*—Schneeberg, Saxony, Germany.
459. ,, *with Pyrites*—Oberstein, Palatinate, ,,
460. ,, *capped crystal* (made up of separable layers, due to the deposition of a little clayey material at intervals in the progress of the crystallization)—Breitenbrunn, Saxony, Germany.
461. **Amethyst**—Halsbach, near Freyberg, Saxony.
462. **Ferruginous Quartz**—*very small crystals*—Iserlohn, Westphalia, Germany.
463. **Pseudomorphous Quartz**—*after Siderite*—Schneeberg, Saxony.
464. **Quartz**—Schneeberg, Saxony.
465. ,, *Geode*—Ural Mountains, Russia.
466. ,, *with cavities in which Rutile formerly existed*—Siberia.
467. ,, *cut, with cavity in which Rutile formerly existed*—Siberia.
468. **Amethyst**—Lake Baikal, Siberia.

The colour of Amethyst is supposed to be due to a small percentage of Oxide of Manganese, or, according to Heintz, to a compound of Iron and Soda.

469. **Smoky Quartz**—*Geode*—Utö, Sweden.
470. **Rose** ,, Zwiesel, Bavaria.
471. **Dark blue Quartz**—*in Amphibolite*—Golling, Styria, Austria.

472. **Pseudomorphous Quartz**—*after Barytes*—Przibram, Bohemia, Austria.
473. **Amethyst**—Uruguay, South America.
474. **Quartz.**
475. „
476. **Amethyst**—*Geodes.*
477. **Rose Quartz.**

The rose colour of quartz is attributed to Oxide of Titanium.

478. **Banded Quartz**—*polished.*
479. **Quartz Crystals**—*with Oxyde of Iron.*
480. **Chalcedony.**
482. „ Iceland, Danish Province.
483. „ **and Quartz**—*Geode*—Uruguay, South America.
484. „ *Onyx*—Uruguay, South America.
485. „ *with Bitumen*—Pont-du-Château, Auvergne, France.
486. „ Geode, Wagnon, Ardennes, France.
487. „ *coralloidal*—Champlitte, Hte-Saône, France.
488. „ **and Opal**—Stenheim, Hesse, Germany.
489. **Plasma**—*a faintly translucent green Chalcedony*—Mount Hauskopf, near Oppenau, Baden, Germany.
490. **Chalcedony**—*Chrysoprase*—Frankenstein, Silesia, Prussia, Germany.
491. „ *Cornaline*—Freiberg, Saxony, Germany.
492. **Agate**—Saxony, Germany.
493. „ „
494. „ Oberstein, Palatinate, Germany.
495. „ Vosges, France.
496. „ Ural Mountains, Russia.
497. „ Uruguay, South America.
498. „ „ „
499. „ *to show the direction of infiltration*—Uruguay, South America.
500. „ Uruguay, South America.
501. „ *polished.*
502. **Cat's-eye**—(*a variety of Chalcedony*)—Baiern.
503. **Chrysoprase**—(*a variety of Chalcedony coloured with nickel*)—Frankenstein, Silesia.
504. **Moss Agate**—Cambay, India.
505. **Silicified Crocidolite or Cat's-eye**—Cape Colony.
506. **Jasper**—*polished heliotrope*—Uruguay, South America.
507. „ Egypt.
508. „ Liehl, Baden, Germany.

509. **Jasper**—Kandern, Baden, GERMANY.
510. „ *Ferruginous variety*—Langenberg, Saxony, GERMANY.
511. „ *banded*—Kohren, Saxony, GERMANY.
512. „ *banded*—Lerbach, Hartz Mountains, GERMANY.
513. **Silex or Hornstone**—Wurtzen, Saxony, GERMANY.
513 *bis*. **Babel-quartz**—Uruguay.
514. **Silex**—Spitzleite, Saxony, GERMANY.
515. „ *with dendrites of manganese*—Johann-Georgenstadt, Saxony, GERMANY.
516. „ Meissen, Saxony, GERMANY.
517. **Jasper**—*polished bloodstone*—Sicily, ITALY.
518. „ *green banded*—Ural Mountains, RUSSIA.
519. „ *polished yellow*—Aarau, SWITZERLAND.
520. „ *Porcellanite*—Teplitz, Bohemia, AUSTRIA.
521. „ „ „ „ „
522. „ *banded Porcellanite*—Teplitz, Bohemia, AUSTRIA.
523. **Silex**—*with Pyrites*—Fahlun, NORWAY.
524. „ Champigny, Seine & Oise, FRANCE.
525. **Jasper**—*from a manganese deposit*—Gomen, NEW CALEDONIA.
526. „ „ „ „ „
527. **Wood Jasper**—*not from petrified wood*—Gomen, NEW CALEDONIA.

HYDROUS SILICA.

OPAL.

From ὀπαλλίος, name given to a precious stone.

Chemical composition—Silica and water.

Never crystallized. Fracture conchoidal. Specific gravity, 2·2. Hardness, 6. Can be scratched by Quartz, and thus distinguished from it. Infusible. It is generally milk white. *Precious or Noble Opal* exhibits a beautiful display of colours, and is a valuable and rare gem. The common varieties are of no value.

528. **Hyalite**—*on basalt.*
529. **Precious Opal**—Czervenitzia, HUNGARY.
530. **Menilite (Earthy Opal)**—Menilmontant, Paris.
531. **Alumocalcite**—Jeohann-Georgenstadt, SAXONY.
532. **Precious Opal**—Grenvenitza, HUNGARY.
533. **Resinite, Opal**—Biella, Piedmont, ITALY.
534. „ ISLE OF ARRAN.

535. **Resinite, Opal**—Hanau, Hesse, GERMANY.
536. „ Kosemitz, Bohemia, AUSTRIA.
537. „ Bilin, Bohemia, AUSTRIA.
538. „ Puy de Rilly, near Issoire, FRANCE.
539. „ Sibethen, Hungary, AUSTRIA.
540. „ Bonn, GERMANY.
541. „ Saxony, GERMANY.
542. „ Teplitz, Bohemia, GERMANY.
543. „ Mts. Euganéens, Vicentin.
544. „ Istadt, Thuringia, GERMANY.
545. „ Kostenblatt, BOHEMIA.
546. „ *with Quincite*—Quincy, Cher., FRANCE.
547. „ Habichtswald, Hesse, GERMANY.
548. **Menilite, Opal**—Menilmontant, Paris, FRANCE.
549. „ „ „
550. „ „ „
551. **Wood Opal**—Siebengebirge, on the Rhine, GERMANY.
552. **Geyserite or Silicious Tuffa**—Iceland, DANISH PROVINCE.
553. **Hyalite or Opal**—*in altered Rock*—Solfatare de Pouzzoli, ITALY.
554. „ *in Dolerite*—Schemnitz, Hungary, AUSTRIA.
555. „ *in Grauwacke*—Steinheim, Hesse, GERMANY.
556. **Hyalite**—*on Dolerite*—Kaiserstuhl, Baden, GERMANY.
557. **Geyserite or Silicious Tuffa**—Iceland, DANISH PROVINCE.
558. **Green Opal**—Plum Bay, NEW CALEDONIA.
559. **Opal**—*with dendrites of manganese*—Gomen, NEW CALEDONIA.
560. **Whitish Opal**—Plum Bay, NEW CALEDONIA.
561. **Banded Opal**—*from Antimony deposit*—Nakety, NEW CALEDONIA.
562. **Green Opal**— „ „ „ „
563. **Banded Opal**— „ „ „ „
564. **Wood Jasper**—*not being from petrifaction of wood*—Gomen, NEW CALEDONIA.
565. **Tripoli**—*or infusorial earth*—Salzhausen, Hesse, GERMANY.
566. „ Oran, Algeria, AFRICA.
567. „ Menot, Auvergne, FRANCE.
568. **Green Opal**—Plum Bay, NEW CALEDONIA.
569. **Opal**—*with manganese dendrites*—Gomen, NEW CALEDONIA.
570. „ *common white*—Plum Bay, NEW CALEDONIA.
571. „ *banded*—Nakety, „
572. „ *greenish spotted*—Nakety, „
573. „ *banded*— „ „
574. **Wood Opal**—Gomen, „

SILICATES.

Out of the eight or nine hundred minerals at present known, at least two hundred and fifty, besides quartz and its varieties, contain Silica in greater or less proportions, and belong to the present subdivision.

Silicates are indispensable in the manufacture of glass, porcelain, earthenware, and for other purposes; but they exist in such profusion that their economical value is exceedingly trifling. The great majority of the Silicates and Silica minerals are purely objects of scientific interest; a few are esteemed as gems and as ornamental stones.

Dana, in his "System of Mineralogy," makes the following arrangement for the Silicates :—

A. Anhydrous Silicates are distinguished into—
  Bisilicates—Ex. Pyroxene, Amphibole, Wollastonite.
  Unisilicates—Ex. Olivine, Garnet, Feldspar.
  Subsilicates—Ex. Andalousite, Disthene, Staurolite.

B. Hydrous Silicates are arranged as follows :—
  1. A General Section, including—
    a. Bisilicates.
    b. Unisilicates.
    c. Subsilicates.
  2. The Zeolites Section.
  3. The Margarophyllite Section.

In that classification the Hydrous Bisilicates of the General Section include but a few minerals some of which have been left with the metallic minerals (Dioptase and Chrysocole), whilst some of the Unisilicates, such as Apophyllite, Laumontite, Prehnite, present some features common to Zeolites, and in fact have been called Zeolites. They will be found close to the Zeolites in any way. The Hydrous Subsilicates of the General Section will not be maintained; they are few in number, and still not crystallized, and will be, for practical purpose, more suitably placed among the clays, and such kindred amorphous minerals.

The Margarophyllite Section is mostly composed of minerals containing more or less magnesia, such as Serpentine, Talc, Chlorite. These minerals form one group often found in close relation with mineral deposits. These two reasons probably, the presence of more or less magnesia or of isomorphous bodies, and their relation to mineral deposits, have led to place them in the Museum close to the anhydrous minerals such as belong to the Pyroxene and

Amphibole group, some of which can be considered as magnesian minerals, and which also include minerals associated with metalliferous deposits.

The order adopted will not be therefore strictly based on scientific principles, such as the mode of crystallization, or the atomic composition leading to a mineralogical formula. It is easily understood that, for practical purposes, the chemical composition bearing in some respect, but not as a rule, some relation to the mode of deposit will bring at once and group together before the visitor some minerals which are generally found associated in nature or occur under similar circumstances.

In the following arrangement of the Silicates and Hydrous Silicates the principal groups of "Dana's System of Mineralogy" have been partly preserved, but it has been departed from, especially in four cases :—

1st. The combination of Silicates with other salts, such as Silicio-Borates, Silicio-Fluorides, Silicio-Sulphates, &c., instead of being scattered respectively in the several groups according to their atomic constitution and mode of crystallization, have been kept together.

2nd. The principal Silicates containing glucina, such as Emerald, Beryl, Euclas, Phenacite, and the Silicate of Zirconia, the Zircon, have been kept separately.

3rd. The Silicates, Silicio-Niobates, Niobates, &c., of Yttria, Ceria, &c., all minerals of rare metals, occurring generally in the rock known as Zircon-Syenite, have been included in a separate class.

4th. The Silicates which are considered as metallic ores, or are generally found accompanying metallic ores, such as Dioptase and Chrysocole (Silicates of Copper), Rhodonite (Silicate of Manganese), Wilhemite and Calamite (Silicate and Hydro-silicate of Zinc), and others, such as Titanite or Sphene (Silicio-Titanite of Lime), which have not been included among the Silicates proper, will be found among the metallic minerals.

The following groups, including Pyroxene sub-group, Amphibole sub-group, of Dana, present the following common features. They are all bisilicates; nearly all are formed with a great number of bases. Wollastonite, however, is to be distinguished as a bisilicate of lime. Magnesia exists in variable but acceptable proportions in most of the others, as Enstatite, Hypersthene, Diaclasite, Pyroxene, Amphibole, Anthophyllite.

Spodumene, Petalite, and Pollucite will be placed close to the Feldspars as being Aluminous Silicates, containing Alkalies.

Next to Amphibole the Nephrite or True Jade ought to take place, being mostly a compact or finely lamellar variety of Amphibole; whilst Saussurite, which is also confounded under the name of Jade, ought to be placed as annexed to Epidote, being a compact variety of Zoisite.

The Chrysolite group, which come next, include minerals which are mostly unisilicates of magnesia or iron. As minerals, in the composition of which magnesia and oxide of iron are unimportant, Garnet, Idocrase, Epidote, and the Micas can be added to this group ; they are all unisilicates of proto and sesqui oxides. Most of the Hydrous Minerals forming the Margarophyllite section of Dana will find place here, including especially Serpentine, Talc and the Chlorites, nearly all of which are again characterized by the presence of Magnesia.

It may be remarked here that Serpentine, the most important mineral of the Margarophyllite section, as forming considerable rock masses, will be found in a suitable place, after Pyroxene and Chrysolite, as these two minerals enter in the composition of anhydrous eruptive rocks, the decomposition and hydratation of which have formed Serpentine.

All the other silicates are mostly distinguished by the presence of alumina in such proportion as they can be taken as a whole, including the Hydrous Silicates, Zeolites, and Clays, as Silicates of Alumina, in which the presence of iron, as well as manganese, in quantities is rare. They will be arranged as follows, beginning by the Anhydrous.

Spodumene and Allucite groups are Silicates of Alumina and Alcalies or isomorphous bodies ; they comprehend bisilicates of protoxydes and peroxydes.

The Scapolite, Amphigene, Feldspar group, &c., are also silicates of alumina with alkalies and isomorphous bodies, but they are unisilicates of proto and sesqui oxides. The Andoulousite, Disthene, Staurotide group, &c., are Aluminous Subsilicates.

Then come the hydrous Silicates of Alumina.

The first groups, including Prehnite, Apophyllite, and others, can be called Pseudo-Zeolites, most of them having been called Zeolites. They are mostly bisilicates and singulo silicates.

The Zeolites form a better-defined group, including bisilicates and unisilicates of Alumina and Alkalies.

In fine, the Clays, Kaolin, Allophane, Halloysite, and others will follow the Zeolites as Silicates of Alumina. These two last groups give opportunities to some remarks. The Zeolites are generally in beautiful crystals, occurring in the geodes and fissures of volcanic rocks. They are all remarkable by their easy fusibility in consequence of the presence of Alkalies. On the contrary, clays and similar products are amorphous and infusible or slightly fusible. As well as Zeolites, clays are products of decomposition, but whilst the first have been carried in solution from the volcanic rocks themselves and deposited in fissures; the clays, on the contrary, are the remains of rocks from which the elements which, in Zeolites, form the most soluble compounds, say the Alkalies, have been driven away.

The arrangement of the Silicates is, therefore, the following:—

1. Mostly Magnesians and Isomorphous.

A. ANHYDROUS

I. Bisilicates of Protoxides—Ex. Pyroxene, Amphibole.
II. Unisilicates of Protoxides—Ex. Crysolite, Forsterite.
III. Unisilicates of Proto and Sesqui Oxides—Ex. Garnet, Epidote, Micas.

B. HYDROUS.

IV. Bisilicates—Ex. Serpentine, Chrysotil.
V. Unisilicates—Ex. Talc.
VI. Subsilicates—Ex. Chlorites.

2. Mostly Aluminous (containing rarely oxides of iron or magnesia).

A. ANHYDROUS.

a. Aluminous, with Alkalies or lime and isomorphous.

VII. Bisilicates of Protoxides and Peroxides—Ex. Spodomene, Pollucite.
VIII. Unisilicates of Protoxides and Peroxides—Ex. Scapolite, Amphigene, Feldspars.

b. Aluminous.

IX. Subsilicates—Ex. Andalusite, Disthene, Staurolite.

B. HYDROUS, CRYSTALLIZED.

a. Calcic or Aluminous, with or without Alkalies.

X. Bisilicates—Ex. Pectolite, Okenite (Dysclasite).
XI. Unisilicates—Ex. Prehnite, Apophyllite.

b. Aluminous with Alkalies.

XII. Bisilicates of Proto and Sesqui Oxides—Ex. Thomsonite, Mesotype.
XIII. Unisilicates of Proto and Sesqui Oxides—Ex. Analcite, Chabasite, Harmotome.

C. HYDROUS, AMORPHOUS.

XIV. Unisilicates and Subsilicates of Alumina, &c.—Ex. Clay, Halloysite, Allophane.

It may be repeated that the above groups are not intended to be a systematic classification at all. But, whilst the scientific man will always find his way among the numerous species of minerals which enter in a tolerably complete collection, the more numerous people, who seek for practical information, will better understand the display of the minerals in such a way as to bring forward such characters as are more familiar to them. In the course of time, when the principal minerals given as examples of groups will be well known to students, it will be more easy to ascertain the relations and differences of such minerals as are likely to enter in the same groups.

SUBDIVISION II.—SILICATES.

(Mostly Magnesian and Aluminous.)

In referring to the above tabular arrangement of this subdivision it will be seen that it comprehends fourteen series. The names of the principal minerals to which a number of others are referable on some points of similarity will be then taken as heads of groups.

Series I.—Anhydrous Bisilicates of Protoxides.

(Mostly Magnesians.)

PYROXENE GROUP.

The common variety of Pyroxene, **Augite**, is generally found in small fine black crystals in ancient and modern lavas.

a. Crystallized in the Orthorhombic System.

ENSTATITE.

’Ενστάτης, *an opponent*, because very refractory.

Chemical composition—Silica, Magnesia.

Occurs in long prisms in serpentines. Hardness, 5·5. Specific gravity, 3·10 to 3·13. Infusible.

575. **Enstatite**—*large crystal*—Bamble, Norway.
576. **Bronzite** (a variety of Enstatite)—*in Talc*—Kupferberg, Bavaria.

HYPERSTHENE.

῾Υπέρ, *upper ;* σθένος, *tough*, from its hardness.

Chemical composition—Silica, Magnesia, Iron, &c.

Isomorphous with Enstatite. Hardness, 6. Specific gravity, 3·35 to 3·39. Fusible into a magnetic glass. Occurs often associated with Labradorite, constituting a dark-coloured granite-like rock, called *Hyperite.*

577. **Hypersthene**—*polished specimen.*

DIACLASITE.

Chemical composition—Silica, Magnesia, Iron, &c.

Isomorphous with Hypersthene and Enstatite; resembles Bronzite. Hardness, 3·5 to 4. Specific gravity, 3·054. Fusible.

578. **Diaclasite**—*in Euphotide*—Hartz.

b. Crystallized in the Monoclinic System.

PYROXENE *and its varieties, including:*

DIOPSIDE.

Δίς, *double;* ὄψις, *a sight.*

HEDENBERGITE.

Dedicated to the Swedish chemist Hedenberg.

AUGITE.

'Αυγή, *brightness.*

Chemical composition—Silica, Lime, Magnesia, &c.

The different varieties of Pyroxene usually occur in stout six- or eight-sided prisms with roof-like terminations. Hardness, 5-6. Specific gravity, 3·2 to 3·5. Fusible. Abundant in igneous and other rocks. Of no value.

579. **Diopside**—Rothenkopf, Tyrol.
580. " *with Essonite, Garnet, and Pennine*—Ala, Piedmont.
581. " Cantal, Auvergne, FRANCE.
582. **Pyroxene, Diopside**—*with Mica*—Mount Vesuvius, ITALY.
583. " **Fassaite**—*with Mica*—Fassa, Tyrol, AUSTRIA.
584. " **Diopside**—Reichenstein, Silesia, Prussia, GERMANY.
585. " **Salite**—*with Mica*—Sala, SWEDEN.
586. " **Mussite**—Reichenstein, Silesia, Prussia, GERMANY.
587. " " Banat, AUSTRIA.
588. " **Coccolite**—Ural Mountains, RUSSIA.
589. **Breislakite** (a variety of Diopside)—*on lava*—Somma, Vesuvius.
590. **Violane** (a violet variety of Diopside containing Alumina)—St. Marcel, Piedmont.
591. **Diallage**—Volpersdorf, Silesia.

(Has the same composition as Diopside, and is amorphous with that mineral.)

592. **Hedenbergite**—*with Calcite*—Arendal, NORWAY.
593. **Schefferite** (a variety of Hedenbergite)—*with Calcite*—Langbanshytta, SWEDEN.

594. **Traversellite** (a variety of Hedenbergite)—*with Talc*—Traversella, Piedmont.
595. **Jeffersonite**—Laminar, Franklin, New Jersey.

(Jeffersonite is a variety of Hedenbergite containing manganese and zinc.)

596. **Jeffersonite**—*in Crystals*—Sterling, New Jersey.
597. **Ægyrite**—Brevig, NORWAY.

(Œgyrite is a variety of Hedenbergite containing soda.)

598. **Augite**—Somma, Vesuvius.
599. ,, *in large Crystals*—Nordmark.
600. ,, Nordmark.
601. ,, *from volcanic lavas*—Auvergne, FRANCE.
602. ,, Arendal, NORWAY.
603. ,, Teplitz, Bohemia, AUSTRIA.
604. ,, *in Basalt*—Kaisertühl, Baden, GERMANY.
605. ,, *in Melaphyre*—Bufaure, Tyrol, AUSTRIA.
606. ,, *in Wacke*—Bilin, Bohemia ,,

WOLLASTONITE.

Dedicated to Wollaston.

Chemical composition—Silica, Lime.

Although rarely crystallized in nature, occurs sometimes in large crystals in the slags of blast furnaces. Hardness, 5. Specific gravity, 2·8 to 2·9. Before blowpipe, melts on the edges.

607. **Wollastonite**—*with blue calcite and garnets*—Oravitza, Banat, AUSTRIA.

Rhodonite, a Silicate of Manganese, which should be placed close to the Pyroxene Group with the above minerals, will be found among the Manganese minerals. It is crystallized in the triclinic system.

AMPHIBOLE GROUP.

Amphibole occurs often in rocks connected with metalliferous deposits.

The most important varieties are the fibrous variety, **Asbestus**, used for many purposes, and the **Jade** or **Nephrite**, as an ornamental stone.

a. Crystallized in the Orthorhombic System.

ANTHOPHYLLITE.

From Anthophyllum, *a clove*, in consequence of its colour.

Chemical composition—Silica, Magnesia, Iron.

Very closely related to Amphibole.

608. **Anthophyllite**—*with Mica*—Pfitsch, Tyrol.
609. **Snarumite** (a variety of Anthophyllite).

b. Crystallized in the Monoclinic System.

AMPHIBOLE *and its varieties, including—*

TREMOLITE.

From Tremola, Switzerland.

ACTINOTE.

ʼΑκτίς, *a ray ;* λίθος, *a stone*, a translation of the German, Strahlstein, *a radiated stone.*

HORNBLENDE.

From the German.

Chemical composition—Silica, Lime, Magnesia, Protoxide of Iron (occasionally Alumina and Fluorine).

In four, six, or eight sided prisms, exhibiting cleavage in some directions, Usually opaque, generally long, slender. Glassy, pearly, or resinous lustre. Specific gravity, 3 to 3·5 Hardness, 5 to 6. Can be scratched with a knife, using pressure. Scratched by quartz. Dark varieties fusible. Asbestos is used as a fire-proof material. White (Tremolite, Grammatite), green (Actinote, Strahlstein), black (Hornblende).

610. **Tremolite or Grammatite**—Somma, Vesuvius.
611. **Tremolite**—*with Iron*—Banat, Hungary, AUSTRIA.
612. ,, *with Dolomite*—Campolongo, St. Gothard, SWITZERLAND.
613. ,, Lengfelden, Saxony, GERMANY.
614. ,, ,, ,, ,,
615. **Actinote**—Engelsburg, Saxony, GERMANY.
616. ,, Grisons, SWITZERLAND.
617. ,, *in Trachyte*—Siebengebirge, on the Rhine, GERMANY.
618. ,, *radiated on Mica-schiste*—Dauphiné, FRANCE.
619. ,, *with compact Chlorite*—Pfitsch, Tyrol, AUSTRIA.
620. ,, *with Talc*—Mount Greiner, ,, ,,
621. ,, Coquimbo, Chili, SOUTH AMERICA.
622. ,, Elba, ITALY.
623. ,, Breitenbrunn, Saxony, GERMANY.
624. **Amphibole** (variety Pargasite)—*with Idocrase and Calcite*—Warwick, New York, U.S.
625. ,, **or Hornblende**—*with Scapolite or Nuttalite*—Sterling, Massachusetts, U.S.
626. ,, ,, *in Wacke*—Bilin, Bohemia, AUSTRIA.
627. **Hornblende**—*in Wacke*—Presnitz, Bohemia.
628. ,, *with Garnet and Pyroxene*—Somma, Vesuvius.

629. **Hornblende**—Somma, Vesuvius.
630. ,, Edenville, New York.
631. ,, Mickenhübl, Bohemia.
632. ,, Laurwig, NORWAY.
633. ,, Salzburg, AUSTRIA.
634. ,, Arendal, NORWAY.
635. ,, Hungary, AUSTRIA.
636. ,, Zobten, Silesia, GERMANY.
637. ,, *in Trachyte*—Siebengebirge on the Rhine, GERMANY.
638. ,, Fahlun, SWEDEN.
639. ,, Lizard, Cornwall, ENGLAND.
640. ,, *radiated*—Breitenbrunn, Saxony, GERMANY.
641. **Orbiculadr Porphyry of Corsica, or Napoleonite**—is a rock formed of Hornblende and Felspar—Corsica.

c. Fibrous and Compact Varieties of Amphibole.

642. **Grammatite**—*Mountain Leather*—Matrey, Tyrol.
643. ,, *Mountain Wood*—Schneeberg.
644. **Asbestus** (or Asbestos) **and Albite**—Dauphiné, FRANCE.
645. **Asbestus**—Valley of Fassa, Tyrol, AUSTRIA.
646. ,, Valais, SWITZERLAND.
647. ,, Dognatzka, Banat, AUSTRIA.
648. **Crocidolite, or Blue Asbestus**—Wakemback, near Schirmeck, Vosges, GERMANY.
649. **Asbestus**—*in beautiful long and silky fibres*—Soldrio, ? ITALY.
650. ,, Mudgee, N.S.W.
651. ,, *common, of no value*—Pregarten, Tyrol.
652. **Crocidolite** (Blue Asbestos)—*a fibrous variety of Arfvedsonite*—Griqualand, SOUTH AFRICA.
653. **Crocidolite**—*polished*—Griqualand, SOUTH AFRICA.
654. ,, *polished*—Griqualand, SOUTH AFRICA.

From κροκις, *woof*, in allusion to its fibrous structure.

655. **Jade, or Nephrite**—*a compact variety of Tremolite*—CHINA.

(See Ornametal Stones.)

656. **Jade** (cut into an axe)—NEW CALEDONIA.
657. ,, NEW ZEALAND.
657 *bis*. **Nephrite**—TURKESTAN.
658. **Smaragdite**—*variety of Actinote*—CORSICA.
659. ,, *variety of Actinote—in Eclogite*—Fichtelgebirge, Bavaria, GERMANY.

d. System of Crystallization doubtful; Orthorhombic or Monoclinic.

GLAUCOPHANITE.

Γλαῦκος, *bluish-green ;* φαίνω, *I appear*—in consequence of its colour.

Crystallized in microscopic needles, rarely in small rods. The acicular prisms are longitudinally striated. It also occurs granular massive. Lustre, vitreous to pearly. Colour, blue, lavender-blue, bluish-black, grayish, streak powder grayish-blue. Translucent to opaque. Powder slightly magnetic. This mineral is rare. It has been found in the Island of Syra, one of the Cyclades, at Zermatt, and in the north of New Caledonia. In the last locality it occurs along with garnet, hornblende, mica, just as at Syra, and is, in New Caledonia, in close connection with rich copper deposits. Analyses of the New Caledonian mineral have been made by Professor Liversidge and given in the Royal Society's papers (N.S.W.). It might be found, according to the late Rev. W. B. Clarke's statements, at Bingera.

660. **Glaucophanite Rock**—*with Garnets and Mica*—Ouegoa, NEW CALEDONIA.
661. " *with Chrome, Mica, and Garnets*—NEW CALEDONIA.
662. " *with Chrome and Mica*—NEW CALEDONIA.
663. " *with White Mica* "

Series II.—Anhydrous Unisilicates of Protoxides.

(Mostly Magnesians.)

CHRYSOLITE GROUP.

Chrysolite, Olivine, or Peridot is important, when pure, as a gem stone. It is a common element of the basalts and lavas.

OLIVINE or CHRYSOLITE or *Peridot.*

From the colour, of the *Olive Fruit,* χρυσός*; gold,* λίθος.

Chemical composition—Silica, Magnesia, and a little Iron.

Crystallized in the orthorhombic system. Often granular. Green, yellow, and brown. Hardness 6·5 to 7. Specific gravity, 3·3 to 3·44 Infusible, except some varieties containing much Iron.

664. **Olivine**—*with Magnetite*—Somma, Vesuvius.
665. " Somma, Vesuvius.
666. " Eifel, Rhine Province, GERMANY.
667 " Sasbach, Kaiserstühl, "

FAYALITE.

A ferruginous variety of Peridot. It is a common product of the puddling furnace.

FORSTERITE.

Named after Forster, a patron in mineralogy.

Chemical composition—Silica, Magnesia, &c.

In imperfect crystals and grains. Hardness, 6 to 7. Specific gravity, 3·21 to 3·33. Vitreous. White, yellowish-white, wax-yellow, grayish, bluish-gray, greenish. Monticellite (after the Italian mineralogist Monticelli) and Batrachite are much related to Olivine and Forsterite. (See *Serpentine*, sp. No. 795, *Pseudomorphous after Monticellite.*)

Series III.—Anhydrous Unisilicates of Protoxides and Sesquioxides.

(Mostly Magnesians; Iron also prevalent.)

a. Crystallized in the Isometric system.

GARNET GROUP.

Some varieties of Garnet, namely the variety called *Almandite*, are valuable as gem-stones. Uwarowite, or Chrome-garnet, is remarkable in consequence of its green colour.

GARNET *and its varieties.*

The minerals of this group are generally crystallized in the shape of rhomboidal dodecahedrons, or trapezohedrons, and intermediate forms. Fusible, except Yttergarnet and Uwarowite. They form a remarkably natural group, all answering to the proportions of oxygen, as 1 : 1 : 2, for the protoxides, peroxides, and silica respectively.

Most of them are used as gem-stones.

They may be divided into five or six principal species, characterized by their elementary composition, the colour being very variable.

Lime Alumina Garnet.

GROSSULARITE *or Essonite or Cinnamon Stone.*

Grossularia, *gooseberry*, from the colour; rarely white; green, yellow, yellowish-brown, hyacinth-red.

Iron Alumina Garnet.

ALMANDITE, *Sirian Garnet, Oriental Garnet.*

From *Alabanda*, a town in Asia Minor, where Garnets were cut and polished as Carbuncles (Pliny). Also from Siriam in Pegu.

Red, brown-red, brown, &c. Hardness, 7 to 7·5. Specific gravity, 3·5 to 4.

Magnesia Alumina Garnet.

PYROPE.

Πῦρωπός, *fire-like.*

Blood-red; contains a small proportion of chromic oxide. Chiefly from Bohemia.

Lime Iron Garnet.

ANDRADITE, *Melanite ex parte.*

Named after the Portuguese mineralogist d'Andrada.

Black (variety Melanite—μέλας, *black*). Topaz yellow or greenish-yellow (variety Topazolite). Brownish-yellow to dark reddish-brown, resinous (variety Colophonite). Brownish-yellow (variety Polyadelphite). Dark brown with striated faces (variety Aplome). Yttriferous Lime Iron Garnet or Yttergarnet is infusible.

Manganese Alumina Garnet.

SPESSARTITE.

From the locality *Spessart*, near Aschaffenburg, Bavaria.

From hyacinth-red to brown.

Lime Chrome Garnet.

UWAROWITE.

Dedicated to the Russian Minister of State Uwarow.

Emerald-green. Infusible.

The following specimens of the collection have not been systematically separated into the above classes, owing to the difficulty of determining their place without a full analysis.

668. **White Garnet** (Grossularite or Wiluite)—Auerbach, Bergstrasse.
668 *bis.* ,, ,, ,, Jordansmuhl, Silesia.
669. **Grossularite**—Wilui, Ural.
669 *bis.* ,, (variety Succinite)—*with Diopside, Chlorite, &c.*—Ala, Piedmont.
670. ,, (variety Succinite)—*with Diopside, Chlorite, &c.*—Ala, Piedmont.
670 *bis.* ,, (variety Essonite)—Grisons, SWITZERLAND.
671. ,, St. Gothard, SWITZERLAND.
671 *bis.* ,, (variety Romanzovite)—Wermeland, SWEDEN.
672. **Almandite**—Passerthal, Tyrol.
672 *bis.* ,, *isolated crystals*—Tyrol.
673. ,, *a large crystal covered with Chlorite*—Arendal, NORWAY.
673 *bis.* ,, St. Gothard, SWITZERLAND.

674. **Almandite**—Ceylon.
674 *bis.* „ *in Mica-schiste*—Finland, RUSSIA.
675. „ Greenland (DANISH COLONY).
675 *bis.* „ *with Chlorite*—Ural Mountains, RUSSIA.
676. „ Arendal, NORWAY.
676 *bis.* „ *with Talc-schiste*—St. Gothard, SWITZERLAND.
677. „ *in trachyte*—Kaiserthul, Baden, GERMANY.
678. **Pyrope**—*in serpentine*—Zieblitz, Saxony.
679. „ *in semi-opal*—Meronitz, Bohemia.
680. „ *cut*—Meronitz, Bohemia.
681. **Garnet**—*with Sodalite*—Somma.
682. „ *Brown yellow*—Somma.
683. **Brown Garnet**—Breithenbrunn, Saxony.
684. **Greenish-brown Garnet**—Knoughertown, Pennsylvania, U.S.A.
685. **Garnet**—Fichtelgebirge, Bavaria, GERMANY.
686. „ Franklin, New Jersey, U.S.
687. **Andradite** (variety Topazolite)—Ala, Piedmont.
688. „ (variety Colophonite)—Lewis County, New York, U.S.A.
689. „ (variety Aplome)—Dognaczka, Bannat.
690. „ „ „ *very dark*—Arendal, NORWAY.
691. „ „ „ Auerbach, Hesse, GERMANY.
692. „ „ „ Schwarzenberg, Saxony, GERMANY.
693. „ „ „ *with Calcite and Wollastonite*—Oravitza, Banat, AUSTRIA.
694. **Melanite**—Vesuvius.
695. „ *with Pyroxene*—Franklin, New Jersey, U.S.A.
696. „ Kaiserthul, Baden, GERMANY.
697. „ Pfitsch, Tyrol, AUSTRIA.
698. **Spessartite**—Haddam, Connecticut, U.S.A.
699. **Uwarowite** (or Green or Chrome Garnet)—*on chrome ore*—Ural.
700. „ *alluvial*—Siberia.

b. Crystallized in the Tetragonal system.

VESUVIANITE OR IDOCRASE GROUP.

This is a mineral of no industrial use. It was first found in the ancient ejections of Vesuvius.

IDOCRASE or VESUVIANITE.

Εἶδος, *shape ;* κρᾶσις, *mixture*—in allusion to the great number of modifications in the shape of this mineral. Found at Vesuvius.

Chemical composition—Silica, Alumina, Lime, Iron, Magnesia, &c.

Square prism. Lustre, vitreous; somewhat resinous in the fracture. Green, yellow, brown. Hardness, 6·5. Specific gravity, 3·35 to 3·45. Easily fusible.

701. **Idocrase**—*brown variety*—Mount Monzoni, Fassathal, Tyrol.
702. ,, *a fine crystal*—Somma, Vesuvius.
703. ,, *green variety*—Ala, Piedmont.
704. ,, ,, ,, ,,
705. ,, Mount Vesuvius, ITALY.
706. ,, Sterling, New Jersey, U.S.
707. ,, Christiansand, NORWAY.
708. ,, Johann-Georgenstadt, Saxony, GERMANY.
709. ,, Eger, NORWAY.

MELILITE or HUMBOLDTILITE.

Μέλι, *honey*, in allusion to the colour. Dedicated to Humboldt.

Chemical composition—Silica, Lime, Magnesia, Alumina, Iron, Alkalies, &c.

Tetragonal. White or pale yellow, honey yellow, greenish yellow, reddish brown, brown. In volcanic rocks. Common as a furnace slag.

710. **Melilite**—Somma, Vesuvius.

c. Crystallized in the Anisometric systems.

EPIDOTE GROUP.

Epidote is a mineral of no industrial use. The crystals are generally remarkable by their columnar shape and their groupings. Often accompanies beds of magnetite or hematite, in crystalline rocks. Also common in rocks containing the ferriferous amphibole, and consequently often connected with metalliferous deposits.

ZOISITE.

Dedicated to the German mineralogist Zois.

Chemical composition—Silica, Alumina, Lime.

Rhomboidal prism. Crystals irregular; generally in rods; one easy cleavage. Translucent. Lustre, vitreous. Grayish white, gray, yellowish gray, &c. A pink variety is called *Thulite*. Hardness, 6 to 6·5. Special gravity, 3·25 to 3·36. Fusible.

711. **Zoisite** *and Feldspar*—Monzoni, Tyrol, AUSTRIA.
712. ,, *on Quartz*—Fatigal, Tyrol, AUSTRIA.
713. **Saussurite.**

EPIDOTE, THALLITE, or PISTACITE.

Ἐπίδοσις, *increase*, the base of the prism having one side longer than the other; θαλλός, *colour of young twigs*, alluding to the green colour, as well as the last name, *Pistacite*.

Chemical composition—Silica, Alumina, Iron, Lime, and a little water.

Crystallized in long prisms. One easy cleavage. Transparent or translucent. Lustre, vitreous. Green, more or less dark, yellow or brown. Hardness, 6·5. Specific gravity, 3·32 to 3·45. Fusible, the bead being sometimes magnetic.

714. **Epidote**—*large crystal*—Haddam, Connecticut.
715. ,, *long fine crystals*—Sultzbachthal, Tyrol.
716. ,, *a large crystal*—Lower Sultzbachthal, Salzbourg, Tyrol.
717. ,, *acicular*—*in talcose rock*—Sultzbachthal, Tyrol.
718. ,, *implanted crystals*—Knappenwald, Sulzbach, Tyrol.
719. ,, *needle-shaped crystals with calcite*—Tyrol.
720. ,, *prismatic crystals*—Upper Sultzbachthal, Tyrol.
721. ,, Oisans, Dauphiné, France.
722. ,, ,, ,, ,,
723. ,, Elba.
724. ,, *with Garnet and Amphibole*—Arendal, Norway.
725. ,, Arendal, Norway.
726. ,, Katharinenburg, Ural Mountains, Russia.
727. ,, *globular variety in a silicious and compact rock*—Hungary.
728. ,, *with Garnet, Calcite, Quartz*—Auerbach, Hesse, Germany.
729. ,, *radiated*—Meissen, Saxony, Germany.
730. ,, *implanted crystals*.

PIEDMONTITE or *Manganesiferous Epidote*.

Being found in *Piedmont*.

Chemical composition—Silica, Alumina, Manganese, Lime, Iron, &c. Elongated crystals, imperfect or in fibrous masses. Red-brown or cherry-red. Dust, cherry-red. Hardness, 6·5. Specific gravity, 3·404. Easily fusible in a black glass.

731. **Piedmontite**—St. Marcel, Piedmont.

ILVAITE or LIEVRITE.

Ilva, the Latin name of the Island of Elba; *Lievrite*, after the name of its discoverer.

Chemical composition—Silica, Iron, Lime, and a little water.

Columnar or in bacillar masses. Black or brown by surface decomposition. Dust, black. Hardness, 5·5 to 6. Specific gravity, 3·9 to 4·1. Slightly magnetic. Easily fusible.

732. **Lievrite**—*with quartz*—Monte Fico, near Rio, Elba.
732 *bis*. „ Monte Fico, near Rio, Elba.
732 *ter*. „ „ „

d. Crystallized in the Orthorhombic System.

CORDIERITE OR IOLITE GROUP.

Cordierite, when pure, is a valuable gem. It is remarkable in consequence of its property of *dichroism*, being often deep blue along one of the axes, and brownish-yellow or yellowish-gray along the other.

CORDIERITE, DICHROITE, or IOLITE.

Dedicated to the French geologist Cordier. Also named Dichroite, in consequence of dichroism. The other name from ἰός, *violet*, and λίθος.

Chemical composition—Silica, Alumina, Magnesia, Iron, &c. Crystals of the orthorhombic system, crystalline masses or granular. Translucent. Lustre vitreous. Blue of various shades, green, yellowish, brown, gray. Dichroism very strong in some specimens: along the principal axis, blue, and perpendicularly to it, yellowish-gray. Hardness, 7 to 7·5. Special gravity, 2·59 to 2·66. Difficult to fuse on the edges.

The Ceylon Cordierite, called by jewellers "saphyre d'eau," is used as a gem. (See Gems.)

733. **Cordierite**—Finland.
733 *bis*. „ *with Chalcopyrites*—Orijerfoir, Finland, RUSSIA.
734. **Aspasiolite** (a variety of Cordierite)—*with Quartz*—Brevig, NORWAY.
735. **Praseolite** „ Brevig, NORWAY.
736. **Pyrargillite** „ *in Granite*—Helsingfors, Finland, RUSSIA.
737. **Chlorophyllite**—*altered Cordierite*—Haddam, Connecticut.

PINITE.

From *Pini*, a mine in Saxony.

An altered variety of Cordierite, preserving its crystalline shape.

738. **Pinite**—*in granite*—St. Pardoux, Auvergne, FRANCE.

d. Crystallized in the Hexagonal or in the Orthorhombic system.

MICA GROUP.

One of the varieties of Mica, **Muscovite**, is very useful when found in large transparent sheets as a substitute for window-glass, lamp-reflectors, &c. It is mostly used in the Russian Navy, being tough and not liable to fracture by the concussion of powerful guns.

THE MICAS.

Chemical composition—Silica, Alumina, Magnesia, Potash, Iron.

Always crystallized in thin plates, which may be split into extremely thin flexible layers. Transparent in thin layers. Brown or black. Lustre, glassy, pearly, or metallic. Streak, white. Specific gravity, 2·7 to 3·1. Hardness, 2 to 2·5. Very easily scratched with a knife. Infusible. Differs from Talc in not having a greasy feel, in being harder, and affording thinner layers perfectly transparent. Abundant in Granite and Schist; fine particles common in Sandstone. Applied to various uses when in large plates, otherwise of no value. Was formerly used for glass in windows.

The minerals known under the name of Micas are very variable in composition, and different formulæ are to be resorted to. They are silicates of peroxides and protoxides, in which the peroxides are those of Alumina and Iron, and the protoxides those of Magnesia, Potash, Soda, Lithia.

The Micas in which Magnesia predominate are called *Magnesia Micas* (Biotite, Phlogopite); those which are nearly deprived of Magnesia and are richer in Alumina and Potash are called *Potash Micas* (Muscovite, Lepidolite).

BIOTITE.

Dedicated to Biot, a French astronomer.

739. **Biotite**—*a large foil*—Monroe, New York, U.S.A.
740. „ Arendal, NORWAY.
741. „ *light greenish.*
742. „ *a shombe-shaped specimen*—Snarum, NORWAY.
743. **Mica**—Brevig, NORWAY.
744. „ *with Chalcopyrite, Titanic Iron, and Calcite*—Arendal, NORWAY.
745. „ Eifel, Prussia, GERMANY.
746. „ Bolsena, ITALY.
747. „ *with quartz*—Pfitsch, Tyrol, AUSTRIA.
748. „ (banded variety)—*in Wacke*—Teplitz, Bohemia, AUSTRIA.

PHLOGOPITE or *Rhombic Mica.*

Φλογωπός, *fire-like*, in allusion to the colour.

749. **Phlogopite**—*Rhombic*—Vrooman's Lake, New York, U.S.A.
750. ,, ,, Rossie, New York, U.S.A.
751. ,, *Rhombic (a lozenge)*—Snarum, NORWAY.
752. ,, Burgess, WEST CANADA.
753. **Hallite**—*light green*—Chester, Massachusetts.
Dedicated to the American geologist Hall.

MUSCOVITE or *Potash Mica.*

From *Moscow.*

754. **Muscovite**—*a large foil*—RUSSIA.
755. ,, *a thick specimen*—RUSSIA.
756. **Mica**—Hamburg, Mass., U.S.
757. ,, Finland, RUSSIA.
758. ,, *with Orthose*—Tamela, Finland, RUSSIA.
759. ,, *bronze variety*—Arendal, NORWAY.
760. ,, *with Feldspar*—Hirschberg, Silesia, GERMANY.
761. ,, Zinnwald, Bohemia, AUSTRIA.
762. ,, *with Dolomite*—Mount Vesuvius, ITALY.

LEPIDOLITE or *Lithia Mica.*

Λεπίς, *a scale ;* λίθοη. Contains the earth Lithia.

763. **Lepidolite** *or Violet Mica*—Roczena, Moravia, AUSTRIA.

MARGARITE or *Lime Mica.*

Μαργᾶρωδης, *nacreous, pearly.*

Chemical composition—Silica, Alumina, Lime, Alkalies, 3 to 5 per cent. of water. White, yellowish, or rose.

Pisani considers this mineral as a Lime Mica. Dana places it in his *Margarophyllite Section*, among the *Chlorites ;* but it contains no Magnesia, as most of the Chlorites, and has characters very close to some of the Micas.

764. **Margarite**—*in granular Chlorite*—Chester, Massachusetts.
765. **Gilbertite**—*a variety of Margarite*—Stonagwyn, Cornwall.
766. **Margarite**—Pfitsch, Tyrol, AUSTRIA.
767. **Nacrite** *and Galena on Gneiss*—Brand, near Freiberg; Saxony, GERMANY.

Series IV.—Hydrous Bisilicates.

(Magnesians or Aluminous.)

TALC GROUP.

Talc in rock is used as a refractory material. Its softness renders it valuable for many purposes, as tailor's chalk, powder for gloves, &c. Among the amorphous varieties occurring in this group, **Agalmatolite, Pagodite,** or *Figure-stone* of the Chinese, is worth mentioning as an ornamental stone.

TALC.

Talk, Arabic name.

Chemical composition—Silica, Magnesia, Water, Protoxide of Iron.

Usually in irregular layers. Nearly opaque. White or green. Pearly lustre. Greasy feel. Specific gravity, 2·7. Hardness, 1. Easily impressed by the nail; but impure varieties are much harder. Infusible. [Yields no water when heated in a glass tube. Is not attacked by boiling sulphuric acid.] Its greasy feel and pearly lustre readily distinguish it.

Mica, which is often confounded with it, is not so soft, has not a greasy feel, and can be split into very thin transparent layers. Steatite is a variety often applied to useful purposes.

768. **Green foliated Talc**—*a fine specimen*—Delaware, Maryland.
769. **Talc** *and Dolomite*—Mount Monzoni, Tyrol, Austria.
770. **Talc**—Vale of Fassa, Tyrol, Austria.
771. „ Valais, Switzerland.
772. „ Priessnitz, Saxony, Germany.
773. „ Zillerthal, Tyrol, Austria.
774. „ *with decomposed siderite*—Ouegoa, New Caledonia.

PYROPHYLLITE.

Chemical composition—Silica, Alumina, &c., and Water.

Foliated, radiated, lamellar; also granular or compact, closely resembling Talc in colour, feel, lustre, and structure. Hardness, 1-2. Specific gravity, 2·785. Exfoliate before the blow-pipe, swelling up to many times the original volume of the assay, hence the name from πῦρ, *fire,* and φύλλον, *leaf.* Melts with difficulty.

775. **Pyrophyllite**—*radiated*—Ottrez, near Spaa, Limburg.
776. „ Ottrez, near Spaa, Belgium.
777. „ *in Quartz*—Miask, Oural Mountains, Russia.

The compact variety of *Pyrophyllite* includes part of what has gone under the name of *Agalmatolite*, from China; it is used for slate-pencils, and is sometimes called *pencil-stone.* Other kinds of *Agalmatolite* are Talc or Steatite. The rest of the species *Agalmatolite* was included by Dana with *Pinite,* Pinite being a compact Hydrous Silicate of Alumina with Alkalies occurring often as pseudomorph after such minerals as Iolite, Nephelite, Scapolite, &c. Pyrophyllite and Pinite are Hydrous Silicates of Alumina with only little Magnesia, but Pinite contains a large proportion of Alkalies, whilst the Agalmatolite referred to Talc is, of course, a Silicate of Magnesia, with only a small percentage of Alumina.

AGALMATOLITE.

Αγαλμα, *an image.*

Figure-stone, Pagodite, Lardite, "Fun-Shih" of the Chinese.

Chemical composition—Silica, Alumina, &c., and Water.

Compact, amorphous. White, greenish, yellow, or fleshy red. Unctuous. Hardness, about 3. Specific gravity, 2·7 to 2·8. Melts with difficulty before the blowpipe.

778. **Agalmatolite**—Chinese works made of—CHINA.
(See Ornamental Stones.)
779. ,, CHINA.

SEPIOLITE GROUP.

Meerschaum, used for making pipes, the best variety of which is from the plains of Eskihi-sher, in Asia Minor, is the most valuable mineral of this group. It is very light, and, when dry, floats on water.

MAGNESITE, or *Sepiolite,* or *Meerschaum.*

Ecume de mer, French.

Containing Magnesia. Sepiolite from σηπια, *cuttle-fish,* the bone of which is light and porous.

The German and French names mean *sea-froth,* and allude to its lightness and colour. Compact, earthy. Adheres to the tongue; soft to touch. Hardness, 2·1. Specific gravity, 1·2 to 1·6. Used for the manufacture of pipes.

780. **Magnesite**—Negroponte, Asia Minor.
781. ,, Krubschnitz, Mahren.
782. ,, New Caledonia.

Series V.—Hydrous Unisilicates.

(Magnesian or Aluminous.)

SERPENTINE GROUP.

Serpentine forms sometimes extensive mountain ranges of an eruptive origin, or occurs in veins. It often is accompanied with metalliferous deposits—chiefly copper, nickel, &c.

The ornamental serpentines of Cape Lizard, Cornwall, are well appreciated. (See Ornamental Specimens.)

SERPENTINE, OPHIOLITE.

Serpentine, *ophiolite* (from οφις, a snake), *lapis colubrinus*, allude to the green *serpent-like* cloudings of the serpentine marble. (See in the ornamental collection a specimen representing two snakes.)

Chemical composition—Silica, Magnesia, Water, Protoxide of Iron.

Often forming rocks. Occasionally fibrous (*Chrysotil*). Opaque. Green. Lustre, resinous or dull. Streak, white. Hardness, 3 ; can be cut with a knife. Specific gravity, 2·5. Infusible, except in thin edges ; turns white in blowpipe flame. [Powder decomposed by sulphuric acid like Chlorite. Gives off water in glass tube.] Some varieties form handsome stone for slabs and ornamental work.

783. **Precious Serpentine**—Snarum, Norway.
784. **Williamsite** (a remarkable variety of Serpentine)—*polished*—Texas, Lancaster Co., Pennsylvania.
785. **Antigorite** (compact variety).
786. ,, (slaty variety)—Greenland.
787. **Gymnite**—Fleims, Switzerland.
788. ,, Porro, New Caledonia.
789. **Serpentine**—*veins in serpentine ranges*—Kanala, New Caledonia.
790. ,, ,, ,, ,, ,,
791. ,, Kanala, New Caledonia.
792. ,, (a red-banded variety)—Porro, New Caledonia.
793. ,, *with a chloritic mineral*—Gomen, ,,
794. ,, **Breccia**—Gomen, New Caledonia.
795. **Pseudomorphous Serpentine**—*after Monticellite*—Pessmeda, Fassathal, Tyrol.
796. **Picrolite**—*fibrous Serpentine*—Zoeblitz, Saxony.
797. ,, Gomen, New Caledonia.

798. **Picrosmine**—*fibrous Serpentine*—Zoeblitz, Saxony.
799. **Hydrotalcite**—*lamellar Serpentine*—Snarum, Norway.
800. **Chrysotil**—*fibrous Serpentine*—Krubschnitz, Mahren.

Several minerals containing Nickel, such as Nickel-Gymnite, Genthite, Noumeaite, Garnierite, Pimelite, &c., are much related in their composition to Serpentine. They have taken place as nickel minerals on a large scale only since few years when the nickel deposits of New Caledonia began to be practically worked (1875). They are therefore represented here as an appendix to Serpentines, but are also exhibited among the Nickel Minerals and Ores. The specimens Nos. 802 to 804, not only from the same vein, but exhibiting in the same specimen differences of shade from pure white to green, show how variable are these products in their composition. (See Prof. A. Liversidge, on Minerals from New Caledonia, Journal of the Royal Society of New South Wales, 1880.)

801. **Pimelite**—Kosemutz, Silesia.
802. **White Hydrosilicate of Magnesia**—*from the same vein as Nos.* 803, 804—Bel Air Mine, New Caledonia.
803. **Noumeaite**—*passing into White Hydrosilicate*—Bel Air Mine, New Caledonia.
804. ,, *passing into White Hydrosilicate*—Bel Air Mine, New Caledonia.
805. **Fibrous Serpentine**—*cut and polished in the shape of an axe*—New Caledonia.
806. ,, ,, *white—from a Nickel deposit*—Tchio, New Caledonia.
807. ,, ,, La Dumbea, New Caledonia.
808. **Fibrous Noumeaite**—*from a Nickel deposit*—Tchio, New Caledonia.
809. **Serpentine**—Tyrol, Austria.
810. ,, Rossie, New York, U.S.
811. ,, Zöblitz, Saxony, Germany.
812. ,, ,, ,, ,,
813. ,, or **Picrolite**—Zöblitz, Saxony, Germany.
814. **Picrosmine**—Waldheim, Saxony, Germany.
815. **Chrysotile**—*Fibrous Serpentine*—Reichenstein, Silesia, Germany.
816. **Bastite or Schiller-spar**—Baste, Hartz, Germany.
817. **Pimelite**—Frankenstein, Silesia, Germany.
818. **Metaxite**—Raschau, Saxony, ,,
819. **Pinguite**—Schneefels ,, ,,
820. **Picrolite**—Waldheim ,, ,,
821. **Serpentine**—*in decomposition*—Monte Catini, Tuscany, Italy.
822. **Gymnite or Deweylite**—Fleims, Austria.

PHOLERITE GROUP.

PHOLERITE.

Φολις, *a scale.*

Chemical composition—Hydrous Silicate of Alumina.

In small crystalline, nacreous, translucent scales. White or grayish. Occurs in small quantities in the layers of argilous schists, in carboniferous schists, mostly on the surfaces of friction.

Series VI.—Hydrous Subsilicates.

(Mostly Magnesian and Ferruginous.)

CHLORITE GROUP.

The minerals of this group are of no use in industry; they often occur in mineralized countries, in connection with metalliferous deposits. It is often the gangue of magnetite, and is said to accompany rock tin-ore in Cornwall, and is also mentioned as accompanying tin in this Colony.

CHLORITE *and Varieties.*

Chemical composition—Silica, Magnesia, Alumina, Protoxide of Iron, Water.

Often forming rocks. Opaque. Green of various shades. Lustre, pearly or dull. Hardness, 1 to 2. Very easily cut with a knife. Infusible. [In glass tube yields water. Boiling sulphuric acid extracts from it Magnesia, Alumina, and Protoxide of Iron, which can be proved by chemical tests.] Abundant; of no value.

823. **Jefferisite** (Vermiculite—a variety of Chlorite)—West Chester, Pennsylvania.
824. **Pennine**—Zermatt, Wallis, SWITZERLAND.
825. **Kammererite**—Kischtim, RUSSIA.
826. **Kotschubeite** or **Ripidolite**—Ufaleisk, Ural.
827. **Leuchtembergite**—Schitchimsk, Ural.
829. **Chlorite**—*compact granular*—Ouegoa, New Caledonia.

DELESSITE.

Named *Ferruginous Chlorite* by Delesse, French geologist; it was dedicated to him.

It occurs generally with a fibrous texture, coating or filling the cavities of Amygdaloids. It contains more Iron and much less Magnesia than Pennine and Ripidolite.

830. **Delessite**—Faroë.
831. ,, *in amygdaloid associated with copper*—Portage Lake, Lake Superior.

CELADONITE or *Green earth.*

A *celadon-green* mineral.

Chemical composition—Silica, Iron, Magnesia, Potash-water.

Earthy or in minute scales, forming nodules or filling cavities in eruptive rocks. Very soft.

831 *bis.* **Green earth**—Val di Fassa, Tyrol.

Celadonite contains up to 53 per cent. of Silica and 10 per cent of Potash, whilst Delessite contains about 30 per cent. of Silica, no Alkali, more Magnesia, and more water than the above mineral.

CORUNDOPHILITE.

Chemical composition—Silica, Alumina, Iron, Magnesia, Water. Near Chloritoid, but contains more Magnesia.

Monoclinic, Crystalline in thin flexible laminæ. Lustre somewhat pearly. Colour, green.

832 *bis.* **Corundophilite**—Chester, Massachusetts.

WALUEWITE, *variety of Xanthophyllite.*

Named after the Russian Minister P. A. von Walnew.

Chemical composition—Silica, Alumina, Magnesia, Lime, Water.

Orthorhombic system. In tabular crystal resembling Mica, but brittle. Colour, green.

833. **Waluewite**—Maximilianowski Mine, in the Nasianski Mountains, near Achmatowsk.

CRONSTEDTITE.

Named after the Swedish mineralogist and chemist, A. Fr. Cronstedt.

Chemical composition—Silica, Iron, with small proportion of Manganese and Magnesia and Water.

Hexagonal prisms. Lustre, brilliantly vitreous. Colour, coal-black to brownish-black. Streak, dark olive-green. Thin laminæ elastic. Accompanies limonite and calcite in veins containing silver ores at Przibram.

832. **Cronstedtite**—*with Calcite*—Przibram, Bohemia.

Series VII.—Anhydrous Bisilicates of Protoxides and Peroxides.

(Aluminous with Alkalies and Isomorphous.)

SPODUMENE GROUP.

Petalite and **Spodumene** contain the rare alkali *Lithia*. They are therefore valuable, as Carbonate of Lithia is used in medicine. The minerals containing Lithia give a red light before blow-pipe. Lithia is placed at the limit of the Alkalies group, as a transition to alkaline-earths.

PETALITE or *Lithium Felspar.*

Πέτᾶλον, *leaf*—in consequence of its structure.

Chemical composition—Silica, Alumina, Lithium, Soda.

Generally in cleavable masses, rarely in rhomboidal prisms. Translucent. Lustre vitreous, nacreous on one of the cleavages, greasy in the fracture. White or pinkish. Hardness, 6 to 6·5. Specific gravity, 2·42 to 2·45. The presence of lithia is readily ascertained before the blow-pipe by the red colour of the flame.

833 *bis.* **Castorite**—*crystallized Petalite*—Elba.

(This mineral is identical with Petalite as to composition, and is considered, after Descloiseaux, as the type of this mineral.)

834. **Petalite**—Uto or Utoë Island, SWEDEN
834 *bis.* ,, ,, ,,

TRIPHANE or SPODUMENE.

Τριψανης, *appearing triple*,—in consequence of its cleavages ; σποδος, *ashes*,—because the mineral becomes ash-coloured before the blow-pipe.

Chemical composition—Silica, Alumina, Lithia, Alkalies, &c.

Long flat crystals. Lustre vitreous, nacreous on the cleavage plans. Yellowish white or greenish, green, rarely faint-reddish. Hardness, 6 to 6·5. Specific gravity, 2·42 to 2·45. Same character as Petalite before blow-pipe.

835. **Triphane**—*with Mica*—Sterling, Massachusets.
835 *bis.* ,, ,, Bahia, Brazil.
(This is a remarkably transparent specimen of a light greenish-yellow colour.)
835 *ter.* **Triphane**—*with Mica*—Norwich, Connecticut.

POLLUCITE GROUP.

The only mineral composing this group is of importance in consequence only of its containing the very rare alkali *oxide of cæsium*. This metal is much related to Potassium, and comes in the same group.

POLLUCITE or PULLUX.

Being found in the Island of Elba, together with *Castorite* or *Castor* (a variety of Petalite). Cubes with faces of trapezohedron. Crystals very rare, generally in masses resembling Hyalite. It is the only mineral containing Cæsium oxide as a constituent.

836. **Pollucite**—*a white crystal*—Elba.

Series VIII.—Anhydrous Unisilicates of Protoxides and Peroxides.

(*Aluminous with Lime and Isomorphous.*)

a. Crystallized in the Tetragonal System.

SCAPOLITE GROUP.

This group includes minerals of no value for industrial purposes. Most of them occur in long square prisms in crystalline rocks. They contain Silica, Alumina, Lime, Soda, &c., and a little water.

SARCOLITE.

Σαρξ, *flesh*—in allusion to its colour.

Lustre vitreous. Flesh-red, rose-red, reddish-white. Transparent or subtranslucent. Very brittle.

837. **Sarcolite**—*vitreous, light pink*—Somma, Vesuvius.
838. ,, *with Humboldtolite* ,, ,,

MEIONITE.

Μειων, *less*—the pyramid being less acute than in Idocrase.

Lustre vitreous. Colourless or white. Transparent, translucent. Often cracked inside.

839. **Meionite**—Somma.

PARANTHINE or SCAPOLITE.

Παρανθειν, *to be faded*—alluding to its colour; σκαπος, *a staff*—alluding to its shape.

Lustre pearly vitreous. Exterior surface waxy. White, grayish white, pale grayish green, sea green, celandine green. Translucent.

840. **Scapolite**—*in large crystals*—Natural Bridge, New York.
841. ,, Bathurst, Ontario.

WERNERITE.

Dedicated to the German mineralogist Werner.

Lustre vitreous, pearly externally, somewhat resinous, white gray, bluish, greenish, reddish, generally pale. Transparent or subtranslucent. Brittle.

842. **Glaucolite** (a variety of Wernerite)—*violet*—Trans Baikal, Siberia.
843. **Wernerite**—*with Quartz*—Arendal, NORWAY.
844. „ *with Lime and Mica*—Laurvig, NORWAY.
845. „ Bolton, Massachusetts, U.S.

Many authors describe Wernerite, Scapolite, and Paranthine as one species. Dana separates them on the ground that in Wernerite the oxygen of the protoxides, the oxygen of the peroxides (Alumina), and the oxygen of the Silica are as 1 : 2 : 4, whilst in Paranthine they are as 1 : 3 : 4. But if a number of specimens of different localities are analyzed, there will be more complication found in these figures, owing to partial decomposition.

DIPYRE.

Δις, *twice ;* πυρ, *fire*—alluding to the two effects of heat, fusion, and phosphorescence.

In large or small crystals, of the same shape as Wernerite, sometimes columnar.

846. **Dipyre**—Mauléon, Pyrenees, FRANCE.

COUZERANITE.

An altered mineral related to Dipyre.

847. **Couzeranite**—*in Mica schist*—Pyrenées, FRANCE.

b. Crystallized in the Hexagonal System.

NEPHELITE GROUP.

There are no minerals of industrial application in that group.

NEPHELITE, *Elæolite.*

Νεψελη, *a cloud*—in allusion to its becoming cloudy when immersed in strong acid ; Ελαιον, *oil*—in allusion to its greasy lustre.

Hexagonal prism. The variety *elæolite* occurs generally massive. Translucent. Fracture resinous. Colourless, white or grayish. *Cancrinite,* which is closely related to Nephelite, is white, rose, yellow, or bluish gray.

848. **Nephelite**—Somma, Vesuvius, ITALY.
849. „ *and Anorthite*—Somma, Vesuvius, ITALY.
850. „ *with Lime*—Somma, ITALY.
851. „ Habichtswald, Hesse, GERMANY.
852. „ *with Melilite*—Capo di Bove, ITALY.
853. **Red Elæolite**—*with Bergmannite*—Brevig, NORWAY.
854. **Brown Elæolite**—Brevig, NORWAY.
855. **Elæolite**—*with Orthose and Ægirine, or Black Hornblende*—Fredriksvärn, NORWAY.
856. **Green Elæolite**—*with Orthose and Titanic Iron*—Fredriksvärn, NORWAY
857. **Beudantite** (a variety of Nephelite)—Dernbach, near Montabaur, Nassau.
858. **Davyne** (a variety of Nephelite).
859. **Gieseckite** (a pseudomorph after Nephelite)—Diana, New York.
860. **Cancrinite**—*in Syenite*—Brevig, NORWAY.
861. „ Litchfield, Maine.

(This variety contains a small percentage of Carbonate of Lime, probably the result of decomposition.)

c. Crystallized in the Monometric System.

AMPHIGENE OR LEUCITE GROUP.

Mineral of no value, but remarkably crystallized in dodecahedrons and other forms. Amphigene occurs in lava.

Sodalite, which crystallizes in the same system, would take place here, but it contains 6 to 7 per cent. of Chlorine, and will therefore be found with Silicio-chlorides.

AMPHIGENE or LEUCITE.

Αμφι, *double ;* γενεά, *origin ;* λευκός, *white.*

Trapezohedrons. Translucent. Lustre, vitreous. White, gray, yellowish. Hardness, 5·5 to 6. Specific gravity, 2·45 to 2·50. Infusible.

862. **Amphigene**—Somma, Vesuvius.
863. „ „ „
864. „ „ „
865. „ Latium, ITALY.
866. „ Albano, „
867. „ Kaiserstuhl, Baden, GERMANY.

d. Crystallized in the Monoclinic or Triclinic Systems.

FELSPAR GROUP.

The Felspars form a very important group, not only in consequence of the use of some of them in manufactures, but for their constituting many rocks of the earth's crust; chiefly crystalline, eruptive, and volcanic rocks.

Orthoclase, for instance, is an essential constituent in Granite, Gneiss, Micaschist, Porphyries, Phonolite, Trachyte, &c.

Albite exists in some Granites, Gneiss, Crystalline-schists, Diorites, &c.

Oligoclase in some Granites, Syenites, Porphyries, Serpentines, and Eruptive rocks.

Andesite in the rock which forms the Andes Ranges in South America; in the Blue Porphyry known as Porphyry of the Esterel (Var, France).

Labradorite in some Gabbros, Diabases, Hyperothenites, Basalts, &c.

Anorthite in some Granites, Gabbros, Serpentines, and in many Volcanic rocks.

The Felspars are distinguished by a specific gravity below 2·85, hardness 6 to 7, their fusibility, and two easy cleavages.

In their chemical constitution the protoxide bases are lime, soda, potash, and in one species baryta; the sesquioxide is only alumina; the oxygen ratio of the protoxides and sesquioxides is constant 1 : 3; while that of the silica and bases varies from 1 : 1 to 3 : 1, the amount of silica increasing with the increase of alkali, and becoming greatest when alkalies are the only protoxides.

The included species are as follows:—

Name of Felspar.	Chemical denomination.	Crystallization.	Oxygen of—				
			Proto.		Sesqui.		Silica.
Orthoclase	Potash Felspar	Monoclinic	1	:	3	:	12
Albite	Soda Felspar	Triclinic	1	:	3	:	12
Oligoclase............	Soda-lime Felspar	,, ...	1	:	3	:	9
Andesite	,, ,, ...	,, ...	1	:	3	:	8
Hyalophane	Baryta-potash Felspar..	Monoclinic	1	:	3	:	8
Labradorite	Lime-soda Felspar	Triclinic	1	:	3	:	6
Anorthite	Lime Felspar	,, ...	1	:	3	:	4

Orthoclase is the most common of all. As it contains Potash, it follows that the Granites and Porphyries must be, in the future, the chief sources of potash when the supplies from other sources, such as the plants, the Carnallite of Stassfurth, will be lessened.

Potash Felspar is used as mixture with Kaolin, and in the covering in the manufacture of Porcelain.

It is from the Felspars of the Granites, Pegmatites, and Porphyries that Kaolin and common clay are mostly derived, through decomposition. The waters carrying the carbonic acid of the atmosphere in the fissures of these rocks have dissolved away some of the components, chiefly potash, in the state of carbonate, and left kaolin or clay, which are more or less pure Silicates of Alumina.

Felspars also play a great part in ornamental stones. Fine specimens of Amazon Felspar, Sunstone, Moonstone, Perthite, and Labradorite are in the collection. Among gem-stones will be seen also some specimens of Moonstone cut in "Cabochon."

ORTHOCLASE.

Named from the angle of its cleavages; ὀρθός, *straight*, and κλάσις, *fracture*.

Chemical composition—Silica, Alumina, and Potash.

Crystallized or in irregular masses. System, oblique; often in twins. Opaque. Usually flesh red, or white, or of various dull tints. Glassy or pearly lustre. Fracture irregular, but in some directions it splits with an even glimmering cleavage face. Specific gravity, 2·3 to 2·8. Hardness, 6. Easily scratched by Quartz. Cannot be scratched with a knife without greatest pressure. In thin edges fusible with difficulty. Abundant in Granitic and Porphyritic rocks. By its decomposition it forms Porcelain Clay or Kaolin.

868. **Orthoclase**—Baveno, Piedmont.
869. ,, Lannitz, Silesia.
870. ,, *with Chlorite*—Baveno, Piedmont.
871. ,, (variety Adularia)—Madranerthal.
872. ,, ,, Mount Stella, St. Gothard.
873. ,, ,, Ritter Karr in Rauris, Salzburg.
874. ,, ,, Floitenthal, Tyrol.
875. ,, ,, Mount Stella, St. Gothard.
876. **Moonstone** ,, Zillerthal, Tyrol.
877. **Sanidine or Glassy Felspar** (a variety of Orthoclase)—Drackenfels, near Bonn.
878. ,, ,, ,,
879. **Amazon Stone** (a variety of Orthoclase)—*Colour due to Copper*—Siberia.

880. **Graphic Granite**—*the large crystals are Orthoclase*—Alabatska, Ural.
881. **Sunstone or Aventurine Felspar** (a variety of Adularia).
(For the same mounted, see Precious Stones.)
882. **Chesterlite** (a variety of Orthoclase)—Chester County, Pennsylvania.
883. **Orthoclase**—Pfitsch, Tyrol, Austria.
884. ,, *with Albite, Chlorite*—Pfitsch, Tyrol, Austria.
885. ,, St. Gothard, Switzerland.
886. ,, ,, ,,
887. ,, *with Tourmaline and Quartz*—Elba, Italy.
888. ,, Mount Somma, Italy.
889. ,, Fleims, Tyrol, Austria.
890. ,, Elbogen, Bohemia, Austria.
891. ,, Hirschberg, Silesia, Germany.
892. ,, Rosenbach, Silesia, Prussia, Germany.
893. ,, Hirschberg, Silesia, Germany.
894. ,, Dresden, Saxony, ,,
895. ,, *with Tourmaline, Mica, and Quartz*—Penig, Saxony, Germany.
896. ,, Bodemnais, Bavaria, Germany.
897. ,, Eifel, Germany.
898. ,, *in Trachyte*—Siebengebirge, on the Rhine, Germany.
899. ,, ,, ,, ,,
900. ,, Chanteloube, near Limoges, France.
901. ,, *with Albite and Quartz*—Ytterby, Sweden.
902. ,, Arendel, Norway.
903. ,, Chesterfield, Massachusetts, U.S.
904. **Weissigite** (a variety of Orthoclase)—*in Amygdalophyre*—Weissig, Saxony.

The white crystals in the rock, called Green Antique Porphyry, are Orthoclase, and the matrix an intimate mixture of Orthoclase and Amphibole.

905. **Green Antique Porphyry**—*a slab polished.*

OBSIDIAN or *Volcanic Glass*, and SPHŒRULITE.

It is melted Orthoclase Felspar, generally black, breaking with a conchoidal fracture and sharp edges, it quite resembles a black glass. Sphœrulite contains often soda and lime instead of potash. In every country of the world where it is found it has been used by the primitive populations as points of spears, knives, axes, &c.

906. **Obsidian**—*Lapis Obsidianus* (*Plin.*)—Iceland, Danish Province.
907. **Sphœrulite**—Meissen, Saxony, Germany.
908. „ Isle of Arran.
909. „ Tharand, Saxony, Germany.

Pumice Stone is volcanic glass in a porous state. (See Rocks.)

ALBITE or PERIKLINE.

Albus, *white.*

Chemical composition—Silica, Alumina, Soda, &c.

Crystals usually mascled. System, anorthic. Lamellar or granular. Hardness, 6 to 6·5. Specific gravity, 2·54 to 2·64.

910. **Albite**—Sohmirn.
911. **Peristerite** (a variety of Albite)—Perth, Canada.
912. **Pericline** „ Pfitsch.
913. **Albite**—*with Quartz and Chlorite*—Dauphiné, France.
914. „ *with Quartz*—Auerbach, Hesse, Germany.
915. „ Schellerhan, Saxony, Germany.
916. „ Finbo, Sweden.
917. „ *with Chlorite*—Pfitsch Valley, Tyrol, Austria.
918. „ *with Mica* „ „ „
919. **Perthite**—Perth, Upper Canada.

(This variety of Felspar is composed of alternate layers of Orthoclase and Albite.)

OLIGOCLASE or NATRON SPODUMEN or *Soda Spodumen.*

’Ολίγος, *little ;* κλάσις, *cleavage.* Natron or Nitrun is the Arabic name for *soda.*

Chemical composition—Silica, Alumina, Lime, and Soda.

Crystallizes in the same shape as Albite. One of the cleavage planes exhibits remarkable striations. Translucent. Lustre vitreous; somewhat nacreous on the striated cleavage. White, greenish, yellowish, grayish, &c. Hardness, 6. Specific gravity, 2·63 to 2·73. Fuses with difficulty.

920. **Saccharite** (a green variety of Oligoclase)—Glassendorf, near Frankenstein.
921. **Oligoclase**—Arendal, Norway.
922. „ *crystallized*—Arendal, Norway.
923. „ Arendal, Norway.
924. „ Brevig, „

LABRADORITE.

From Labrador, North America, where it is found.

Chemical composition—Silica, Alumina, Lime, and Soda.

Crystals very rare. Generally in lamellar masses. Cleavage planes striated. Remarkably nacreous on one of the cleavage planes. Resinous in the fracture. Gray, white, yellow, &c. Hardness, 6. Specific gravity, 2·68 to 2·76. Fusible. (See Ornamental Stones, Vases, &c., and a large specimen as trophy.)

925. **Labradorite**—*polished*—Coast of Labrador, NORTH AMERICA.
926. „ „ „ „
927. „ „ „ „
928. **Orthoclase**—*with Tourmaline and Quartz*—Elba, ITALY.
929. „ Fleims, Tyrol, AUSTRIA.
930. „ Hirschberg, Silesia, GERMANY.

APPENDIX TO LABRADORITE.

931. **Saussurite ?** (a compact variety of Labradorite ? not Saccharite)—Langenbielan, near Reishenbach, SILESIA.

The globules of the rock called Variolite, of the Durance River, France, are referred to Labradorite.

932. **Labradorite**—*in Variolite—a slab polished*—Durance River, FRANCE.

ANORTHITE or INDIANITE or CHRISTIANITE.

1st, 'Ανορθός, *not being at right angles* ; 2nd, being the gangue of corundum in the Carnatic, India ; 3rd, dedicated by Covelli and Monticelli to Prince *Christian* Frederick of Denmark, who explored Vesuvius with them.

Chemical composition—Silica, Alumina, Lime, &c.

Small crystals, the angles of which are nearly the same as Albite. Two oblique cleavages as in Oligoclase. Transparent or translucent. Lustre vitreous. Colourless, white. Hardness, 6. Specific gravity, 2·69 to 2·75. Fusible.

933. **Anorthite**—*with Talc*—Pesmeda, Tyrol.
934. „ *with Mica and Diopside*—Somma, Vesuvius.
935. „ *with Augite.*
936. **Lindsayite or Linseite** (a black variety of Anortite)—*with Copper Pyrites* (considered as altered Lepolite, a variety of Anorthite)—Orijerfvi, Finland.

Series IX.—Anhydrous Subsilicates of Alumina.

The minerals of the **Andalusite** Group are all Subsilicates of Alumina, and consequently of a sesquioxide. Staurolite, which composes the other group, contains more than 10 per cent. of protoxide of iron and a small percentage of magnesia, and is therefore a Subsilicate of proto and sesqui oxides.

ANDALUSITE GROUP.

The minerals of this group are of no use for industrial purposes. They present a remarkable similarity in their mode of occurrence, being chiefly found in mica-schists, talco-schists, and gneiss.

FIBROLITE or SILLIMANITE.

From *fibra*. Dedicated to Silliman.

Chemical composition—Silica, Alumina.

In long prismatic or fibrous crystals. Translucent. Lustre vitreous. Yellowish or brown gray. Hardness, 6 to 7. Specific gravity, 3·23. Infusible.

937. **Fibrolite**—Chester, Connecticut.
938. ,, Pfitsch, Tyrol, AUSTRIA.
939. **Bamlite** (a variety of Fibrolite)—*with Chlorite, Mica, and Quartz*—Brevig, NORWAY.

ANDALUSITE.

From *Andalusia*.

Chemical composition—Silica, Alumina.

In large four-sided prisms generally covered with mica, sometimes radiated, and granular. Hardness, 7·5. Specific gravity, 3·1 to 3·2. Infusible. Occurs generally in clay-schists and in mica-schists.

940. **Andalusite**—Lisenthal, Tyrol.
941. ,, *with Quartz and Mica*—Lisenz, Tyrol, AUSTRIA.
942. ,, *radiated*—Grube Solotuschnitz, Sarapulken.
943. ,, Morbihan, Bretagne, FRANCE.
944. **Macle or Chiastolite** (variety of Andalusite)—Bretagne, FRANCE.
944 *bis*. ,, Arriège, Pyrenées, FRANCE.
945. **Andalusite**—*with Felspar*—Braunsdorf, Saxony, GERMANY.
946. ,, Delaware County, Pennsylvania, U.S.

The name macle is from the Latin "macula," a spot, and it alludes to the use of the "mascle" in heraldry, in which the word signifies a voided lozenge, or a rhomb with open centre. Chiastolite is from Chi, the Greek name for the letter X. This mineral is a remarkable instance of the symmetrical arrangement of the crystals called macled crystals.

DISTHENE or CYANITE.

The name Disthene is from δίς, *twice or of two kinds*, and σθένος, *strong*—alluding to the unequal hardness and electric properties in two different directions. The name Cyanite is from κυανός, *blue*.

Chemical composition—Silica, Alumina.

In long prisms. Blue or white. Specific gravity, 3·58 to 3·68. Hardness, 5 on the lateral faces, 7 on the others. Infusible. Occurs generally in mica-schists and talco-schists.

947. **Disthene**—Katerinenburg, Ural.
948. ,, Yancey County, North Carolina.
949. ,, Providence, Rhode Island, U.S.
950. ,, Litchfield, Connecticut, U.S.
951. ,, Leiperville, Pennsylvania, U.S.
952. ,, *with Staurotide, in Margarodite*—St. Gothard, SWITZERLAND.
953. ,, *with Quartz*—Zillerthal, Tyrol, AUSTRIA.
954. ,, or **Rhœticite** (a white variety)—Tyrol, AUSTRIA.

STAUROLITE GROUP.

Staurolite or *Cross Stone* (pierre de croix) is only remarkable by its shape, being of no use in industry. It is mentioned in old mineralogical works as being worn as an amulet at baptisms. Its mode of occurrence is about the same as the minerals of the above group, being found in mica-schists, argillaceous-schists, and gneiss.

STAUROLITE.

Σταυρός, *a cross*—alluding to the cross-shaped macle.

Chemical composition—Silica, Alumina, Iron, &c.

Translucent or opaque in masses. Brown-red, brown. Hardness, 7 to 7·5 Specific gravity, 3·4 to 3·8. Infusible.

955. **Staurolite**—Bretagne, FRANCE.
956. ,, *in Mica-schist*—Goldenstein.
957. ,, St. Gothard, SWITZERLAND.
958. ,, Pyrenees, SPAIN.

Series X.—Hydrous Bisilicates of Various Bases.

(Mostly Lime, Alumina, Alkalies.)

PECTOLITE GROUP.

(Or Pyroxenoid Group, being Monoclinic and Isomorphous with the Amphibole Group.)

The minerals composing this group are of no value for industrial purposes. They bear some resemblance with the Zeolites, being hydrous, and occurring, at least most of them, in trap and similar eruptive rocks, though some of them occur in other kinds of rocks.

PECTOLITE.

Πέκτος, *combed ;* λίθος, *a stone.*

Isomorphous with Wollastonite. Acicular radiated crystal. Translucent. Lustre nacreous or silky. White.

959. **Pectolite**—Bergen Hill, New Jersey.

OKENITE or DYSCLASITE.

Δῦς, *hard ;* κλάω, *to break*—in consequence of its great toughness. Dedicated to Oken, a German naturalist.

In fibrous or compact masses. Translucent. White.

960. **Okenite**—Greenland, Danish Province.

LAUMONTITE—*Zeolithe efflorescente* (French).

Dedicated to the French mineralogist Gillet de Laumont.

Crystallized or lamellar. Translucent. Lustre vitreous, nacreous on the cleavages. White, yellowish, gray, or reddish. Often efflorescent by loss of water.

961. **Laumontite**—Plauen, near Dresden, Germany.
962. „ Kilpatrick, Scotland.

LEONHARDITE.

Near Laumontite, and probably that species.

963. **Leonhardite**—Schemnitz, Hungary.

Series XI.—Hydrous Unisilicates of Various Bases.

(Mostly Lime, Alumina, Alkalies.)

PREHNITE GROUP.

(Approximately Isomorphous with Chrysolite.)

The minerals of this Group, as well as the following in the same Series, are of no value for industrial purposes. They are closely related to Zeolites, and most of them occur in eruptive or trappean rocks. For instance, **Apophyllite** occurs in amygdaloids and related rocks, **Prehnite** in the same rocks, and occasionally in others, **Gismondine** in some kinds of lava. **Carpholite**, however, occurs in granite in connection with tin.

PREHNITE.

Dedicated to the Dutch miner Prehn.

Modified rhomboidal prisms, often barrel-shaped. Translucent. Lustre vitreous, nacreous on the base. Greenish white, green. Hardness, 6 to 7. Specific gravity, 2·80 to 2·95.

964. **Prehnite**—Oisans, Dauphiné, FRANCE.
965. ,, *associated with Copper in Amygdaloid*—Houghton, Lake Superior.
966. ,, Pfitsch, Tyrol, AUSTRIA.
967. ,, ,, ,, ,,
968. ,, Oberstein, Palatinate, GERMANY.
969. ,, Kilpatrick, near Glasgow, SCOTLAND.
970. ,, Dumbarton, SCOTLAND.

APOPHYLLITE GROUP, &c.

APOPHYLLITE or ICHTHYOPHTHALME.

Απόφυλλεζω, *to strip the leaves off*—in consequence of the action of the blowpipe.

The ordinary shape is that of a square prism with an octahedron placed on the angles. Transparent or translucent. Lustre vitreous, nacreous on the base. Colourless, white, rose, greenish, &c.

971. **Apophyllite**—*large radiated crystals*—Poonah, INDIA.
972. „ Andreasberg, Hartz.
973. „ *in Basalt*—Nalso, Faroe Islands.
974. „ *with Delessite*—Faroe Islands.
975. **Tesselite** (a variety of Apophyllite)—Bergen Hill, New Jersey.
976. **Albine** „ Aussig, Bohemia.
977. **Apophyllite**—*with Mesotype*—Aussig, Bohemia, AUSTRIA.
978. „ *with Analcime*—Fassa, Tyrol, AUSTRIA.

GISMONDITE or ABRAZITE.

Dedicated to the Italian mineralogist Gismondi.

Octahedrons. Transparent or translucent. Lustre vitreous. White.

979. **Gismondite**—Monte Somma, Vesuvius.

CARPHOLITE.

Κάρφος, *straw*—occurring in radiated tufts and groups of acicular crystals.

Chemical composition—Silica, Alumina, Manganese, Iron, Water, &c.

Pure straw-yellow to wax-yellow.

980. **Carpholite**—*on Quartz with Tin*—Schlaggenwald, Bohemia.

MILARITE.

From the name of the locality, Milar.

Chemical composition—Silica, Alumina, Lime, Soda, and a little Water.

Hexagonal prisms resembling certain crystals of Apatite. Transparent or translucent. Lustre vitreous. Colourless or greenish. Hardness, 5·5 to 6. Specific gravity, 2·59. Fusible.

981. **Milarite**—Val Guif, Tavetsch, SWITZERLAND.

The two following series form the **Zeolites**. It is a group of minerals generally beautifully crystallized. As above stated, they occur in geodes of volcanic rocks. If they should be of any industrial use, it would be for the alkalies they contain. They are all very easily fusible.

Series XII.—Hydrous Bisilicates of Protoxides and Sesquioxides.

(Alumina and Alkalies.)

MESOTYPE GROUP, &c.

MESOTYPE or NATROLITE.

Μέσος, *middle ;* τύπος, *type*—because, according to Haüy, it was intermediate in shape, between Stilbite and Analcite. Natron, *soda ;* λίθος, *a stone.*

Generally bacillar, fibrous, radiated. Colourless, white, reddish, yellow, &c.

982. **Mesotype**—*with Datolite and Apophyllite*—Bergen Hill, New Jersey.
983. ,, ,, Bergen Hill, New Jersey.
984. ,, *in Geode*—Faroe.
985. ,, ,, ,,
986. ,, *yellow, radiated*—Hohentwiel, Wurtemberg.
987. ,, *on Phonolite*—Hohentwiel, Baden, GERMANY.
988. ,, Aussig, Bohemia, AUSTRIA.
989. ,, ,, ,, ,,
990. ,, Fassa, Tyrol, ,,
991. ,, **and Amphibole**—Brevig, NORWAY.
992. ,, *with Calcite*—Aussig, Bohemia.
993. **Galactite** (a variety of Mesotype)—*in long silky needles*—Kilpatrick, Dumbarton, SCOTLAND.
994. **Crocalite?** (a red variety of Mesotype)—*with Calcite*—Fassa, Tyrol, AUSTRIA.

SCOLECITE or *Needle Stone.*

Σχολιαζω, *to twist ;* or σχολεζ, *a worm*—in consequence of the change it undergoes before the blowpipe.

Crystals always mascled, generally in radiated needles or fibrous. Transparent or translucent. Lustre vitreous. White or colourless.

995. **Scolecite**—*in long radiated needles*—Kandallah, INDIA.
996. **Poonahlite** (a variety)—*in long radiated needles*—Poonha, Indostan.

COMPTONITE or THOMSONITE.

Dedicated to Lord Compton, born in 1785, in Scotland. Dedicated to the mineralogist Thomson.

In modified rhomboidal crystals or in columnar masses. White.

997. **Mesole** (a variety of Comptonite)—*in Geode*—Faroe.
998. **Comptonite**—Toeplitz, Bohemia.

LEVYNE.

Dedicated to the mineralogist Levy.

Rhombohedrons. Crystals mascled. Colourless or white.

Series XIII.—Hydrous Unisilicates of Protoxides and Sesquioxides.

(Aluminia and Alkalies.)

ANALCITE, CHABAZITE GROUPS, &c.

ANALCITE or CUBOITE.

Ἀναλκος, *weak*—because it gives only a small quantity of electricity.

Trapezohedrons, or cubes combined with the trapezohedron. Colourless, white, reddish, &c.

999. **Analcite**—Fassathal, Tyrol.
1000. „ „ „
1001. „ *with Apophyllite*—Frombach, Tyrol.
1002. „ „
1003. „ Cipit, Tyrol, AUSTRIA.
1004. „ *in Phonolite*—Aussig, Bohemia, AUSTRIA.
1005. „ *in Trachyte*—Kaiserstuhl, Baden, GERMANY.
1006. „ *in Cyclophyre*—Island of Cyclops, GREEK ARCHIPELAGO.
1007. „ (variety Cubicite or Cuboite)—*in Dolerite*—Iceland, DANISH PROVINCE.

FAUJASITE.

Dedicated to the French geologist Faujas de Saint-Fond.

Small regular octahedrons. Yellowish or brown.

1008. **Faujasite ?**—Kaiserstuhl, Baden, GERMANY.

CHABAZITE or PHACOLITE.

Χαβαζιος, *name of a stone spoken of in Orpheus;* φαχος, *a bean*—this variety occurring in lenticular crystals.

Rhombohedrons; often mascled. Colourless. White, yellow, rose, &c.

1009. **Chabazite**—Faroe.
1010. „ „
1011. „ „
1012. „ Dalsnypen, Faroe.

1013. **Chabazite**—Oberstein, Palatinate.
1014. ,, ,, ,,
1015. ,, *in Geode*—Aussig, Bohemia.
1016. ,, Lobositz, Bohemia, Austria.
1017. ,, Aussig, ,, ,,
1018. ,, Teplitz, ,, ,,
1019. **Acadialite** (a light-red variety of Chabazite)—Five Island, Nova Scotia.
1020. **Chabazite**—Kilpatrick, Scotland.
1021. ,,

PHILLIPSITE or CHRISTIANITE.

"Harmotome de Marbourg," Lime Harmotome.

Dedicated to the mineralogist Phillips. The other name dedicated by Descloiseaux to Christian VIII of Denmark.

The crystals, ordinarily mascled, resemble a quadrangular prism with a pyramid placed on the angles over it. Sometimes they are mascled in the shape of a cross. Translucent. Lustre vitreous. White, gray, yellowish, &c.

1022. **Phillipsite**—*mascle cross-shaped*—Lowenbourg, Siberia.

HARMOTOME.

Kreuzstein (German), *Baryt-Harmotome.*

'Αρμός, *joint;* τέμνω, *to cut*—in consequence of the re-entering angles of the mascle. The German term means *Cross Stone.*

White, yellowish, &c.

1023. **Harmotome**—Scotland.
1024. ,, Andreasberg, Hartz, Germany.
1025. ,, ,, ,, ,,
1026. ,, *with Calcite*—Oberstein, Palatinate, Germany.

HYPOSTILBITE or PUFLERITE.

'Υπό, *below*—as it contains less Silica than *Stilbite.*

In small concretions, compactly fine fibrous within; also in large radiate fibrous or columnar masses. Transparent to translucent. Lustre vitreous. White; sometimes greenish white.

1027. **Puflerite** (globular)—*in cavities in Melaphyre*—Puflerloch, Tyrol.

STILBITE or DESMINE.

Στίλβω, *to shine;* δέσμη, *a bundle.*

Acicular crystals grouped in bundles. Translucent. Lustre vitreous, nacreous on one face. White, yellowish, red, &c.

1028. **Desmine** (a variety of Stilbite)—Tiegarhoon, Iceland.

1029. **Stilbite**—Nova Scotia, North America.
1030. „ Dumbarton, Scotland.
1031. „ *with Calcite*—Kilpatrick, Scotland.
1032. „ Andreasberg, Hartz, Germany.
1033. „ „ „ „
1034. „

HEULANDITE or *Foliated Zeolite.*

Dedicated to Heuland.

Crystallized in modified rhomboidal prisms or in laminar masses. Lustre, vitreous; nacreous on one face. White, red, &c.

1035. **Heulandite** (a large specimen)—Bernfiord, Iceland.
1036. „ Bernfiord, Iceland.
1037. „ „ „
1038. „ (red)—Fassathal, Tyrol.

According to Kenngott, the red colour of the Fassa crystals is due to the mixture of microscopic grains of another mineral.

1039. **Heulandite**—Faroe Islands.
1040. „ *with Chabasite*—Kaiserstuhl, Baden, Germany.
1041. „ (red variety)—Kilpatrick, Scotland.

Series XIV.—Hydrous Unisilicates and Subsilicates of Alumina.

(With more or less of other bases—all Amorphous.)

The most interesting minerals of this series are the properly called *clays*, possessing certain qualities, namely, plasticity and refractoriness to a greater or lesser degree, which make them fit for industrial purposes. Pure **Kaolin** is the type of the clays.

However, such hard earthy products as **Allophane, Halloysite,** may be termed by analogy hard clays, having generally a composition similar to some of the soft clays. These do not seem to have been yet required for manufacturing purposes. They are not able to make a paste with water, they are not plastic; their mode of formation is, in some cases, similar to that of soft clays, being derived from the decomposition of felspathic rocks. They often are found in mineral deposits. Such is the case for the two species abovementioned.

Pimelite and similar compounds which may be represented here, though already placed among magnesian hydrosilicates, is most probably a product of decomposition, and when it contains magnesia ought to proceed from the decomposition of serpentines.

Fuller's Earth, a kind of clay used for freeing wool from the fatty matters, does not make easily a paste with water; its application is therefore limited to the above purpose, for which it is of great value.

The principal varieties of true clays are, according to their uses—

Porcelain Clay or Kaolin;
Pottery Clay or Pipeclay;
Fireclay.

Here is appended the composition of good samples of these clays for the sake of comparison:—

Name of Clay.	Silica.	Alumina.	Protoxide of Iron.	Alkalies.	Other Oxides.	Water.
Kaolin	46	39	......	......	1	14 %
Pipeclay	49	32	2½	3·3	0·65	12 ,,
Fireclay	56	26	2½	2½	½	12 ,,
Stourbridge Fireclay	65	22	2	0·2	½	9½ ,,
Ordinary Stourbridge Clay	52	30½	4	trace	½	13 ,,
Fuller's Earth	53	10	9	......	2	24 ,,

The presence of alkalies is objectionable, as it gives fusibility, as well as the presence of numerous oxides, even if alkalies were not present. Iron not only is objectionable as giving fusibility, but as a colouring matter. The presence of a too large proportion of water and of carbonic acid or organic matters enables the material used to contract under the action of fire. The same effect will be produced by partial fusibility of the material. Contraction is also due to the mechanical arrangement of the particles; for instance, of two clays of the same composition, containing both a certain percentage of free silica, the finest one will undergo more contraction than the coarser one, as the particles will be prevented from a close contact necessary for their ready combination and fusion.

KAOLIN or CLAY.

Chemical composition—Silica, Alumina, and Water.

Subdivided into:—1. Kaolin or Porcelain Clay, nearly pure, from the decomposition of pegmatite or granite felspar; 2. Plastic or Pottery Clay, not so pure as Kaolin; 3. Fuller's Earth, used in consequence of its faculty of absorbing the fatty matters; 4. Bolus, containing a great percentage of oxide of iron. (See Collection of Rocks.)

1042. **Kaolin**—St. Yrieix, Haute-Vienne, FRANCE.
1043. ,, ,, ,, ,,
1044. ,, ,, ,, ,,
1045. ,, Aue, Saxony, GERMANY.
1046. **Bolus**—*Mountain-Soap*, *Rock-Soap*—Bilin, Bohemia.
1047. ,, ,, ,, Kaisertuhl, Baden.
1048. **Teratolite**—“*Eisensteinmark*” (Germ.)—Zwickau, Saxony.

WOLKONSKOITE.

Dedicated to Prince Wolkonskoi.

Chemical composition—Silica, Oxide of Chromium, Alumina, &c., and Water.

Amorphous. Conchoidal fracture. Emerald green. Infusible.

1049. **Selwynite**—VICTORIA. (Dedicated to A. R. C. Selwyn, formerly Government Geologist of Victoria.)

ALLOPHANE.

’Αλλοφανης, *resembling something else*—having been mistaken for copper ore.

Chemical composition—Silica, Alumina, and Water.

Amorphous. Conchoidal fracture. Translucent. Lustre, waxy or vitreous. Blue, green, brown, yellow, white. Very brittle. Hardness, 3. Specific gravity, 1·85 to 2·02. Before the blowpipe, swells without melting.

1050. **Blue Allophane**—*colour due to copper*—Bridestowe, Devonshire.

HALLOYSITE.

From the name of the Belgian geologist d’Omalius d’Halloy.

Chemical composition—Silica, Alumina, and Water.

Amorphous. Fracture conchoidal or earthy. Lustre waxy or earthy. White, greenish, yellow, pink. Often adheres to the tongue, and falls to pieces in water. Hardness, 1·2. Can be polished and scratched with the nail. Specific gravity, 1·92 to 2·12. Infusible.

1051. **Lithomarge** (a variety of Halloysite)—Johann-Georgenstadt, SAXONY.
1052. **Halloysite** (yellow variety)—Angleure, near Liége, BELGIUM.
1053. ,, (white variety) ,, ,, ,,

THURINGITE—PALAGONITE.

From Thuringia ; from Palagonia, Sicily.

Chemical composition—Silica, Alumina, Iron, Magnesia, Alkalies, Water.

Amorphous. In grains and fragments aggregated into a tufa-like rock, or as a constituent of tufa or volcanic conglomerate. It is formed from the decomposition of the Pyroxene of the volcanic rock which becomes oxidized and hydrated.

1054. **Palagonite.**

STILPNOMELANE and CHALCODITE.

Is a product of alteration.

Chemical composition—Silica, Iron, Alumina, &c., and Water.

(See Iron Compounds.)

SUBDIVISION III.—SILICATES.

(With other Acids.)

SILICATES WITH BORACIC ACID OR SILICIO-BORATES.

Tourmaline is the most important of these minerals. The red, blue, and green varieties are used as gems, under the following names:—

Rubellite is the red variety.
Indicolite : Pale blue or bluish black.
Brazilian Sapphire (in jewellery) : Berlin blue and transparent.
Brazilian Emerald, Chrysolite (or Peridot) of Brazil : Green and transparent.
Peridot of Ceylon : Honey-yellow.
Achroite : Colourless tourmaline, from Elba.
Aphrizite : Black tourmaline, from Krageroe, Norway.

Axinite is also occasionally used as a gem.

Tourmaline, besides its value as a gemstone, possesses some physical properties of great interest. It was long known under the name of *electric schorl*, in consequence of its electrical properties. It is very valuable in the hands of the mineralogist, in consequence of its optical properties, to ascertain if a mineral is birefringent or not. Black Tourmaline is often present in stanniferous granites.

DANBURITE.

From Danbury, Connecticut.

Chemical composition—Silicic Acid, Boracic Acid, Lime, &c.

Crystals irregular. Translucent. Pale yellow.

1055. **Danburite**—*in Dolomite*—Russel, New York.
1056. " " "

DATOLITE.

Δᾶτέομαί, *to partake ;* and λίθος, *a stone*—in consequence of the granular structure of some varieties.

Chemical composition—Silicic Acid, Boracic Acid, Lime, and Water.

Crystals generally short, exhibiting numerous modifications. Transparent or translucent. Lustre vitreous, somewhat greasy in the fracture. White, greenish, &c.

1057. **Datolite**—*with Calcite*—Bergen Tunnel, Bergen Hill, New Jersey.
1058. ,, ,, ,, ,,
1059. ,, ,, ,, ,,
1060. ,, *on Diorite* ,, ,, ,,
1061. ,, Arendal, NORWAY.

AXINITE.

'Αζίνη, *an axe*—in consequence of the shape of the crystals.

Chemical composition—Silicic Acid, Boracic Acid, Lime, Alumina, Iron, &c.

Transparent or translucent. Lustre vitreous. Violet of several shades, grayish, greenish. Hardness, 6·5 to 7. Specific gravity, 3·29 to 3·30.

1062. **Axinite**—Medets, SWITZERLAND.
1063. ,, Oisans, Dauphiné, FRANCE.
1064. ,, Thurn, Saxony, GERMANY.

TOURMALINE.

Chemical composition—Silica, Alumina, Magnesia, Boracic Acid, Fluorine, Oxides of Iron, Lime, and Alkalies.

In prisms, with three, six, nine, or more sides, furrowed lengthwise, terminating in low pyramids. Commonly black and opaque ; rarely transparent, and of a rich red, yellow, or green colour. Glassy lustre. Fracture uneven. Specific gravity, 3·1. Hardness, 7 to 8. Cannot be scratched with a knife. Not scratched by quartz. Infusible. When the smooth side of a prism is rubbed on cloth it becomes electric, and can attract a small piece of paper ; if the prism is as wide as a pipe-stem, when one side is heated for a moment in the blow-pipe flame the opposite side becomes electric, and can attract paper until the heat spreads uniformly through the crystal. On this account Tourmaline is said to be *pyro-electric.* Occurs in granite and slate. Of no value ; except the fine coloured transparent varieties, which are used as gems and for optical purposes.

1065. **Rubellite and Green Tourmaline**—Chesterfield, Massachusetts.
1066. „ **or Rose Tourmaline** (a large specimen)—Elba.
1067. „ *with Albite, Quartz, Talc, &c.*—Elba.
1068. „ „ *Smoky Quartz, &c.*—Elba.
1068 *bis.* **Tourmaline**—Elba.

(This specimen is an illustration of the peculiarity sometimes presented by Tourmaline of being of two different colours at the two ends of the crystal.)

1069. **Rubellite**—*with Quartz*—Roezena, Moravia, Austria.
1070. **Tourmaline**—*in large Black Crystals*—Snarum, Norway.
1071. „ Snarum, Norway.
1072. „ „ „
1073. „ „ „
1074. „ „ „
1075. „ *in trans. Green Crystals*—Campo Longo, St. Gothard.
1076. „
1077. „ *in Mica-schist*—Munroe, Connecticut.
1078. „ *with Quartz & Felspar*—Litchfield, Massachusetts, U.S.
1079. „ *with Mica*—Wallis, Switzerland.
1080. „ *with Quartz*—Helsingfors, Finland, Russia.
1081. „ Hartz, Germany.
1082. „ *in flattened Crystals, with Mica*—Hamburg, New Jersey, U.S.
1083. „ *with Chloride Slate*—Pfitsch, Tyrol, Austria.
1084. „ Clermont, Auvergne, France.
1085. „ Black Ranges, Goulburn River, N.S.W.

SILICATES WITH HYDROFLUORIC ACID OR SILICIO-FLUORIDES.

Topaz is the only mineral of value in this group. It is much used as a precious stone. It is ordinarily yellow of different shades; but white topaz of no value are often found.

The largest crystals are found in Nertschinsk, beyond Lake Baikal, in the Adun-Tschilon Mountains; they are usually light blue or yellowish. One crystal from near the river Uralga, in the Imperial Cabinet at St. Petersburg, is $11\frac{3}{8}$ inches long and $6\frac{1}{2}$ inches broad, weighing $22\frac{1}{2}$ lbs., and magnificent also in its perfect transparency and wine-yellow colour. A blue crystallized specimen of Topaz from New South Wales, and being about 5 inches broad, is in the Technological Museum in Melbourne.

Leucophane and **Melinophane** are remarkable as containing Glucina, besides Fluor. They are placed among the minerals of Glucina.

TOPAZ.

From Τοπαζιος, an island in the Red Sea, as stated by Pliny.

Chemical composition—Silica, Alumina, Fluorine.

In prisms, sometimes furrowed lengthwise, variously terminated, breaking easily across with smooth brilliant cleavage. Transparent or semi-transparent. White, yellow, greenish, bluish, pink. Glassy lustre. Specific gravity, 3·5. Hardness, 8. Scratches quartz. Is scratched by Sapphire. Infusible, but often blistered and altered in colour by heat. When smooth surfaces are rubbed on cloth they become strongly electric, and can attract small pieces of paper, but rough surfaces do not show this. The brilliant cleavage of Topaz distinguishes it from Tourmaline and other minerals. Occurs in granite. Used in jewellery. (The Topaz becomes electric by friction much easier than other gems, such as the Balas Ruby, which it may resemble. The white Topaz resembles the Diamond; but, unlike Diamond, it can be scratched by Sapphire.)

1086. **White Topaz**—Schneckenstein, Saxony, GERMANY.
1087. **Yellow Topaz**—Brazil, SOUTH AMERICA.
1088. **Blue Topaz**—Adun-Tschilon, Siberia, RUSSIA.
1089. **Topaz**—*large prismatic crystal*—Mursinsk, Ural.
1090. „ „ Villa Rica, BRAZIL.
1091. „ „ Minas Novas, „
1092 **Pycnite or Cylindrical Topaz**—*with Quartz and Mica*—Altenberg, Saxony, GERMANY.

CHONDRODITE or HUMITE.

Χόνδρος, *a grain*—alluding to its granular structure. After Hume, an English geologist.

Chemical composition—Silicic Acid, Magnesia, Fluorine, &c.

Crystals much modified. Translucent. Lustre vitreous, somewhat resinous. White, yellow, brown. Hardness, 6·5. Specific gravity, 3·1 to 3·2.

1093. **Chondrodite**—*with Meionite* (var. of Vernerite)—Somma, Vesuvius.
1094. „ „ „ „
1095. „ *with Icespar and Idocrase*—Mt. Somma, Vesuvius, ITALY.
1096. „ *Spinellane and Lime*—Warwick, New York, U.S.
1097. „ *with Lime*—Orange County, New York, U.S.

SILICATES WITH HYDROCHLORIC ACID OR SILICIO-CHLORIDES.

The minerals of this group are not numerous, nor of any importance for industrial purposes. **Sodalite** is a volcanic product.

Silicio-Chlorides.

SODALITE.

Containing Soda.

Chemical composition—Silica, Alumina, Soda, Chlorine.

Crystals. Rhomboidal dodecahedrons, often elongated. Granular or laminar masses. Lustre, vitreous. Colourless, white, green, blue, &c. Fusible. Hardness, 6. Specific gravity, 2·27 to 2·29.

1098. **Sodalite**—*with Chondrodite and Olivine*—Somma, VESUVIUS.
1099. ,, *in Dodecahedrons.*

Hydrous Silicio-Chlorides.

PYROSMALITE.

Πῦρ, *fire*, and οδμη, *odour*—in consequence of its odour when heated.

A Silicio-Chloride of Iron and Manganese. Hexagonal prisms or tables. Lustre, nacreous on the base. Yellowish-brown or greenish-brown.

1100. **Pyrosmalite**—Nordmarken, Wormland, SWEDEN.

(In an iron mine, where it is associated with calc-spar, pyroxene, apophyllite, and magnetic iron.)

SILICATES WITH SULPHURIC ACID OR SILICIO-SULPHATES.

Among these minerals **Lazulite** or **Ultramarine** is the only mineral of use. It is a beautiful ornamental stone. **Hauyne** is a volcanic product.

LAZULITE, ULTRAMARINE or *Lapis Lazuli.*

From the Arabic word "azul," *hæven*—in consequence of its blue colour.

Chemical composition—Silicic Acid, Sulphuric Acid, Alumina, Soda, Lime, Iron, &c.

Isometric. In dodecahedrons. Commonly massive or compact. Hardness, 5 to 5·5. Specific gravity, 2·38 to 2·45. Colour, rich azure blue, violet blue, red, green; also colourless. It often contains pyrites.

When this substance was the only one used for manufacturing *Ultramarine Blue* it was worth about £40 per lb. The inventor of the artificial ultramarine made a large fortune, and now the price is reduced about a thousand times.

1101. **Lazulite**—*a polished slab*—Cordillera d'Ovalle, CHILI.
1102. „ *in Granite* „ „

HAÜYNE.

Dedicated to the mineralogist Haüy.

Chemical composition—Silicic Acid, Sulphuric Acid, Alumina, Lime, Soda, and Potash.

In small dodecahedrons or amorphous. Blue, green, grayish. Fusible with difficulty. Occurs in lavas.

1103. **Hauyne**—Niedermendig, RHENISH PRUSSIA.
1104. „ *in old lava*—Andernach, near Coblentz.
1105. „ Somma, Vesuvius, ITALY.

SUBDIVISION IV.—SILICATES.

(Containing Glucina or Zirconia.)

SILICATES CONTAINING GLUCINA.

Though not in accordance with Dana's System of Mineralogy, these minerals will be described together in consequence of the rarity of Glucina, and of the minerals which contain it.

According to Dana, Emerald, Phenacite, and Euclase should have been separated, the first being a bisilicate, the second a monosilicate, and the third a subsilicate.

Emerald and **Phenacite** are hexagonal, **Euclase** is monoclinic. **Emerald** and **Aquamarine** are only valuable as gems, especially **Emerald.** **Phenacite** and **Euclase** are only valuable, in consequence of their rarity, for mineralogical cabinets. **Euclase,** which is sometimes of a good green or blue colour, is not used as a gem in consequence of its brittleness.

EMERALD or BERYL or AQUAMARINE.

Σμαραγδος, name given by Theophrastes to several green stones ; *βήρυλλος*, Greek.

Chemical composition—Silica, Alumina, Glucina.

In six-sided prisms. Usually green. Transparent or opaque. Glassy lustre. Fracture uneven. Specific gravity, 2·7. Hardness, 7 to 8. Scratches quartz. Infusible, or nearly so, but becomes clouded by heating. Occurs in Granite and Schist. Valuable for jewellery when transparent and rich grass-green (emerald), or sea-green (aquamarine). (See Gems.)

The common varieties are generally called Beryl, and attain to large sizes. One from Grafton (New Hampshire) is 22 and 32 inches in its diameters, and 4 feet 3 inches in length; it weighs 2,900 lbs. Another one from the same locality is 24 inches in diameter, 45 inches in length, and weighs nearly 2½ tons.

1106. **Beryl**—*a very large crystal*—Acworth, New Hampshire.
1107. „ *a fine long crystal*—Nertschinsk, SIBERIA.
1108. „ *common* „ „
1109. **Blue Beryl**—Odontchelon, SIBERIA.
1110. **Beryl** „ „
1111. „ *in Pegmatite*—Royalston, Massachusetts, U.S.
1112. „ Limoges, FRANCE.
1113. „ „ „
1114. **Emerald**—*a large crystal*—Ural.
1115. „ Katerinenburg.
1116. „ *a fine crystal in rock*—Sta Fe de Bogota, New Granada.
1117. „ Muse, New Granada.
1118. „ *a fine crystal.*
1119. „ Sta Fe de Bogota, New Granada.
1120. „ *in Mica-slate*—Takawaja, Ural Mountains, RUSSIA.
1121. „ Odontchelon, Siberia, RUSSIA.

PHENACITE.

Φέναξ, *deceiver*—in consequence of its resemblance to quartz.

Colourless, yellow, brownish. Hardness, 7·5 to 8. Specific gravity, 2·96 to 3.

1122. **Phenacite**—Takawaja, Ural, SIBERIA.
1123. „ „ „

HELVITE or TETRAHEDRAL GARNET.

Ἠέλιος, *the sun*—in consequence of its colour.

Isometric. Yellow. Contains Glucina.

Helvite—*in Gneiss, accompanied by Blende, Calcite, Quartz, Fluorine, &c.*—Schwarzenberg, Saxony, GERMANY.

DANALITE.

Dedicated to Dana.

Also contains Glucina and, besides, Zinc. Crystallized in the isometric system. Gray or rose.

LEUCOPHANITE.

Λευκοφανης, *white.*

Chemical composition—Silicic Acid, Glucina, Lime, Soda, Fluorine, &c.

Crystals rare, generally in crystalline masses. Translucent. Lustre, vitreous. White or yellowish. Fusible.

Leucophanite—*in long black needle-shaped crystals in Syenite*—NORWAY.

MELINOPHANE or MELIPHANITE.

Μελι, *honey ;* φαινω, *to appear.*

Chemical composition—Silicic Acid, Glucina, Lime, Soda, Fluorine, &c.

In crystalline lamellar masses. Translucent. Lustre vitreous. Yellow.

SILICATES CONTAINING ZIRCONIA.

The minerals of this group are much related in their mode of occurrence with those of the next Division, say, occurring all in Zircon-syenite. **Zircon,** however, is more scattered, and, as well as other gemstones, resisting alteration, is found in many auriferous sands.

It is also found in volcanic products. In Zircon-syenite it exists in large prismatic crystals.

Zircon is sometimes transparent enough to be used as a gem-stone.

ZIRCON (HYACINTH) or JARGON.

Etymology, from the Cingalese.

Chemical composition—Silica, Zirconia.

In square prisms, terminated by pyramids, and in octahedrons. Often found in pebbles and grains. Transparent or opaque. Wine or brownish red, gray, yellow, white. Glassy lustre. Fracture, usually irregular, but in one direction it can be split so as to exhibit a smooth even cleavage face having an adamantine lustre like the Diamond. Specific gravity, 4·0 to 5·0. Hardness, 7·5. Scratches quartz; is scratched by Topaz. Infusible; the red varieties, when heated before the blow-pipe, emit a bluish phosphorescent light, and become permanently colourless. Occurs in Syenite, Granite, Basalt. Clear crystals used in jewellery, in jewelling watches, and imitation of Diamond. It may be distinguished from Diamond by its inferior hardness, and in not becoming so readily electric by friction.

1124. **Zircon**—Slatoust, Ural.
1125 „ Ober-Cassel.
1126. „ Tyrol.
1127. „ *with Idocrase and Anorthite*—Somma, Vesuvius.
1128. „ *with Sanadine* „ „
1129. **Malacone** (a variety of Zircon, probably altered)—Hitteroe, Norway.
1130. **Zircon**—*with Elaeolite, Orthose, Fluorspar, &c.*—Brevig, Norway.
1131. „ *in Syenite* „ „

(See Gems and Precious Stones.)

CATAPLEIITE.

Καταπλεος, *full*—because it is found with other rare minerals.

Chemical composition—Silica, Zirconia, Soda, &c., and Water.

Hexagonal prism. Generally in tubular masses. Not much translucent. Lustre, semi-vitreous. Brown, yellow. Hardness, 6. Specific gravity, 2·8. Fusible with difficulty.

1132. **Catapleiite**—*in Zircon-syenite*—Brevig, Norway.

Division D.—ZIRCON-SYENITE MINERALS.

SILICATES, PHOSPHATES, CARBONATES.

(And other compounds containing such rare metals as Yttrium, Cerium, Columbium, &c.)

According to the newest system of chemical classification these bodies come in three different classes.

The Cerium or fourth class of Roscoe includes Yttrium, Erbium, Lanthanum, and Didymium. These four metals form such oxides as cannot be reduced by Carbon or Hydrogen. They are closely related to the earthy metals.

The Tin or seventh class of Roscoe includes Titanium, Zirconium, and Thorium. Titanium being sufficiently important as oxide, in consequence of its association with iron ores, has been left among the metallic minerals. Zirconium being extensively disseminated in the state of silicate has been left by itself among the silicates. Zircons are abundant in the rock called Zircon-syenite, where most of the minerals considered are found, and they both occur in the composition of some of them. Tin exists in Columbite. The metals of the Tin class are all tetravalents, and decompose water at a high temperature, in the presence of alkalies. They are all closely connected with Silicon.

The Antimony or ninth class of Roscoe includes Bismuth, Vanadium, Niobium (or Columbium), and Tantalum. They are all trivalents, and form the junction between the metals and metalloids, closely resembling Arsenic, Phosphorus, and Nitrogen in their properties. Antimony and Bismuth come among the metallic minerals, being important in the industrial arts. Vanadium is rare, and occurs as Vanadate; whilst Niobium and Tantalum, forming Niobates and Tantalates, are placed among the rare minerals which follow.

It will be observed that there is great similarity in the mode of occurrence of these minerals, being mostly found in the so-called Zircon-syenite.

Among the specimens belonging to this group of minerals in the collection some of them, besides their rarity, are remarkable as being represented by fine crystals. The following are worth mentioning :—One crystal of **Gadolinite** from Hitteroe; **Pyrochlore**, from Flemengebirge, Ural; **Columbite**, from Standish, Maine, U.S.A.; **Monazite**, from Miask, Ural; and **Parisite**, from Muzo, New Granada.

Others are remarkable as containing a large percentage of very rare metals such as **Cerite**, containing more than 60 per cent. of oxide of Cerium or

Ceria; **Gadolinite,** containing from 48 to 50 per cent. of Yttria; **Lanthanite,** about 55 per cent. of oxide of Lanthanum; **Thorite** and **Orangite,** containing nearly 60 and more than 60 per cent. of oxide of Thorium.

SUBDIVISION I.—SILICATES OF YTTRIA, CERIA, &C.

ANHYDROUS SILICATES OF YTTRIA, CERIA, &c.

ORTHITE and ALLANITE.

Ὀρθός, *straight*—occurring frequently in long prisms.

Chemical composition—Silica, Alumina, Iron, Manganese, Cerium, Lanthanum, Didymium, Yttrium, &c.

Occurs also amorphous. Allanite is in tubular crystals. Brittle. Black or brown, dust greenish or yellowish.

Orthite—*a large specimen*—Fahlun, SWEDEN.
(To be seen in a special case).

1133. „ *with Felspar*—Plauen, near Dresden; Saxony, GERMANY.
1134. „ *in Granite*—Stockholm, SWEDEN.
1135. „ Westpoint, New York, U.S.
1135 *bis.* **Allanite**—*a large specimen*—Snarum, NORWAY.
(See in special case).

GADOLINITE.

Dedicated to the chemist Gadolin.

Chemical composition—Silica, Yttrium, Cerium, Lanthanum, &c.

Generally massive, or in rough and irregular crystals. Black. **Fracture,** conchoidal.

1136. **Gadolinite**—*in Syenite*—Hitteroe, NORWAY.
1137. „ *remarkably crystallized*—Hitteroe, NORWAY.
1138. „ *in Syenite*—Itterby, SWEDEN.
1139. „ *crystal, in Pegmatite*—Finbo, SWEDEN.
1140. „ „ „ „

TRITOMITE.

Τριτομος, *breaking in triangles.*

Chemical composition—Silica, Cerium, Lanthanum, &c.

Crystallizes in irregular tetrahedrons. Dark brown.

1141. **Tritomite**—*in Felspar*—Brevig, NORWAY.

ANHYDROUS SILICATES OF THORIUM, &c.

THORITE and ORANGITE.

Both containing Thorium ; Orangite named from its colour.

Chemical composition.—Silica, Thorium ; Orangite being the richer ; Thorite is brown.

1142. **Thorite**—*with Actinote, in Syenite*—Brevig, Norway.
1143. „ „ „
1144. **Orangite**—*in Syenite* „ „

HYDROUS SILICATES OF CERIA.

CERITE or CERERITE.

Containing Cerium.

Chemical composition—Silica, Cerium, Lanthanum, &c. Very rich in Cerium.

Amorphous, finely granular. Reddish gray.

1145. **Cerite**—Bastnaes, Sweden.
1146. „ Riddarhytta, „

HYDROUS SILICATES OF THORIUM, &c., WITH CHLORINE.

EUCOLITE and EUDYALITE.

Ευδιαλυτος, *easy to dissolve.*

Chemical composition—Silica, Chlorine, Zirconium, Titanium, Lime, Sodium, &c.

Both are crystallized, and exhibit one cleavage. Eucolite is garnet red. Eudyalite peach-tree-flower pink.

1147. **Eucolite**—*in Syenite*—Brevig, Norway.
1148. **Eudyalite**—*Octahedrons, in Syenite*—Kangerdluarsuk, Greenland.
1149. „ „ „ „ „

HYDROUS SILICIO-TITANATES OF CERIUM, &c.

YTTROTITANITE or KEILHAUITE.

Dedicated to Professor Keilhau.

Chemical composition—Silica, Titanic Acid, Iron, Alumina, Calcium, Yttrium, Cerium, &c.

Isomorphous with Sphene. Crystals irregular. Two cleavages. Brown, red.

1150. **Yttrotitanite**—*in Pegmatite*—Arendal, Norway.

MOSANDRITE.

Dedicated to Mosander.

Chemical composition—Silica, Titanic Acid, Iron, Cerium, Lanthanum, Didymium, Calcium, &c.

Crystallized in long flattened prisms. Brown. Dust yellow.

1151. **Mosandrite**—*with Black Mica and Ægirine, in Zircon Syenite*—Island of Lammanskäret, near Brevig, NORWAY.

ANHYDROUS TITANATES OF YTTRIA, &c.

POLYCRASE and POLYMIGNITE.

Πολυς, *many*, χρασις, *mixture ;* and Πολυς, *many*, μιγνομι, *to mix.*

Chemical composition—A Titanate of Yttria and many other bodies.

Long thin prisms. Black.

1152. **Polycrase**—*in Oligoclase*—Hitteroe, NORWAY.
1153. **Polymignite**—*in Syenite*—Hunnerbacke, NORWAY.

PHOSPHATES OF CERIA, WITH LANTHANUM, THORIUM, &c.

Μοναζω, *to be alone*—alluding to its rare occurrence.

Flat crystals. Lustre, resinous. Colour, red or hyacinth red. Resembles Zircon.

1154. **Monazite**—Miask, Ural.

CARBONATE OF CERIA, &c.

PARISITE.

Dedicated to Mr. J. J. Paris, proprietor of an Emerald Mine, New Granada.

Chemical composition—Carbonic Acid, Ceria, Didymium, Lanthanum, &c., and Fluorine.

Hexagonal. In elongated double six-sided pyramids. Lustre, vitreous ; nacreous on the basal cleavage. Brown, yellow. Infusible. Very rare.

1155. **Parisite**—*occurs associated with Emerald*—Muzo, New Granada.

LANTHANITE.

Hydrous Carbonate of Lanthanum. Small crystals. Yellow, pink, or white.

1155 *bis.* **Lanthanite**—Saucon Valley, Pennsylvania.

ANHYDROUS NIOBATES OR COLUMBATES, &c.

PYROCHLORE.

Πυρ, *fire ; χλωρος, green*—because it gives with salt of phosphorus, in the oxidizing flame, a bead which becomes grass-green on cooling, and due to the presence of Uranium.

Chemical composition—Niobic or Columbic Acid, Cerium, Calcium, Yttrium, Lanthanum, Uranium, &c.

Regular octahedrons or cleavable masses. Brown.

1156. **Pyrochlore**—*in Felspar*—Flemengebirge, Ural.
1156 *bis.* ,, *in Syenite, with Labradorite*—Frederiksvärn, NORWAY.

COLUMBITE or NIOBITE.

Containing Columbium or Niobium.

Chemical composition—Niobic or Columbic Acid, Iron, Manganese, Tin.

Crystallizes in small prisms. Lustre, metalloid. Black. Dust, brown red.

1157. **Columbite**—*in Pegmatite*—Standish, Maine, U.S.
,, *in Granite*—Chanteloube, Haute-Vienne, FRANCE.
,, *in Orthoclase*—Middleton, Connecticut, U.S.A.

SAMARSKITE.

Dedicated to Samarski.

Chemical composition—Niobic Acid, Uranium, Iron, Yttrium, &c.

Conchoidal fracture. Black. Dust, red brown.

1158. **Samarskite**—Mitchell County, North Carolina.

HYDROUS NIOBATES, &c.

EUXENITE.

Ευξενος, *a stranger*—in consequence of its rare occurrence.

Chemical composition—Niobic and Titanic Acids, Yttrium, Uranium, Cerium, &c.

Lustre, metalloid. Black. Dust, brown red.

1158 *bis.* **Euxenite**—Tromoë, near Arendal, NORWAY.

FERGUSONITE.

After Robert Ferguson.

Chemical composition—Niobic Acid, Yttrium, Cerium, Zirconium, &c.

In black scales. Dust, light brown.

1159. **Fergusonite**—*with veins of Quartz*—Ytterby, SWEDEN.

HYDROUS SILICIO-NIOBATE (OR COLUMBATE) OF LIME, ZIRCONIUM, &c.

WOHLERITE.

Dedicated to the chemist Wohler.

Chemical composition—Silica, Columbic Acid, Zirconium, Calcium, Sodium, &c.

Crystals tubular, irregular. Amber yellow.

1160. **Wohlerite**—*in Zircon-Syenite*—Lamo Island, near Brevig, NORWAY.

PART II.

METALLIC MINERALS.

Division A.—ZINC CLASS.

(*Roscoe's Class V, partly ; Magnesium to be found among Alkalies and Earths ; Glucinium among Silicates.*)

ZINC AND CADMIUM MINERALS.

THIS class includes Glucinium, but the minerals of Glucinium could not be included here. The metals forming the Fifth Class of Professor Roscoe's classification are all (Glucinium, Magnesium, Zinc, Cadmium) volatile at high temperature, and burn when heated in the air. They decompose water at high temperature or in presence of an acid.

The principal minerals of Glucina are Emerald or Beryl, Cymophane or Chrysoberyl, Phenacite, Euclase, Gadolinite, Leucophane, &c. These are all silicates, most of them of great value as gem-stones. (See Gems and Silicates.)

Vauquelin, who discovered the earth Glucina in the Emerald or Beryl of Limoges, gave it that name, *Glucina*, in consequence of the sweet taste possessed by its salts.

The most important ores are : Smithsonite, or *Carbonate of Zinc ;* Calamine, or *Silicate of Zinc.* They are of a white, grayish-white, or greenish-white colour, commonly possess a slight waxy lustre and smooth look (often stalactitic or mammillary), yet sometimes earthy, and a hardness such that the surface is scratched with a knife-blade with some little difficulty. They are often both associated in their deposits with other zinc ores of less importance. They differ in their action with hydrochloric acid ; when the surface is drusy the silicate shows projections of minute rectangular prisms. Zincite, or *Red Zinc Ore,* is also important ; it is a bright red, and very distinctly foliated. Blende, or *Sulphide of Zinc,* is a common ore, having a yellow to black colour and resinous lustre, and distinctly cleavable ; the black varieties are sometimes a little metallic in lustre, but the powder is nearly or quite white. The other ores of Zinc are *Sulphates, Phospates, Arsenates, &c.*

Zinc as a metal of extensive use is of relatively recent date. The production and consumption of this metal have grown very rapidly. It is used as sheet zinc for roofing and other purposes, and as alloy in brass and German silver. It is extensively used for *galvanizing* iron.

Zinc easily dissolves in dilute acids, with evolution of hydrogen, and is thus used as the oxidizable portion of the galvanic battery.

Cadmium is little used, the Iodide being sometimes used in photography, and the Sulphide as a yellow pigment. It is a rare metal, occurring in small quantities in most zinc ores. The yellow mineral Greenockite is a Sulphide of Cadmium.

OXIDE OF ZINC.

ZINCITE, ANCRAMITE, or *Red Oxide of Zinc.*

Hexagonal. Foliated grains, coarse particles and masses; also granular. Streak, orange yellow. Colour, deep red, also orange yellow. Translucent, sub-translucent. Brittle.

1161. **Zincite**—*with Franklinite, Calcite, and Fowlerite*—Sterling, New Jersey, U.S.

BLENDE, or SPHALERITE, or *Sulphuret of Zinc.*

Blende, in German, means *blind* or *deceiving*—because, while often resembling galena, it yields no lead; Sphalerite is from Σφαλερος, *treacherous.*

Chemical composition—Zinc, 66·70; Sulphur, 33·30 per cent.

In dodecahedrons, octahedrons, and allied forms. Also massive. Yellow, red, brown, black. Lustre, adamantine, resinous, or waxy. Transparent or opaque. Breaks with brilliant cleavage faces in some directions. Specific gravity, 4·0 to 4·1. Hardness, 3·5 to 4·0. Easily scratched with a knife. Infusible. Emits a strong light when heated, but no odour of sulphur is perceptible. It is easily distinguished by its waxy lustre, softness, infusibility, and perfect cleavage. It dissolves at once in nitric acid. Occurs with lead and copper ores. It is the "*Blackjack*" of miners. An ore of Zinc, but more difficult to smelt than the Carbonate and Silicate.

1162. **Blende**—*large specimen*—Cumberland.
1163. ,, ,, ,,
1164. ,, ,, ,,
1165. ,, ,, ,,
1166. ,, ,, ,,
1167. ,, Alston, Cumberland, ENGLAND.

1168. **Blende**—*with Pearlspar*—Alston, Cumberland, ENGLAND.
1169. „ Matlock, Derbyshire, ENGLAND.
1170. „ *with Calcite*—Old Matlock, Derbyshire, ENGLAND.
1171. „ *with Pyrites and Quartz*—Cornwall, „
1172. „ *in large crystals*—Leadhill, SCOTLAND.
1173. „ *with remarkable irisations*—Schemnitz, Hungary.
1174. „ Kapnick, Hungary, AUSTRIA.
1175. „ *with Realgar and Quartz*—Kapnick, Hungary, AUSTRIA.
1176. „ *massive*—Bernsberg, near Cologne.
1177. „ *crystalline, reddish*—Schwartzenberg, Saxony.
1178. „ *with Pyrites and Siderose*—Freiberg, Saxony, GERMANY.
1179. „ Clausthal, Hartz, GERMANY.
1180. „ *with Dolomite*—Schneeberg, Saxony, GERMANY.
1181. „ Bonn, Prussia, GERMANY.
1182. „ Schwartzenberg, Saxony, GERMANY.
1183. „ *in Dolomite, fine crystals*—Binnenthal, Wallis, SWITZERLAND.
1184. „ *in large transparent crystals*—Santander, SPAIN.
1185. „ (yellow variety)—Laffrey, Isère, FRANCE.
1186. „ Frabach, Moselle, FRANCE.
1187. „ *with Galena*—Puebla, Mexico, NORTH AMERICA.
1188. „ Bolivia, SOUTH AMERICA.
1189. „ *water-worn (Blackjack)*—New England, N.S.W.
1190. „ „ „ „ „
1191. „ Welcome Reef, N.S.W.
1192. „ „ „
1193. „ „ „

ANHYDROUS CARBONATE OF ZINC.

SMITHSONITE (also commonly called *Calamine*).

Dedicated to the English chemist Smithson.

Contains over 50 per cent. of Zinc. Rhombahedrons, generally in small crystals. Lustre, vitreous or nacreous. White, yellow, greenish, &c. Hardness, 5. Specific gravity, 4·34 to 4·45. Infusible. It is one of the best ores of zinc.

1194. **Smithsonite**—*yellow*—Altenberg, Aix-la-Chapelle.
1195. „ *colourless*—Moresnet, near Aix-la-Chapelle.
1196. „ Tarnowitz, Silesia, GERMANY.
1197. „ Wiesloch, Baden, „
1198. „ „ „ „
1199. „ Alston, Cumberland, ENGLAND.

HYDROUS CARBONATE OF ZINC.

HYDROZINCITE, *Zinconise*, or *Calamine* (*Smithson*).

Massive, earthy or compact. As incrustations, the crusts sometimes concentric and agate-like. Reniform, Pisolitic, Stalactitic. Lustre, dull. White, grayish, or yellowish.

HYDROUS CARBONATE OF ZINC, COPPER, &c.

BURATITE or AURICHALCITE.

Dedicated to Professor Burat.

Aurichalcum was the name given by the Ancients to the best of the brass ores, cupriferous calamine. Acicular crystals. Lustre, nacreous. Verdigris or heaven-blue.

1200. **Buratite**—*blue*—Santander, SPAIN.
1201. „ „ Guipuscoa, „

ANHYDROUS SILICATE OF ZINC.

WILLEMITE, or *Silicious Oxide of Zinc.*

Dedicated to the King of Netherlands, Wilhelm the First.

The ordinary shape is that of an hexagonal prism, capped by an obtuse rhombohedron (Moresnet) and several rhombohedrons (Franklin, New Jersey). Transparent or translucent. Lustre, vitreous, somewhat resinous. Colourless, yellow, brown. Hardness, 5·5. Specific gravity, 3·89 to 4·18. Fusible with difficulty.

1202. **Willemite**—*red, in a light-green rock*—Franklin, New Jersey.
1203. „ *with Fibrous Calamine and Quartz Crystals*—The "Old Mountain," near Aix-la-Chapelle, GERMANY.

HYDROUS SILICATE OF ZINC.

CALAMINE, *Galmei*, *Carbonate of Zinc*, or *Zinc-spar.*

Contains 52 per cent. of Zinc. Usually in crusts or masses. White, green, or brown. Opaque. Pearly or glassy. Specific gravity, 4·1 to 4·5. Hardness, 5. Can be scratched with a knife, using a little pressure. Infusible. On charcoal becomes yellow whilst hot, white on cooling. Dissolves rapidly with effervescence when heated with nitric acid. Occurs with Galena and Blende. A valuable Zinc Ore.

1204. **Calamine**—*mammillated small shining crystals*—Altenberg, near Aix.
1205. " *crystals in rock fissure* "
1206. " *blue, contains copper* "
1207. " *yellow* "
1208. " *in shining crystals on ferruginous rock* "
1209. " *small crystals on ferruginous rock* "
1210. " *green coating on ferruginous rock* "
1211. " *crystallized*—near Aix-la-Chapelle, Prussia, GERMANY.
1212. " Alston, Cumberland, ENGLAND.
1213. " *cupriferous*—Drygill, near Keswick, Cumberland, ENGLAND.
1214. " Santander, SPAIN.
1215. " " "
1216. " Lehigh County, Pennsylvania, U.S.
1217. " *with Smithsonite*—Santander, SPAIN.

Division B.—IRON CLASS.

(Roscoe's Class VI.)

IRON, MANGANESE, COBALT, AND NICKEL.

The Iron Class, including Manganese, Cobalt, and Nickel, forms the Sixth Class of the Chemical Classification of Professor Roscoe. These metals are not volatile at the temperature of our furnaces. They decompose water at a high temperature or in presence of an acid.

Iron is far the most important. When it occurs as native iron it is generally found to be meteoric iron. In that state it contains from 1 to 20 per cent. of nickel with other bodies. It occurs in some basalts in very minute grains. The largest masses of meteoric iron attain to the weights of 6 and 13 tons—the first one being found at Bahia, Brazil, and the other in the district of Chaco-Gualamba. The ordinary ores of iron are found in sedimentary as well as in lode deposits.

The amorphous carbonate of iron known as *black-band*, a variety of Sphærosiderite or Chalybite, which occurs in the coal-measures, is one of the best iron-ores of England. Another source of sedimentary iron-ore, which is very extensive on the Continent, is the oolitic iron-ore of the Inferior Oolite (Upper Lias or Toarcien of some geologists). This ore is very phosphorous, as it contains organic remains, chiefly shells, and is not, consequently, fit for the manufacture of steel ; nor is it rich, containing only 25 to 30 per cent. of iron ; but its abundance gave rise to very prosperous smelting works. For iron of very good quality another kind of sedimentary ore has been used of late, but is becoming rare ; it is *alluvial* or *pisolitic iron.* By transport and exposure this iron-ore (Limonite) has got rid of its accompanying impurities, and is very pure.

For the manufacture of steel in France, for instance, the local ores are generally mixed with a certain proportion of first-class imported ores from Algeria, Spain, and Italy. Among the best ores used as mixture for pig-iron to be worked for steel are some decomposed carbonates containing Manganese, which, through decomposition, have lost their impurities, have become very soft and partly powdery, and which are then a mixture of hydrous peroxide of Iron and Manganese. Manganese ores are much sought for now, as they are used in the blast-furnace for mixing with ores which have not the advantage of the above-mentioned decomposed carbonates. But still, to be of use, they must be nearly free from sulphur and phosphoric acid.

SUBDIVISION I.—MANGANESE.

Common, as Pyrolusite and Psilomelane, both black or grayish-black ores, and having little lustre, and a blackish streak or powder, in which last particular they are distinct from the iron-ore called Limonite, with which they are often associated, and also from Hematite, or specular iron. Wad is an earthy bog Manganese, sometimes abundant and valuable. Manganite is abundant in certain mines, but is of little value in the arts, because of its containing so little oxygen (one-third less than Pyrolusite), to which fact Beudant alludes in his name for the species, Acerdese; it differs from Pyrolusite in its reddish-brown powder. The other Manganese ores are *Sulphides, Arsenides, Oxides, Silicates, Phosphates, Carbonates, &c.* Various oxides of Manganese are used as Manganese ores. Their character is as follows :—

Crystallized or massive. Black. Lustre, unmetallic; dull or shining. Powder or streak brown or black. Specific gravity, 4 to 5. Hardness, generally below 3. Very easily scratched with a knife. Infusible. With Borax bead gives the characteristic indications of Manganese. Widely distributed. Used in chemical manufactures.

DIOXIDE OF MANGANESE.

PYROLUSITE.

Πυρ, *fire*; λουειν, *to wash*—being employed for discharging the brown and green tints of glass. For the same reason it is whimsically entitled by the French *savon des verriers* (glassmakers' soap).

The richest in oxygen for manufacturing Chlorine. Dust, black.

1218. **Pyrolusite**—Hartz.
1219. „ Ilefeld, Hartz, GERMANY.
1220. „ Pseudomorphous variety—Ilefeld, Hartz, GERMANY.
1221. „ Siegen, Prussia, GERMANY.
1222. „ Ilemenau, Saxe-Weimar, GERMANY.
1223. „ Platten, Bohemia.
1224. **Polianite** (a variety of Pyrolusite)—Platten, Bohemia.
1225. **Pyrolusite**—Platten, Bohemia, AUSTRIA.
1226. „ Gomen, NEW CALEDONIA.

HYDROUS SESQUIOXIDE OF MANGANESE.

MANGANITE or ACERDESE.

Αχερδης, *of no profit*—as not being so profitable as Pyrolusite for manufacturing Chlorine.

Dust, dark-brown red.

1227. **Manganite**—Ilefeld, Hartz.
1228. ,, ,, ,,
1229. ,, ,, ,,
1230. ,, ,, ,,
1231. ,, ,, ,, GERMANY.
1232. ,, ,, ,, ,,
1233. ,, **and Pyrolusite**—*with Barytine*—Ilefeld, Hartz, GERMANY.

MANGANATE OF PROTOXIDE OF MANGANESE.

HAUSMANNITE.

Dedicated to the mineralogist Hausmann.

Square prism, octahedron. Brown black. Dust, brown red.

1233 *bis*. **Hausmannite and Braunite**—Ilmenau, Thuringia, GERMANY.
1234. ,, Ilmenau, Thuringia, GERMANY.
1235. ,, Ochrenstock, ,, ,,
1236. ,, Ilmenau, ,, ,,

ANHYDROUS SESQUIOXIDES OF MANGANESE.

BRAUNITE.

Dedicated to the Councillor Braun, of Gotha.

Small octahedrons. Brown black. Dust, brown.

1237. **Braunite**—Ilmenau, Thuringia, GERMANY.

MANGANATE OF BARYTA, &c.

PSILOMELANE.

Ψίλος, *smooth or naked; μελας, black.*

Amorphous. Bluish black or grayish black. Dust, black.

1238. **Psilomelane**—Siegen, Prussia, GERMANY.
1239. ,, Schneeberg, Saxony, ,,
1240. ,, Eibenstock, ,, ,,
1241. ,, Horhausen, Rhenish Prussia, GERMANY.

CARBONATE OF MANGANESE, &c.

RHODOCHROSITE or DIALOGITE.

Ροδον, *a rose ;* Χροσις, *colour ;* Διαλογη, *a selecting.*

Rhombohedrons, reniform or compact. Fleshy pink.

1242. **Rhodochrosite**—*small crystals on Pyrites*—Oberneisen, Nassau.
1243. **Dialogite**—Puebla, Mexico, North America.
1244. „ Freiberg, Saxony, Germany.
1245. „ Kapnick, Hungary, Austria.

MANGANOCALCITE.

Rhombic prisms or radiated. Flesh red to dull reddish white.

1246. **Manganocalcite**—Oberneisen, Nassau, Germany.
1247. „ „

PHOSPHATES OF MANGANESE, &c.

HUREAULITE.

From the locality *Hureaux*, near Limoges, France.

SULPHIDES OF MANGANESE.

ALABANDINE.

From *Alabanda*, Asia Minor.

Cubes or octahedrons. Iron black or steel gray. Dust, dark green. Hardness, 4. Specific gravity, 3·9 to 4.

HAUERITE.

Dedicated to *Hauer*, Director of the Geological Survey of Austria.

Octahedrons. Brownish black. Dust, brown red. Hardness, 4. Specific gravity, 3·46. Contains more sulphur than Alabandine.

TRIPLITE or PITCHY ORE.

Τριπλως, *triple*—having three cleavages.

Phosphate of Manganese and Iron, containing Fluorine. Massive, cleavable, resinous. Lustre, chestnut brown, reddish or blackish brown. Dust, blackish gray.

1248. **Triplite**—Chanteloube, near Limoges, France.

SILICATES OF MANGANESE, &c.

RHODONITE.

Ροδον, *a rose.*

In small crystals or massive, two cleavages. Pink or brown. Dust, reddish white.

1249. **Rhodonite**—*in small prismatic crystals*—Oberstein, Nassau, GERMANY.
1250. „ *Mammillated*—Dicy, Nassau, GERMANY.
1251. „ *massive*—Aderville, Pyrenees, FRANCE.
1252. „ „ *saccharoid*—SWEDEN.
1253. „ Freiberg, Saxony, GERMANY.
1254. „ Elbingerode, Hartz, „
1255. **Allagite** (a variety of Rhodonite, in scales like Mica)—St. Marcel, Piedmont.

SILICIO-SULPHIDE OF MANGANESE.

HELVINE.

Ηλιος, *the sun,* in consequence of its yellow colour.

Small tetrahedrons.

1256. **Helvine**—Schwarzenberg, Saxony.

SUBDIVISION II.—IRON MINERALS.

The important ores are: Hematite, or *specular iron* (the *bloodstone* of Theophrastus), characterized by its blood-red powder, and occurring either earthy and red, or metallic and dark steel-gray; in the latter condition very hard, a knife-point making no impression. Magnetite, or *magnetic iron-ore,* as hard as the preceding, but having a black powder, and being attractable by a magnet. Limonite, called also *brown hematite,* a softer hydrous ore, affording a brownish-yellow powder; earthy or semi-metallic in appearance, and often in mammillary or stalactitic forms. Chalybite, or *spathic iron,* a sparry ore, of grayish, grayish-brown, and brown colours, very distinctly cleavable, turning brown to black on exposure. The common clayey iron-ores are impure ores, either of *spathic iron, limonite,* or *hematite;* when the last, they are red; when brown, reddish-brown, or yellowish-brown to black, they may be either of the two former.

Sulphides of Iron or Iron Pyrites cannot be called ores of Iron; they are, in fact, mostly used for the manufacture of Sulphur and of Sulphate of Iron

(Green Vitriol). They very often contain more or less gold, even in sedimentary deposits, the white-chalk formation, for instance. Therefore, specimens of Iron Pyrites will be found again with the ores of gold.

NATIVE IRON.

Chemical composition—Iron, with a small percentage of Nickel.

1256 *bis.* **Meteoric Iron**—Resembles ordinary Iron. Malleable. Is attracted by a magnet. Specific gravity, 7·0 to 7·8.—Atacama, Chili, SOUTH AMERICA.

1257. **Meteorite or Aerolite**—*Fell on 9th December*, 1858.—Ausson, near Montrégeau, Haute-Garonne, FRANCE.

1257 *bis.* **Meteorite**—*cut*—Alexinac, Sokolbung, SERVIA.

1258. „
1259. **Model of a Meteorite** } *Fell, 3rd February*, 1882—Mocs, near Klausenberg, Transylvania.
1260. „ „

1261. **Meteoric Iron**—*Oxidized*—Ovifak, SIBERIA.

ANHYDROUS OXIDES OF IRON.

MAGNETITE or MAGNETIC IRON.

From the name of a shepherd, *Magnes*, who, according to Pliny, discovered that mineral.

Chemical composition—Iron, 72·4 ; Oxygen, 27·6 per cent.

In octahedrons and dodecahedrons. Also in masses (*lodestone*) and in grains. Black. Lustre, metallic. Streak or powder, black. Fracture irregular. Specific gravity, 5·0 to 5·2. Hardness, 5·5 to 6·5. Not scratched with a knife. Magnetic. Is attracted by a magnet. Sometimes, when it possesses polarity, can attract iron filings. Infusible. With borax bead gives the indications of Iron. Occurs in many rocks, sometimes in beds, or forming mountainous masses ; common in river-sands. Used as an ore of Iron.

1261 *bis.* **Magnetite**—Elba, ITALY.
1261 *ter.* „ Greiner, Tyrol, AUSTRIA.
1262. „ **and Jenkinsite**—Orange County, New York, U.S. (*Jenkinsite* is a variety of Serpentine).
1262 *bis.* „ *in Syenite*—Arendal, NORWAY.
1263. „ *a fine octahedron crystal*—Traverselle, Piedmont.
1264. „ *with cubic Pyrites*—Elba, ITALY.
1265. „ Breisenbrunn, Saxony, GERMANY.
1266. „ Arendal, NORWAY.

HEMATITE, SPECULAR IRON, MICACEOUS IRON.

Αιμα, *blood*—the dust being red.

Chemical composition—Iron, 70 ; Oxygen, 30.

In tabular crystals or scales; also fibrous, massive, granular, earthy. Colour, black. Streak or powder, red. Lustre, metallic or dull. Specific gravity, 4·5 to 5·3. Hardness of crystals, 5·5 to 6·5. Not scratched with a knife. Earthy varieties softer, and can be scratched with a knife. Infusible. With borax bead gives the indications of Iron. An abundant ore of Iron. Often gradually changes into red or brown ochre.

1267. **Hematite**—*Kidney ore*—Whitehaven, Cumberland.
1268. ,, ,, ,, ,,
1269. ,, *with Quartz* ,, ,,
1270. ,, ,, ,, ,,
1271. ,, *Kidney ore*—Ulverston, Lancashire.
1272. ,, *with Quartz*—Elba.
1273. ,, ,, ,,
1274. ,, ,, ,,
1275. ,, *lamellar* ,,
1276. ,, Framont, Vosges, FRANCE.
1277. ,, *with Quartz*—Framont, Vosges, FRANCE.
1278. ,, *lamellar*—Phillipstadt, SWEDEN.
1279. ,, Schneeberg, Saxony.
1280. ,, Ems, Nassau, GERMANY.
1281. ,, **and Brown-spar**—Altenberg, Saxony, GERMANY.
1282. ,, (Ochre variety)—Goslar, Hartz, GERMANY.
1283. ,, Zwickau, Saxony, GERMANY.
1284. ,, (compact variety)—Dognatz, Banat, AUSTRIA.
1285. **Earthy Hematite or Clay Ironstone**—Teplitz, Bohemia, AUSTRIA.
1286. **Hematite**—*with Calcite.*
1287. ,, *on Hematite Schist*—BRAZIL.

(See Titanium).

HYDROUS OXIDES OF IRON.

GOETHITE or *Velvet Iron-ore.*

Dedicated to Goethe.

Chemical composition—Iron, about 63 ; Oxygen, 27 ; Water, 10 per cent.

Small acicular or tabular crystals or compact. Often radiated. Dust, ochre-yellow. Hardness, 5 to 5·5. Specific gravity, 4·13 to 4·37.

1288. **Goethite** (variety Pyrrhosiderite)—*with Quartz*—Tavistock, Devonshire.
1289. „ (variety Przibramite)—Przibram, Bohemia.
1290. „ (variety Lepidocrocite)—Herdorf, Siegen.
1291. „ Siegen.

LIMONITE or *Brown Iron-ore.*

Limus (Latin), *swamp.*

Chemical composition—Oxide of Iron, Water.

Of a brown-yellow or black colour. Earthy, fibrous, stalactitic. Scratches with a knife. Dust, brown. Blackens before the blow-pipe. With borax bead gives the indications of Iron. An abundant Iron-ore.

Observation.—The percentage of Iron of an ore ought to be ascertained by analysis of an *accurate average sample.* The chemical composition given above only refers to the crystallized and nearly pure mineral. This observation is applicable to all kinds of ore. Besides the percentage of metal, the proportion of injuring bodies ought to be carefully determined, such as Phosphoric Acid and Sulphur, which are often present in Iron ores, namely, in Limonite.

1292. **Limonite or Brown Hematite**—Ural Mountains, RUSSIA.
1293. „ „ **Iron-ore**—Zwickau, Saxony, GERMANY.
1294. „ Siegen, Prussia, GERMANY.
1295. „ Schmalkalden, Hesse, GERMANY.
1296. „ **or Pitch Iron-ore**—Hof, Bavaria, GERMANY.
1297. „ (a ferruginous Schist containing fossil Crinoids)—Braubach, Nassau, GERMANY.
1298. „ Kandern, Baden, GERMANY.
1299. „ *Oolitic in Spilite*—Hof, Bavaria, GERMANY.
1300. „ *Ochreous*—Rammelsberg, Hartz, „
1301. „ **or Hydrous Peroxide of Iron**—Vicdessos, Ariége, FRANCE.
1302. „ *Oolitic*—St. Quentin, Isère, FRANCE.
1303. „ Paris, FRANCE.
1304. „ **or Clay Iron-ore**—Paris, FRANCE.
1305. „ Rheims, FRANCE.
1306. „ Périgueux, FRANCE.
1307. „ *Aetite*—Le Puy, Haute-Loire, FRANCE.
1308. „ Berann, Bohemia, AUSTRIA.
1309. „ *Bog Iron-ore*—Teplitz, Bohemia, AUSTRIA.
1309 *bis.* **Mammillated Limonite**—*Iridescent, on Quartz*—Siegen.
1310. **Limonite**—*Brecciated, Iridescent.*
1310 *bis.* „ *with cellular Quartz.*

1311. **Limonite**—*Stalactitic*—Siegen, Nassau, Germany.
1311 *bis*. „ Neuwied.
1312. „ *radiated*—Dernbach, near Montabaur.
1312 *bis*. **Pseudomorphous Limonite**—*in cubes, after Pyrites*—Elba.
1313. „ „ Ural.
1313 *bis*. „ *after Siderite*—Knappenberg.
1314. „ „ Westphalia.
1314 *bis*. **Clay Iron-ore or Thoneisen**—Bohemia.
1315. **Jasper Iron-ore or Sinopite**—Sinope, Natolia.

RED OCHRE.

Chemical composition—Oxide of Iron and more or less Water.

An uncrystalline earthy variety of Iron-ore, often mixed with Clay. Colour, bright or dull red. Can generally be scratched with a knife. Blackens when heated, but regains its red colour on cooling. With borax bead gives the indications of Iron. Used as pigment.

1316. **Limonite**—*Red Ochre*—Copiapo, Chili, South America.

YELLOW OCHRE.

Chemical composition—Oxide of Iron and Water.

Like the last, but of a brown-yellow or black colour. Earthy, fibrous, stalactitic. Scratched with a knife. Blackens before the blow-pipe. With borax bead gives the indications of Iron. Used as pigment.

1317. **Limonite**—*Yellow Ochre*—Goslar, Hartz, Germany.

IRON PYRITES or *Yellow Pyrites*.

Chemical composition—Iron, 46·70; Sulphur, 53·30 per cent.

In cubes and allied forms; sides often marked with fine parallel lines. Also massive. Brass-yellow. Lustre, metallic. Fracture, irregular. Specific gravity, 4·8 to 5·1. Hardness, 6· to 6·5. Cannot be scratched with a knife; scratched by Quartz; scratches glass with great facility. Strikes fire with steel (the origin of the term *pyrites*). Before the blow-pipe it blows with a blue flame, giving off an odour of Sulphur, and ultimately fuses into a black magnetic globule. Abundant. Used as a source of Sulphur; also in the manufacture of Alum. Occasionally auriferous. This ore and arsenical pyrites form the "mundic" of miners. It is easily distinguished from Copper Pyrites by its hardness, Copper Pyrites being easily cut with a knife. Distinguished from Gold by its hardness, and in not being malleable, and in giving off sulphurous odours in the blow-pipe flame.

1318. **Iron Pyrites**—Elba, ITALY.
1319. „ *a large crystal, the centre of Hematite.*
1320. „ *dodecahedrons*—Grube Heinrichssen, Littfeld.
1321. „ Traversella, Piedmont, ITALY.
1322. „ Freiberg, Saxony, GERMANY.
1323. „ **and Brown-spar**—Siegen, Prussia, GERMANY.
1324. „ *in Siderite*—Linz-on-the-Rhine, GERMANY.
1325. „ Schneeberg, Saxony, GERMANY.
1326. „ Liskeard, Cornwall, ENGLAND.
1327. „ *with Chalcopyrites and Quartz*—Atacama, Chili, SOUTH AMERICA.
1328. „ Miguera, Chili, SOUTH AMERICA.
1329. „ Namur, BELGIUM.
1330. „ Rossie, New York.
1331. „ Framont, Vosges, FRANCE.
1332. „ (Pseudomorphous variety)—Milhau, Aveyron, FRANCE.
1333. „ *on Clay-slate*—Angers, FRANCE.
1334. „ Schemnitz, Hungary, AUSTRIA.

MARCASITE or *White Pyrites.*

Marcasita, name given by the Ancients to Pyrites.

This species has the same composition as Yellow Pyrites, but crystallizes in the orthorhombic system instead of crystallizing in cubes. Its colour is also lighter. Dust, greenish-gray. Hardness, same as pyrites. Specific gravity smaller, about 4·65 to 4·90. Is more decomposable than pyrites, by absorbing oxygen.

1335. **Marcasite**—Eger, Bohemia, AUSTRIA.
1335 *bis.* „ *on Barytes*—Freiberg, Saxony, GERMANY.
1336. „ Ems, Nassau, GERMANY.
1336 *bis.* „ Schneeberg, Saxony, GERMANY.
1337. „ Alais, Gard.
1338. „ Badenweiler, Baden, GERMANY.

PYRRHOTITE, MAGNETIC PYRITES, MAGNETKIES (Germ.)

Πυρροτης, *reddish ;* kies, *pyrites.*

Magnetic, being attractable in fine powder by a magnet. Hexagonal prisms. Colour, bronze-yellow or copper-red ; tombac, brown. Tarnishes readily. Dust, grayish black. Hardness, 3·5 to 4·5. Specific gravity, 4·5 to 4·7.

1339. **Pyrrhotite**—*Pseudomorphous*—Freiberg, Saxony.
1340. ,, Bodenmais, Bavaria, GERMANY.
1341. ,, Somma, Vesuvius.
1342. ,, *massive*—Wheal Jane, Cornwall.
1343. ,, Sion, Valais, SWITZERLAND.

CHALYBITE, *Carbonate of Iron*, *Siderite*, or *Spathic Iron*.

Χαλυψ, *steel*—the best steel being made with this ore; Σιδηρος, *iron*.

Chemical composition—Carbonic Acid, 37·9; Protoxide of Iron, 62·1.

In rhombohedrons; faces often curved. Usually massive, globular, fibrous, or encrusting. Light or dark brown. Glassy or pearly lustre. Streak white. Specific gravity, 3·7 to 3·9. Hardness, 3·5 to 4·5. Scratched with a knife. Infusible. Blackens when heated. With borax bead gives the indications of Iron. Dissolves in nitric acid with effervescence when heated. Occurs in beds and nodules in stratified rocks; in veins and cavities. It is often mixed with clay (Clay Ironstone). Valuable ore of Iron when pure.

1344. **Chalybite**—*with Mesitite in lenticular crystals*—Brazil.

(Mesitite, μεσιτης, *intermediate*—being a Carbonate of Magnesia and Iron *intermediate* between *Giobertite* and *Chalybite.*)

1345. **Chalybite**—*with Pyrites on Quartz.*
1346. ,, ,, ,,
1347. ,, Neudorf, Hartz, GERMANY.
1348. ,, Schwarzenberg, Saxony, GERMANY.
1349. ,, Rheinbreitbach, Prussia, GERMANY.
1350. ,, Zorge, Hartz, GERMANY.
1351. ,, Siegen, Prussia, GERMANY.
1352. ,, Tavistock, Devon, ENGLAND.
1353. ,, Allevard, Isère, FRANCE.
1354. ,, Baigorry, Pyrénées, FRANCE.
1355. ,, ,, ,,
1356. ,, Dauphiné, FRANCE.
1357. ,, Eisenerz, Styria, AUSTRIA.
1358. ,, *with Copper Pyrites*—Cornwall, ENGLAND.
1359. **Mammillated Chalybite**—*Geode in Anamesite*—Steinheim, Hesse, GERMANY.
1360. **Chalybite**—*Blackband from Coal-measures*—Wieseck, Baden, GERMANY.
1361. ,, *Spherosiderite from Coal-measures*—Charleroi, BELGIUM.

HYDROUS PHOSPHATES OF IRON.

ELEONORITE or BERAUNITE.

From the Eleonor Iron-mine, near Giessen.

Monoclinic. In twins or in radiated foliated crusts. Vitreous. Red brown to dark hyacinth red.

1362. **Eleonorite**—*on Limonite*—Waldgirmes, near Giessen.

STRENGITE.

Dedicated to Professor A. Strong, of Giessen.

Orthorhombic. Radiated or botryoidal. Peach-blossom red, carmine red, also various shades to nearly colourless.

1363. **Strengite**—*on Limonite*—Eleonor Mine, near Giessen.

HYDROUS SULPHATES OF IRON.

MELANTERITE—*Eisen vitriol* (Germ.)

Melanteria, name given to this substance by Pliny.

Transparent or translucent. Lustre, vitreous. Green. Taste, sweetish, astringent, and metallic.

1364. **Melanterite**—*with Fibroferrite.*

FIBROFERRITE.

Fibra and *ferrum, iron*—in consequence of its silky fibrous appearance.

1365. **Fibroferrite.**

HYDROUS PHOSPHATE OF IRON.

VIVIANITE.

Dedicated to the English mineralogist Vivian.

Acicular crystals generally in fibrous radiated masses or earthy. Nacreous on one of the cleavages. Colour, indigo blue, blackish green, or bluish green. Dust, bluish white. Fusible in a magnetic globule.

1366. **Vivianite**—*crystallized with Pyrites*—Truro, Cornwall.
1367. „ *in calcinated Coal-measures*—Cransac, Aveyron, FRANCE.
1368. „ Elbogen, Bohemia, AUSTRIA.

HYDROUS ARSENIATES OF IRON.

SCORODITE.

Σχοροδον, *garlic*—in consequence of the odor of arsenic before the blow-pipe.

Orthorhombic prism. Translucent. Lustre, vitreous. Green or greenish blue. Hardness, 3·5 to 4. Specific gravity, 3·18 to 3·30.

1369. **Scorodite**—*in light-blue crystals*—Dernbach, Nassau.
1370. „ *in small greenish crystals*—St. Day, Cornwall.

PHARMACOSIDERITE.

Φάρμακον, *poison*, and σιδερος, *iron*.

Small cubes. Translucent. Lustre, vitreous. Olive green.

1371. **Pharmacosiderite or Cube-ore**—St. Day, Cornwall.

ARSENIOSIDERITE.

Chemical composition—Arsenic Acid, Iron, Lime, and Water.

Fibrous nodular masses. Lustre, silky. Brownish yellow. Hardness, 1 to 2. Specific gravity, 3·52 to 3·9.

1372. **Arseniosiderate**—Romanéche, near Macon, FRANCE.

SILICIO-CHLORIDE OF IRON AND MANGANESE.

PYROSMALITE.

(See also among Silicates.)

1373. **Pyrosmalite**—Nordmarken, SWEDEN.

STILPNOMELANE and CHALCODITE.

Στιλπνός, *shining*, and μελάς, *black ;* and Χαλκός, *brass* or *bronze*.

Chemical composition—Hydrous Silicates of Iron, with smaller proportions of Alumina, Magnesia, Potash, &c.

Stilpnomelane is foliated or granular and black ; Chalcodite is bronze green.

1374. **Chalcodite**—*with Quartz on Hematite*—Antwerp, New York, U.S.A.

NICKEL AND COBALT MINERALS.

Among the minerals which present a metallic lustre the Nickel and Cobalt minerals are the most difficult to distinguish by a mere glance at them. As they are important it will be useful to take together the different Arsenides, Sulphides, and Arsenio-Sulphides of Cobalt, Nickel, &c., and state briefly their principal characters, so as to enable the discoverer to recognize them, or at least in most of the cases to allow him to have some clue about the minerals found.

Some are readily identified as being of a reddish silver-white colour or of a pale copper-red colour; they are Cobaltite,* an Arsenio-Sulphide of Cobalt, Linnœite, a Sulphide of Nickel and Cobalt, and Nickeline (Niccolite or Copper Nickel), an Arsenide of Nickel. The last one is easily distinguished in consequence of its copper-red colour. Linnœite is rare, and crystallizes like Cobaltite, say in octahedrons. Cobaltite is often found in small octahedrons, and they both occur also in a compact or granular state. Therefore it is necessary to test before the blow-pipe, when it will be most often ascertained as Cobaltite, Arsenic being present. Nicopyrite or Pentlandite, a Sulphide of Iron and Nickel, will be easily distinguished from other Cobalt and Nickel compounds in consequence of its light bronze-yellow colour, but it much resembles chalcopyrites or copper pyrites and iron pyrites.

It may be remarked here that the mineral named Domeykite or Whytneyite, an Arsenide of Copper, is also described as of a bronze colour after being exposed to the air, being tin-white in the fracture; but some tarnished specimens might be mistaken for Niccolite, as the bronze colour it assumes is somewhat reddish.

Another mineral of Nickel of a bronze colour—Millerite—is not likely to be mistaken for any other mineral, as, besides its brass-yellow colour and metallic lustre, it is generally found in small capillar crystals, or at least in columnar tufted coatings, partly semi-globular and radiated.

The other compounds of Nickel and Cobalt are not so easily recognized from one another, and they also resemble Mispickel and other Arsenides of Iron. They are generally tin-white or steel-gray, so that the quickest assay will be made with blow-pipe to ascertain the presence of Cobalt by the blue colour of the borax bead and the presence of Arsenic by smell of the fumes.

All the other minerals of Nickel and Cobalt, resembling more or less Mispickel and Galena, will be found to contain Arsenic. Three of them will give also a blue bead when fused with borax. They are Smaltite, an Arsenide of Cobalt; Glaucodot, a Sulpho-arsenide of Cobalt and Iron; and Cobaltiferous Mispickel. If crystallized, Smaltite will be recognized as being in the shape of cubes or cubo-octahedrons; whilst the two others occur in the same shape as Mispickel or White Mundic. Glaucodot is, in fact, very closely related to Mispickel, in which Iron has been replaced by Cobalt up to 24 per

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* Cobaltite occurs also of a silver-white colour inclined to red, and grayish-black when containing much iron.

cent., whilst in Cobaltiferous Mispickel the proportion of Cobalt is, at the maximum, 9 per cent.

The remaining minerals are to be distinguished into Mispickel and its allied forms and Ores of Nickel.

The first ones are three in number: Mispickel, which is an Arsenio-sulphide of Iron, and Lollingite and Leucopyrites, which are both Arsenides of Iron. Dissolved in nitric acid they will give a yellow solution, but Nickel ores will give a green solution. The last ones are: Cloanthite, isomorphous with Smaltite, and being an Arsenide of Nickel; and Gersdorffite or Disomose, which is an Arseno-sulphide of Nickel, and has the same crystalline form. However, the first one is tin-white, the other light lead-gray and often massive. They both are frequently covered with an apple-green coating of Arseniate of Nickel.

SUBDIVISION III.—COBALT MINERALS.

The ores of Cobalt of first importance are Smaltine and Cobaltine, both of nearly a tin-white colour, with the powder grayish-black colour, sometimes verging slightly to gray. The *Black Oxide of Cobalt*, a kind of bog-ore, and very impure, is sometimes sufficiently abundant to be valuable, as in New Caledonia.

OXIDE OF COBALT AND MIXTURES.

ASBOLITE or *Earthy Cobalt* or *Cobaltiferous Wad.*

Ἀσβόλη, *soot*—in consequence of its appearance and soiling the fingers.

It is a mixture of Oxide of Manganese and Oxide of Cobalt. In reniform masses. Black. Infusible.

1375. **Asbolite** (a large specimen exhibiting reniform structure on one face, and "slickensides" on the other face or wall side)—NEW CALEDONIA.

ARSENIO-SULPHIDE OF COBALT.

COBALTITE or *Gray Cobalt* or *Glance Cobalt.*

Octahedrons, dodecahedrons, &c. Lustre, metallic. Reddish silver-white. Dust, grayish black. Hardness, 5·5. Specific gravity, 6·1 to 6·3.

1376. **Cobaltite**—*in beautiful crystals*—Siegen.
1377. „
1378. „ *in crystallized grains*—Tunaberg, near Nyköping, SWEDEN.
1378 *bis*. „ „ „ „

ARSENIDE OF COBALT.

SMALTITE or ARSENICAL COBALT.

Being used for the manufacture of *Smalt.*

Chemical composition—Cobalt up to 24 per cent. Arsenic.

In octahedrons, cubes, dedecahedrons, and allied forms. Also massive. Tin-white or steel-gray. Lustre, metallic. Tarnishes by being exposed to the atmosphere. Streak, grayish black. Fracture, uneven. Specific gravity, 6·3 to 6·6. Hardness, 5·5. Fusible. In the blow-pipe flame gives off arsenical fumes (odour of garlic). With borax bead gives the characteristic indications of Cobalt. In nitric acid forms a pink solution. Resembles Mispickel, but is at once distinguished by the test with borax bead. It is also distinguished from the same by its crystalline form. Occurs in veins in Slate and Gneiss. A valuable ore of Cobalt.

1379. **Smaltite**—*massive.*
1380. ,, Riechelsdorf, Hesse, GERMANY.
1381. ,, Schneeberg, Saxony, ,,
1382. ,, *Argentiferous*—Schapbach, Baden, GERMANY.
1383. ,, (black variety)—Challanches, Isère, FRANCE.

GLAUCODOT.

An Arsenio-sulphide of Cobalt and Iron. Orthorhombic. Form like that of Mispickel. Also massive. Grayish tin-white. Streak, black.

1384. **Glaucodot**—*a large crystal*—Hakanboda, SWEDEN.

HYDROUS ARSENIATES OF COBALT.

ERYTHRITE or *Arseniate of Cobalt, Cobalt Bloom.*

Ερυτρος, *red.*

Chemical composition—Oxide of Cobalt, 37·60 ; Arsenic Acid, 38·40 ; Water, 24·00 per cent.

In oblique crystals, with a highly perfect cleavage like Mica. Also in incrustations. Red or pink, gray, green. Lustre, brilliant, pearly. Transparent or opaque. Specific gravity, 2·9 to 3·1. Hardness, 1·5 to 2. Very easily cut with a knife. Fusible in blow-pipe flame, evolving arsenical fumes. When heated on charcoal it gives off an odour of arsenic. With borax bead gives indication of Cobalt. Occurs in beds and veins with other ores of Cobalt. Is usually found accompanying Cobalt ores.

1385. **Erythrite.**
1386. „ *earthy*—Riechelsdorf.
1387. „ *with Nickel, &c.*—Schneeberg, Saxony.
1388. „
1389. „
1390. „ *Stalactites*—Riechelsdorf.
1391. **Roselite** (a variety containing Lime)—Schneeberg, Saxony.
1392. **Erythrite** (crystallized variety)—Schwartz, Tyrol, AUSTRIA.
1393. „ (earthy variety)—Riechelsdorf, Hesse, GERMANY.

SUBDIVISION IV.—NICKEL MINERALS.

SULPHIDES OF NICKEL.

MILLERITE.

Dedicated to Miller, an English mineralogist.

Hexagonal. Capillary crystals. Lustre, metallic brass-yellow. Hardness, 3·5. Specific gravity, 5·26 to 5·30.

1394. **Millerite**—*on Quartz*—St. Louis, Missouri.
1395. „ *on red Hematite*—Antwerp, New York, U.S.A.
1396. „ *mammillated and radiated*—Gape Mine, Pennsylvania, U.S.A.

ARSENIDE OF NICKEL.

NICCOLITE or COPPER NICKEL, *Kupfernickel* (Germ.)

Chemical composition—Nickel, 44; Arsenic, 56 per cent.

Usually in masses of a pale copper colour and metallic lustre. Specific gravity, 7·2 to 7·8. Hardness, 5 to 5·5. Scratched with a knife, using pressure. Before the blow-pipe on charcoal melts, giving out white arsenical fumes having a garlic odour. It is readily distinguished by its pale copper-red colour and its arsenical fumes when heated. Occurs in veins in Granite and Slate, with ores of Cobalt, Silver, Copper, Bismuth, and Lead. A valuable source of metallic Nickel.

1397. **Niccolite.**
1398. „
1399. „ Lostwithiel, Cornwall, ENGLAND.
1400. „ *with Mispickel and Nickel Ochre*—Challances, FRANCE.

CHLOANTHITE.

Χλοανθης, *greenish*, because this mineral is generally covered with a coating of Arseniate of Nickel.

Chemical composition—Arsenic, 71·77; Nickel, 28·23 per cent. Cubes. Lustre, metallic. Tin-white. Hardness, 5·5. Specific gravity, 6·43 to 6·73.

1401. **Chloanthite**—Marienberg, Saxony.

SULPHIDE OF IRON AND NICKEL.

NICOPYRITE or PENTLANDITE, *Eisennickelkies* (Germ.)

Named after Mr. Pentland.

Isometric. Massive or granular. Hardness, 3·5 to 4. Specific gravity, 4·6 Colour, light bronze-yellow. Streak, light bronze-brown. Not magnetic.

1402. **Pentlandite**—Gladenbach, Hessia, GERMANY.

CARBONATE OF NICKEL, &c.

TEXASITE or NICKEL SMARAGD.

From the locality Texas.

A carbonate with hydrate of Nickel. Emerald-green. Coatings on chrome iron-ore.

1403. **Texasite**—*on Chrome Iron-ore*—Texas, Pennsylvania.

HYDROSILICATES OF NICKEL, &c.

A number of green, earthy, serpentine-like minerals containing more or less oxide of Nickel, have been named as follows:—Nickel-Gymnite, Pimelite, Alipite, Genthite, Roettisite, Conarite, Refdanskite, Garnerite, Noumeaite, and probably other names.

Attention was called to this class of minerals, as ores of Nickel, mostly since the working in New Caledonia of similar Hydrosilicates as ores of Nickel. Professor A. Liversidge made the first accurate analyses of the New Caledonia minerals, and distinguished two species, Garnerite and Noumeaite. The first name was given by the Rev. W. B. Clarke, after Jules Garner, a French mining engineer, who discovered it about the year 1865. The name Noumeaite was given to one of the species by Professor Liversidge, and alludes to the town Noumea, the capital of New Caledonia. These analyses are published in the Transactions of the Royal Society of New South Wales for the year 1874, and in the same Journal for 1881.

Since 1875, when the New Caledonian ores began to be systematically worked, the Nickel production of the world has been largely increased, the price of the metal has been considerably lowered, and its applications greatly and universally extended.

PIMELITE.

Πιμελη, *fatness*—being of a greasy appearance.

Earthy. Lustre, greasy. Colour, apple-green.

1404. **Pimelite**—*powdery*—Frankenstein, Silesia.
1405. ,, *green, nacreous* ,, ,,
1406. ,, *gray* ,, ,,

GENTHITE or NICKEL-GYMNITE.

Dedicated to the mineralogist Genth.

Amorphous. Stalactitic and incrusting. Lustre, resinous. Colour, pale apple-green or yellowish.

ROETTISITE.

Named from the locality *Roettis*.

Forms incrustations. Colour, apple-green to emerald-green. Is probably a variety of Genthite.

1407. **Roettisite**—Voigtland.
1407*a*. **Garnierite**—*rich ore*—Tchio, New Caledonia.
1407*b*. ,, *exhibiting a peculiar mode of formation*—Tchio, New Caledonia.
1407*c*. ,, *brecciated ore*—Ouailou, New Caledonia.
1407*d*. ,, *pale bluish green* ,, ,,
1407*e*. ,, (hard variety passing into Hydrous Silicate of Magnesia)—Ouailou, New Caledonia.
1407*f*. ,, *Mammillated or Stalactitic*—Ouailou, New Caledonia.
1407*g*. ,, *powdery*—Dumbea River, New Caledonia.
1407*h*. ,, *brecciated ore*—Mt. Ouazangou, Gomen, New Caledonia.
1407*i*. ,, *of a rich apple-green colour*—Porro, New Caledonia.
1407*j*. ,, *Stalactitic*—Kanala, New Caledonia.
1407*k*. ,, *Pisolitic*—Kouaoua, ,,
1407*l*. ,, (a peculiar variety, used for ornaments, not being brittle, and being easily carved)—Ouailou, New Caledonia.

Division C.—TIN CLASS.

(Roscoe's Class VII, partly; Zirconium and Thorium to be found among Silicates.)

TIN AND TITANIUM MINERALS.

The Tin Class (Class VII of Roscoe) comprehends Tin, Titanium, Zirconium, and Thorium. These metals decompose water at high temperature, and in presence of Alkalies. The first four are closely connected with Silicon, and form a connecting link between metals and metalloids.

Tin and Titanium are the most important. Zirconium, as Silicate (Zircon), is to be found among the Silicates and the Gems in this collection.

The only ore of Tin is Cassiterite or Stannic Acid, and it is only found in granitic formations, in acidic rocks. Stannite or Sulphide of Tin and Copper is not abundant as an ore. When found in workable deposits it is more to be considered as an ore of Copper than as an ore of Tin, and is known under the name of *bell-metal.*

Remarkable pseudomorphs of Cassiterite after Orthoclase Felspar, from Cornwall, will be found in the collection.

Titanium enters into the composition of some very valuable ores of iron, and gives hardness to steel.

There is in the collection a remarkable and large crystal of Iserine, from Krageroe, Norway.

Sphene or Titanite, a Silicio-Titanate of Lime, is sometimes, when transparent and pure, used as a gem. Some cut specimens are among the last ones. Two fine transparent crystals, one green and the other yellow, from Tyrol and Switzerland respectively, are to be found in the present group.

SUBDIVISION I.—TIN CLASS.

The only valuable ore is Cassiterite, or the *Oxide of Tin,* a very hard mineral, of a dark brown to black colour, sometimes gray or grayish brown, without any metallic appearance. The crystals usually have a very brilliant lustre. Tin also occurs as a *Sulphide,* and is sparingly found in ores of *Tantalum,* and some other mineral species.

OXIDE OF TIN.

CASSITERITE or TIN-ORE, *Zinnerz* (Germ.).

Κασσιτερος, *tin.*

Chemical composition—Tin, 78·4 ; Oxygen, 21·6.

In four-faced prisms and pyramids, having an adamantine lustre. In kidney-shaped *radiated* masses, from which is derived the so-called *Wood Tin.* Also in masses and grains (Stream Tin) ; usually dull, semi-transparent or opaque. Brown or black ; streak and powder pale brown. Fracture uneven. Specific gravity, 6·8 to 7. The great comparative weight is an important character to observe in distinguishing Tin-ore from other minerals. Hardness, 6 to 7. Cannot be scratched with a knife, and may thus be distinguished from Blende, which it resembles in lustre and infusibility. Infusible. When mixed in powder, with carbonate of soda, placed on charcoal and covered with a small piece of Cyanide of Potassium, and then heated in the blow-pipe flame, a malleable globule of metallic tin is obtained.

Occurs in veins, and disseminated in Granite, Schist, Slate, and Porphyry ; and in alluvial deposits. It is a valuable ore, and the sole commercial source of the metal.

At Mount Bischoff, Tasmania, Tin-ore occurs in a peculiar detritic deposit, formed of a fine white or brown stuff (White Face, Brown Face).

TIN-ORE IN ROCK, LODE TIN, REEF TIN.

1408. **Cassiterite or Tin-ore**—*with Pyrites in Granite*—Cornwall.
1409. „ „ *white*—Cornwall.
1410. „ „ Cornwall.
1411. „ „ St. Agnes, Cornwall, England.
1412. „ „ Cornwall, England.
1413. „ „ Ehrenfriedersdorf, Saxony, Germany.
1414. „ „ Altenberg, Saxony, Germany.
1415. „ „ Morbihan, France.
1416. „ „ France.
1417. „ „ Schlaggenwald, Bohemia, Austria.
1418. „ „ Zinnwald, „ „
1419. „ „ Bohemia.
1420. **Wood Tin**—*broken radiated specimen* „ „
1420 *bis.* **Pseudomorphic Cassiterite**—*after Orthoclase Felspar*—Wheal, Coates, Cornwall.

STREAM TIN.

1421. **Stream Tin**—*large rolled specimen*—Cornwall.
1422. ,, *Toad's-eye, rolled* ,,
1423. ,, ,, ,, ,,
1424. **Wood Tin**—Wheal, Cornwall.
1425. ,, *red-brown*—Redmoor, ,,
1426. ,, Redmoor, Cornwall.
1427. ,, *variegated*—Redmoor, Cornwall.
1428. **Stream Tin**—Redmoor, Cornwall.
1429. ,, *in octahedrons*—Luxillion, Cornwall.
1430. **Wood Tin**—*light brown*—Cornwall.
1431. ,, *reddish, blistered*—Sancred, Cornwall.
1432. **Stream Tin**—*ash colour*—St. Agnes, Cornwall.
1433. **Wood Tin**—*brown*—Morvah, Cornwall.
1434. ,, Cornwall.
1435. ,, *fibrous*—Cornwall.
1436. ,, *variegated* ,,
1437. **Stream Tin**—*red*—Penlander, Cornwall.
1438. **Wood Tin**—*variegated*—Morvah, ,,
1439. **Stream Tin**—*blistered*—St. Lawrence Works, Bodium, Cornwall.
1440. **Tooth Tin**—Cornwall.
1441. **Stream Tin**—*yellowish*—Cornwall.
1442. ,, Cornwall.
1443. ,, ,,
1444. ,, *brown*—Cornwall.
1445. ,, *crystallized*—Golden Hope Works, Cornwall.
1446. ,, *buff-coloured*—Cornwall.
1447. ,, *mahogany* ,,
1448. ,, *reddish yellow* ,,
1449. ,, *with impression of Quartz Crystal*—Morvah, Cornwall.
1450. ,, *red, shot-holed*—Cornwall.
1451. ,, *small grains* ,,
1452. ,, *white* ,,
1453. ,, *shot-holed*—Luxillion, Cornwall.
1454. ,, *small, very rich*—Redmoor, Cornwall.
1455. ,, *red and brown streaked*—Sancred, Cornwall.
1456. ,, *fine*—Cornwall.
1457. ,, *small*—Straits Settlement, INDIA.
1458. ,, *coarser* ,, ,,

AUSTRALIAN TIN-ORE.

FROM NEW SOUTH WALES.

LODE TIN, REEF TIN.

1459. **Tin-ore**—*in Greisen*—Elsmore Mine, New England.
1460. ,, *in surface stone* ,, ,,
1461. ,, *Lode Tin* ,, ,,
1461 *bis* ,, ,, Newstead Mine.
1462. **Lode Tin**—Glen Lode Mining Co.
1463. **Reef Tin**—Hall and Sturr's Lease, Tent Hill, New England.
1464. ,, Moore & Co.'s Lease, The Glen, ,,
1465. ,, *in Quartz*—Tenterfield, New England.
1466. ,, Cope's Creek, New England.
1467. ,, *surface stone*—MacMaster's Lease, New England.
1468. ,, Glen Innes, New England.
1469. **Lode Tin**—Mr. Bray's Claim, New England.
1470. ,, *washed*—Bagot and Clarke's Claim, Oban River, New England.
1471. ,, *as taken from the ground*—Same deposit.
1472. ,, Glen Lode, Glen Creek.
1473. ,, ,, ,,
1474. ,, ,, ,,
1475. ,, Karaula.
1476. ,, ,,
1477. ,, ,,
1478. ,, ,,
1479. ,, Elsmore.
1480. ,, ,,
1481. ,, ,,
1482. ,, ,,
1483. ,, Tent Hill.
1484. ,, New England.

STREAM TIN.

1485. **Stream Tin**—Brisbane Company, Quart-pot Creek, New England.
1486. ,, Silver Tin Company, Four-mile Creek, ,,
1487. ,, Tumut.
1488. ,, Queensland Company, New England.
1489. ,, Inverell Tin-mining Co., ,,
1490. ,, Dumaresq Mine, Mole River, New England.

1491. **Stream Tin**—Inverell, New England.
1492. ,, ,, ,,
1493. ,, Borolong, ,,
1494. ,, Dundee River, New England.
1495. ,, Oban River, ,,
1496. **Tin-ore**—*little rolled*—Mr. Langley's Claim, New England.
1497. **Stream Tin**—Mole River, New England.
1498. ,, Hogg's Creek, ,,
1499. ,, Tumut.
1500. ,, (assayed by Mr. Twemlow, 64 per cent.)—New England.
1501. ,, Horse-shoe Bend, Oban River, New England.
1502. ,, **and Gold**—Mr. Bray's Claim, Oban River.
1503. ,, Mr. Bambury's Claim, Ruby Creek, New England.
1504. ,, *little rolled*—Glen Lode Company's Claim, New England.
1505. ,, (assayed by Mr. Twemlow, 72 per cent. of Tin)—New England.
1506. ,, (assayed by Mr. Twemlow, 55 per cent.)—New England.
1507. **Tin Crystals**—Elsmore Mine, New England.
1508. **Stream Tin**—Mr. Henderson's Claim, Oban River, New England.
1509. ,, Mr. Love's Claim, Washpool, ,,
1510. ,, ,, Skeleton Creek, ,,
1511. ,, Elsmore Mine, New England.
1512. ,, Washpool.
1513. ,, Glen Lode.
1514. ,, Tent Hill.
1515. ,, Silver Reef Company.
1516. ,, New England.
1517. ,, Abingdon.
1518. ,, Annandale Company.
1519. ,, Cope's Creek.
1520. ,, ,,
1521. **Wood Tin.**

From Victoria.

1522. **Stream Tin**—Beechworth.
1523. ,, Ovens.

From Queensland.

1524. **Wood Tin**—Palmer River.

SULPHIDE OF TIN.

STANNINE (from *Stannum*, Lat.), *Tin Pyrites, Bell-metal Ore.*
Germ., *Zinnkies.*

Crystallized in cubes or massive. Brass-yellow, greenish. Hardness, 4. Specific gravity, 4·3 to 4·5. Besides Tin, contains Copper, Zinc, and Iron.

1525. **Stannine**—*massive*—East Pool, Camborne, Cornwall.
1526. „ „ Redruth, Cornwall.

Manufacture Products.

15 *Specimens.*

1527. **Tin-ore** (prepared)—*in various stages, being refined.*
1528. **Commercial Tin.**
1529. **Pure Tin-foil.**
1530. „
1531. **Impure Tin.**
1532. **Old Jew's Tin** (Phœnician).
1533. **Jew's House Tin.**

SUBDIVISION II.—TITANIUM MINERALS.

TITANIC ACID.

RUTILE, OCTAHEDRITE, and BROOKITE.

Rutilus, red. Brookite, dedicated to the English mineralogist Brooke.

Chemical composition—Titanium and Oxygen.

Rutile.—In tetragonal crystals and masses. Red-brown. Streak, paler. Lustre, metallic. Hardness, 6· to 6·5. Specific gravity, 4·2 to 4·3.

Octahedrite or Anatase.—In the tetragonal system. Commonly octahedral or tabular. Colour, various shades of brown, passing into indigo-blue, and black; greenish-yellow by transmitted light. Streak, uncoloured. Lustre, metallic adamantine. Hardness, 5·5 to 6. Specific gravity, 3·83 to 3·93.

Brookite.—Orthorhombic prisms capped by an octahedron. Yellowish-brown, red-brown, or hyacinth-brown. Lustre, adamantine, somewhat metallic. Hardness, 6. Specific gravity, 4·12 to 4·17.

In the artificial formation these three species of the same chemical composition, but differing in their physical properties, crystallize at various temperatures from about red to bright-red heat, in the following order:—Anatase, Rutile, Brookite. Infusible. With borax bead, yellowish-green or colourless (oxidising), dirty violet (reducing).

1534. **Rutile**—*in a black rock.*
1535. „ Snarum, NORWAY.
1536. „ *with Amphibole and Orthose*—Laurvig, NORWAY.
1537. **Nigrine**—*in Quartz*—Galarino, NEW CALEDONIA.
1538. „ *in water-worn crystals*—Galarino, NEW CALEDONIA.
1539. **Octahedrite** or **Anatase**—*in Gneiss*—Binnenthal, Wallis, SWITZERLAND.
1540. „ Tavetsch, SWITZERLAND.
1541. „ *in Gneiss*—Binnenthal.
1542. **Rutile**—*with Quartz*—St. Gothard, SWITZERLAND.
1543. „ **or Sagenite**—Valais, SWITZERLAND.
1544. „ *with Albite and Hornblende*—Pfitsch, Tyrol, AUSTRIA.
1545. **Octahedrite or Anatase**—Oisans, Dauphiné, FRANCE.
1546. **Rutile**—St. Yrieix, Haute Vienne, FRANCE.
1547. „ *in needles, obtained artificially.*

TITANATE OF IRON.

MENACANNITE or TITANIC IRON.

From near Menaccan, Cornwall. Other varieties: *Ilmenite*, from Ilmen Mountains; *Iserine* or *Iserite*, from Iser.

Chemical composition—Oxides of Iron and Titanic Acid, in variable proportions.

In octahedrons or in tabular plates. Also in grains. Black. Lustre, metallic. Streak or powder, black. Specific gravity, 4·5 to 5·3. Hardness, 5 to 6·5. Not scratched with a knife. Infusible. With borax gives the indications of Iron. [With microcosmic salt, which is often used instead of borax, in an exactly similar way, it gives a red bead in the reducing part of the flame, but rather a large quantity of the mineral must be used to obtain this result.] It is sometimes magnetic. Its black streak or powder distinguishes it from Specular Iron, which it often resembles. Common in river sand. Of little or no value in the arts.

1548. **Iserine or Slag-like Magnetic Iron**—*in Dolerite*—Kaiserstuhl, Baden, GERMANY.
1549. **Iserine**—*in basalt*—Linz on the Rhine, GERMANY.
1550. **Iserine or Titanic Iron-sand**—St. Brieuc, Côtes du Nord, FRANCE.
1551. **Ilmenite, Titanate of Iron, or Crichtonite**—*on Quartz*—Oisans, Dauphiné, FRANCE.
1552. **Ilmenite and Spinel**—Warwick, New York, U.S.
1553. **Iserine**—*a large crystal*—Krageroe, NORWAY.
1554. „ *in noble Serpentine*—Snarum, NORWAY.
1555. **Ilmenite**—Snarum, NORWAY.

TITANATE OF LIME.

PEROWSKITE.

Dedicated to Perowski, of St. Petersburg.

Generally in cubes. Lustre, adamantine, somewhat metallic. Black or red-brown. Hardness, 5. Specific gravity, 3·99 to 4·01. Infusible.

1556. **Perowskite**—Achmatosk, Ural.
1557. ,, ,, ,,
1558. ,, *in Mica-schist*—Zermatt, SWITZERLAND.

SILICIO-TITANATE OF LIME.

SPHENE or TITANITE.

Σφην, *a wedge*—in consequence of its shape.

Monoclinic. Often in mascled crystals. Lustre, vitreous, somewhat adamantine. Yellow, green, and brown, of various shades; red or rose (variety Greenovite). Hardness, 5 to 5·5. Specific gravity, 3·3 to 3·7. Fusible with intumescence to a yellow, brown, or black glass.

1559. **Sphene**—*transparent, green crystals*—Pregratten, Tyrol.
1560. ,, *transparent, yellow crystals*—Tavetsch, SWITZERLAND.
1561. **Semeline**—*a variety of Sphene*—Somma, Vesuvius.
1562. **Guarinite**—Somma, Vesuvius.

Guarinite occurs at Vesuvius in small yellow crystals in a rock mostly composed of Sanidine and Nepheline.

1563. **Sphene**—*with Chlorite, Adularia, and Quartz*—St. Gothard, SWITZERLAND.
1564. ,, *with Adularia and Byssolite*—Pfitsch, Tyrol, AUSTRIA.
1565. ,, or **Ligurite**—*in Amphibolite*—Ala, Piedmont, ITALY.
1566. **Greenovite**—*with Manganesian Epidote*—St. Marcel, Piedmont, ITALY.
1567. **Sphene** (brown variety)—*with Pyroxene and Calcite*—Warwick, New York, U.S.
1568. ,, ,, *with Pyroxene, Graphite, and Felspar*—Roger's Rock, New England, U.S.
1569. ,, ,, *with Elæolite, Scapolite, and Epidote*—Arendal, NORWAY.

Division D.—CHROMIUM CLASS.

(Roscoe's Class VIII.)

CHROMIUM, MOLYBDENUM, TUNGSTEN, URANIUM.

The Tin Class is followed by the Chromium Class (VIIIth Class, Roscoe). The metals it comprehends decompose water at a high temperature.

Chromium is used chiefly in the state of Chromate and Dichromate of Potash in dyeing, and alsoin the manufacture of pigments. Large quantities of the ore, Chromite, have been of late years shipped from New Zealand and New Caledonia. It occurs in serpentines.

Molybdenite or Sulphide of Molybdenum has the aspect of Plumbago. It occurs in granite, gneiss, and other crystalline rocks.

Tungsten, the chief ore of which is Wolfram or Tungstate of Iron, is sometimes used to produce very hard qualities of steel.

Uranium is an interesting metal, the main ore of which is Pitchblende. The uranous oxide gives to glass a black colour, and uranic oxide a particular opaline yellow colour.

SUBDIVISION I.—CHROMIUM MINERALS.

SIDEROCHROME or CHROMITE, *Fer Chromé* (Fr.)

Σιδηρος, *iron* and *chromium.*

Chemical composition—A Chromate of Iron, or more exactly a Chromo-aluminate of Iron and Magnesia.

Crystallized in small octahedrons, and occurs also massive. Lustre, metallic, resinous. Iron-black or pitch-black. Dust, yellowish-brown. Hardness, 5·5. Specific gravity, 4·40 to 4·59. Slightly magnetic. Infusible.

1570. **Siderochrome**—New Caledonia.
1571. ,, ,,
1572. ,, ,,
1573. ,,

SUBDIVISION II.—MOLYBDENUM MINERALS.

MOLYBDENITE or *Sulphuret of Molybdenum or Molybdena*

Chemical composition—Molybdenum, 58·9 ; Sulphur, 41·1 per cent.

In thin plates, like Graphite. Lustre, metallic. Colour, lead gray. Specific gravity, 4·5 to 4·6. Hardness, 1·0 to 1·5. Easily scratched by the nail. Infusible. Tinges blow-pipe flame faint green. Heated on charcoal for a long time, it gives off a faint sulphurous odour, and becomes encrusted white. Occurs in Granite, Syenite, and Chlorite Schist. Not applied to any particular uses.

1574. **Molybdenite**—Altenberg, Saxony, GERMANY.
1575. „ New South Wales.

SUBDIVISION III.—TUNGSTEN MINERALS.

WOLFRAMITE, TUNGSTATE OF IRON, or WOLFRAM.

Contains *Wolframic* or Tungstic Acid.

Chemical composition.—Tungstic Acid, Iron, and Manganese.

Crystals or masses. Brownish-black. Lustre, shining or dull. Opaque. Hardness, 5·5. Specific gravity, 7 to 8. Cusible with difficulty. With borax gives the colour of Iron. Characterized by its great weight. Found often with Tin-ores.

1576. **Wolfram**—*in large crystalline masses.*
1577. „ *crystallized.*
1578. „ Zinnwald, Bohemia, AUSTRIA.
1579. „ St. Leonard, Haute-Vienne, FRANCE.
1580. „ Altenberg, Saxony, GERMANY.
1581. „ New South Wales.
1582. „ Victoria.

SCHEELITE.

Dedicated to the Swedish chemist Scheele.

Chemical Composition.—Tungstate of Lime.

Tetragonal prism. The general shape is an elongated octahedron. Translucent. Lustre, adamantine, resinous in the fracture. White, gray, yellowish &c. Hardness, 4·5. Specific gravity, 5·9 to 6·22. Fusible with difficulty.

1583. **Scheelite**—*in yellow crystals*—Ala, Piedmont.
1584. „ *with Magnetite and Dolomite*—Traversella, Piedmont, ITALY.
1585. „ *on Greisen*—Altenberg, Saxony, GERMANY.
1586. „ *with Quartz and Mica*—Zinnwald, Bohemia, AUSTRIA.
1587. „ *with Wolfram*—Keswick, Cumberland, ENGLAND.
1588. „ Joachimsthal, Bohemia, AUSTRIA.

SCHEELITINE.

Is a Tungstate of Lead. Crystallizes in small elongated octahedrons.

SUBDIVISION IV.—URANIUM MINERALS.

OXIDE OF URANIUM.

PITCHBLENDE or URANINITE.

Of a pitch-black appearance.

Chemical composition.—Uranous and Uranic Oxides, Iron, Lime, Magnesia, and a little Silica.

Generally amorphous. Dust, greenish-black. Hardness, 5·5. Specific gravity, 6·4 to 8.

1589. **Pitchblende**—Johann-Georgenstadt, Saxony.
1590. „ Joachimsthal, Bohemia.

PHOSPHATES OF URANIUM.

URANITE or AUTUNITE.

Being found at *Autun*, France.

Hydrous Phosphate of Uranium and Lime.

1591. **Uranite**—St. Symphorien, near Autun, FRANCE.

CHALCOLITE, TORBERNITE, *Copper-Uranite or Uranglimmer.*

Χαλκος, *copper*, and λιθος. Dedicated to Torber (Torbernus) Bergmann.

Has the appearance of Mica, hence the German name Uranglimmer (Uran-Mica). Tabular crystals. Emerald-green or grass-green.

1592. **Torbernite**—Johann-Georgenstadt, Saxony.
1593. „ Redruth, Cornwall.

SULPHATES OF URANIUM, &c.

URANOCHRE or URACONITE.

Hydrous Sulphate of Uranium. Lemon-yellow or orange-yellow. Earthy or scaly.

1594. **Uranochre**—Joachimsthal, Bohemia.

ZIPPEITE.

Dedicated to Professor Zippe, the mineralogist.

Hydrous Sulphate of Uranium and Copper. In needles, acicular rosettes, and warty crusts. Colour, fine sulphur-yellow, lemon-yellow, orange-yellow.

1596. **Zippeite**—Joachimsthal, Bohemia.

CARBONATE OF URANIUM.

VOGLITE.

Dedicated to Vogl.

Chemical composition.—An Hydrous Carbonate of Uranium, Copper, and Lime.

In aggregations of crystalline scales or coatings on Pitchblende. Green.

Division E.—ANTIMONY CLASS.

(*Roscoe's Class V, partly, plus Arsenic; Vanadium is to be found as Vanadate of other metals; Niobium and Tantalum, after the Silicates.*)

ARSENIC, ANTIMONY, AND BISMUTH.

In Roscoe's Chemical Classification the Ninth Class is called the Antimony Class, and comprehends Bismuth, Vanadium, Niobium, and Tantalium. In the present collection of minerals these two last metals have been left in one group with the rare minerals of Yttrium, Thorium, &c., for some reasons given.

Arsenic has been added to that group, as being the connecting link between the metals and the metalloids. Arsenic closely resembles Antimony in its properties, forming Arsenids as well as Antimony forms Antimonids. On another hand it is closely connected with Phosphorus and Nitrogen, forming Arseniates as well as Phosphorus and Nitrogen form Phosphates and Nitrates. Antimony and Bismuth also form Antimoniates and Bismuthates.

Antimony is much used in the arts. With lead it forms an alloy known as type metal. Bismuth, in consequence of its fusibility, is mostly used for preparing fusible alloys. Arsenic, Antimony, and Bismuth play a great part in the metallurgy in Australia, Arsenic and Antimony being often associated with gold, and Bismuth, notwithstanding its great value, interfering as an impurity in some copper ores.

The compound of Arsenic which is mostly accompanying gold is Mispickel, a Sulpho-Arsenide of Iron, especially in Victoria, where the presence of Mispickel (commonly called *White Mundic*) is a good indication of gold in the quartz. In New South Wales some specimens of Mispickel from Lucknow, very rich in gold, gave to Professor Liversidge the opportunity of investigating on the formation of Moss-gold and Silver (Journal of the Royal Society of New South Wales for 1876).

Antimony ores (Stibnite or Sulphide of Antimony) often contain silver and gold.

SUBDIVISION I.—ARSENIC MINERALS.

Native Arsenic is too rare to be of much avail. Orpiment, a sulphur-yellow foliaceous and somewhat pearly mineral; and Realgar, bright red and vitreous, are both compounds of Sulphur and Arsenic. Arsenic is mostly derived for the arts from the Arsenical ores of *Iron*, *Cobalt*, and *Nickel*.

NATIVE ARSENIC.

Seldom distinctly crystallized. Usually in fine granular or spherical masses. Colour, white, usually with a black tarnish. Streak, white, metallic. Brittle. Specific gravity, 5·7 to 5·8. Hardness, 3·5. Before the blow-pipe it quickly volatilizes without fusing, giving off white fumes having an odour of garlic. Occurs in veins with Lead and Silver Ores.

1595 *bis.* **Arsenic**—*with Quartz*—Badenweiler, Baden, GERMANY.
1595 *ter.* „ *with Sternbergite*—Andreasberg, Hartz, GERMANY.

ARSENIOUS ACID.

Cubes. Octahedrons. Usually in minute capillary crystals. White. Transparent or opaque.

ARSENOLITE.

Artificial. (See Specimen 1595a, Supplement.)

SULPHIDES OF ARSENIC.

REALGAR or *Red Sulphuret of Arsenic.*

The name *Realgar* has an Arabic origin.

Prismatic crystals. Orange-red. Lustre, resinous. Hardness, 1·5. Specific gravity, 3·55.

1596. **Realgar**—*on Quartz*—Felsobanya, Hungary.
1597. „ *crystallized* „ „
1598. „ „ „ „
1599. „ *on Calcite*—Andreasberg, Hartz, GERMANY.
1600. „ „ „ „ „

ORPIMENT.

Auri pigmentum, in consequence of its golden colour.

Small irregular crystals. Generally massive. Citrine or orange yellow. Hardness, 1·5. Specific gravity, 3·48.

1601. **Orpiment**—Van, Anatolia.
1602. „ *and Realgar.*
1603. „ *crystallized.*
1604. „ *mammillated*—Felsobanya, Hungary.

SULPHO-ARSENIDE OF IRON.

MISPICKEL or ARSENICAL PYRITES.

Chemical composition.—Iron, 34·4; Arsenic, 19·6; Sulphur, 46·0 per cent.

In flattened prisms; also massive. White. Lustre, metallic. Streak, gray. Fracture uneven. Specific gravity, 6 to 6·3. Hardness, 5·5. Cannot be scratched with a knife; scratched by Quartz. Heated before the blowpipe it gives off white arsenical fumes of a garlic odour, and ultimately fuses into a black globule. Used for the extraction of Arsenic. Abundant in mining districts; sometimes auriferous. This ore and Iron Pyrites form the "Mundic" of miners.

1605. **Mispickel**—Freiberg, Saxony, Germany.
1606. ,, *with Siderite and Quartz*—Freiberg, Saxony, Germany.
1607. ,, Reichenstein, Silesia, Germany.
1608. ,, Altenberg, Saxony, ,,
1609. ,, Breitenbrunn, Saxony, ,,
1610. ,, Lobenstein, Thuringia, ,,
1611. ,, *crystallized*—Freiberg, Saxony.
1612. ,, *in large crystals*—Freiberg, Saxony.
1613. ,, *large crystals.*
1614. ,, Cieux, Haute-Vienne, France.

(Other specimens will be found with the compounds of Iron.)

ARSENIDE OF IRON.

LOLLINGITE.

From the locality Lolling, in Carinthia.

1615. **Lollingite**—Edenville, New York.

SUBDIVISION II.—ANTIMONY MINERALS.

Stibnite or *Gray Antimony* is the source of the Antimony of commerce. It is a lead-gray ore, usually fibrous or in prismatic crystals, and distinguished from a similar ore of Manganese by its perfect diagonal cleavage and its easy fusibility. Antimony occurs also in numerous ores of *Lead* and *Silver*, of *Nickel*, and also as *Oxides*.

NATIVE ANTIMONY.

1616. **Antimony**—*of a granular texture*—Allemont, Isère, France.
1617. ,, *manufactured, exhibiting crystalline fracture.*
1618. ,, *manufactured, exhibiting fern-like surface*—Tenterfield.

OXIDES OF ANTIMONY.

SENARMONTITE.

Dedicated to the French mineralogist De Senarmont.

Cubes. Octahedrons. Lustre, resinous, somewhat adamantine. Colourless or grayish. Is a result of decomposition.

1619. **Senarmontite**—*in large octahedrons*—Djebel Nador, Constantine, ALGERIA.

A nice octahedron crystal of Senarmontite is to be seen in the collection of crystals and wooden models.

VALENTINITE or EXITELE.

Dedicated to Basil Valentin, an alchimist of the Fifteenth Century, who discovered the properties of Antimony. Εξιτηλος, *vapourisable.*

Flat crystals. Translucent. Lustre, adamantine. White or yellowish. Is result of alteration.

OXI-SULPHIDE OF ANTIMONY.

KERMESITE or *Red Antimony.*

Radiated acicular crystals. Cherry-red.

1620. **Kermesite**—Braunsdorf, Saxony, GERMANY.

SULPHIDE OF ANTIMONY.

STIBNITE or ANTIMONITE.

Stibium, name given by Pliny.

Chemical composition.—Antimony, 72·9; Sulphur, 27·1 per cent.

Usually in long columnar or fibrous Crystals; also massive and granular. Lustre, metallic. Lead colour. Often tarnished or irisated. Streak, metallic. Specific gravity, 4·6 to 4·7. Hardness, 2. Very easily scratched with a knife. Easily fusible. Before blow-pipe gives off white vapours and an odour of Sulphur, and is entirely volatilized. When the corner of a large piece of ore is fused the border of the fused part is often tinted red. When heated on charcoal with Cyanide of Potassium it gives a globule of Metallic Antimony, which is brittle, has a crystalline surface, burns when strongly heated, emitting white fumes, and can be entirely volatilized. Occurs in veins in Granite and Slate alone, or with Ores of Silver, Lead, and other metals. This ore is the principal commercial source of the metal.

1621. **Stibnite**—*in numerous acicular crystals*—Felsobanya, Hungary.
1622. „ „ „
1623. „ Kremnitz, Hungary.
1624. „ *with Copper ore.*

1625. **Stibnite**—Schemnitz, Hungary, Austria.
1626. ,, Allemont, Isère, France.
1627. ,, Siegen, Prussia, Germany.
1628. ,, *with Quartz*—Braunsdorf, Saxony, Germany.
1629. ,, *with Kermes*—Freiberg, ,, ,,
1630. ,, Arnsberg, Prussia, Germany.
1631. ,, *prisms covered with Oxide of Antimony*—N.S.W.
1632. ,, *massive*—New Brunswick.
1633. ,,
1634. ,,
1635. ,, Clarence District, N.S.W.
1636. ,, Tenterfield, ,,
1637. ,, Victoria.
1638. ,, ,,
1639. ,, Nakety, New Caledonia.

BERTHIERITE.

Dedicated to the French chemist Berthier.

Fibrous or massive. Dark steel-gray. Hardness, 2 to 3. Specific gravity, 4 to 4·3.

ARSENIDE OF ANTIMONY.

ALLEMONTITE.

From the name of the locality where found.

Generally compact, granular, or scaly.

1640. **Allemontite**—*scaly*—Allemont, Dauphiné, France.

HYDROUS ANTIMONIATE OF LEAD.

BLEINERITE or *Native Naples Yellow.*

From the German, *Bley, lead.*

Amorphous. Lustre, resinous. Yellow. It is a product of decomposition.

1641. **Bleinerite or Bindheimite**—Endellion, Cornwall, England.

SULPHO-ANTIMONIDE OF LEAD.

JAMESONITE, HETEROMORPHITE; *Federerz* of the Germans.

1642. **Heteromorphite or Feather-ore**—Wolfsberg, Hartz, Germany.
1643. ,, Endellion, Cornwall, England.

(See Lead Ores.)

SUBDIVISION III.—BISMUTH MINERALS.

NATIVE BISMUTH.

Somtimes crystallized in rhombohedrons closely resembling cubes, but generally massive. Lustre, metallic. White, with a tinge of red, liable to tarnish. Brittle. Specific gravity, 9·6 to 9·8. Hardness, 2 to 2·5. Easily scratched with a knife. Easily fusible. Sometimes gives off an odour of garlic, owing to admixture of arsenic. Occurs with Cobalt, Silver, and Tin Ores, in Granite and Slate rocks. Bismuth is a very valuable metal.

1644. **Native Bismuth**—*with Fluor-spar and Chloanthite*—Altenberg, Saxony, GERMANY.
1645. ,, Schneeberg, Saxony, GERMANY.
1646. ,, *with Quartz*—Carrakfell, Cumberland, ENGLAND.
1647. ,, Wheal Owles, Cornwall.

SULPHIDE OF BISMUTH.

BISMUTHINITE.

Orthorhombic. Also massive, with a foliated or fibrous structure. Elongated, sometimes acicular crystals. Lustre, metallic. Streak and colour lead-gray, inclining to tin-white, with a yellowish or iridescent tarnish. Sectile. Hardness, 2. Specific gravity, 6·4 to 6·46.

1648. **Bismuthinite**—*with Chalcopyrites*—Schlagenwald.
1649. **Bismuthine or Sulphuret of Bismuth** — Redruth, Cornwall, ENGLAND.

EMPLECTITE.

Sulphide of Bismuth and Copper.

In acicular crystals.

1650. **Emplectite**—Schneeberg, Saxony.

TELLURIDE OF BISMUTH.

TETRADYMITE or BORNINE.

Τετραδυμος, *quadruple*—in consequence of its mascle of four crystals.

Lustre, metallic. Light lead-gray. Flexible in small laminæ.

1651. **Tetradymite**—Retzbanya, Hungary.

VANADATE OF BISMUTH.

PUCHERITE.

From the name of the mine Pucher.

Small crystals. Colour, brown-red. Dust, yellow.

1652. **Pucherite**—*with coating of oxide (Bismuth-ochre)*—Schneeberg, Saxony.

SILICIO-PHOSPHATE OF BISMUTH.

EULYTITE.

Ευλυτος, *easy to dissolve.*

Small tetrahedrons. Translucent. Brown, yellowish-gray. Fusible. Occurs with Atelestite.

1653. **Eulytine**—Schneeberg, Saxony.

ARSENIATE OF BISMUTH.

WALPURGITE.

Small prismatic crystals. Wax-yellow.

1654. **Walpurgite**—Schneeberg, Saxony.

ATELESTITE.

Chemical composition—Arseniate of Bismuth and Phosphate of Iron.

Small crystals. Lustre, adamantine. Colour, sulphur-yellow.

1655. **Atelestite**—Schneeberg, Saxony.

Division F.—LEAD CLASS.

(Roscoe's Class X.)

LEAD AND THALLIUM MINERALS.

Lead forms nearly itself the Lead class (Xth class of Roscoe), as the only metal which is placed in the same class is Thallium, a rare metal.

The most valuable ore of lead is Galena; the other minerals of lead, such as Carbonate (Cerussite), Phosphate (Pyromorphite), and Oxide of Lead, are products of secondary formation or of decomposition of Galena itself. Galena is generally treated for the silver it contains as well as for the lead. It has been often repeated that Galena in large crystals or cleavages is generally poor in silver, whilst Galena in small crystals or granular in texture is rich. The truth is that there is no exterior character to indicate the presence of more or less silver in Galena. An assay is always necessary. For instance, an assay of a specimen of Galena exhibiting large cleavage planes gave about 1,500 ozs. of silver per ton and some gold. It might be useful, however, to quote the following citation of Dana:—"E. J. Chapman remarks that Galenite or Galena is seldom much argentiferous, except when it is associated with mispickel or some other arsenical ore." In North America Galena occurs sometimes in very large crystals.

Though not represented in the collection, something might be said about Thallium. This metal occurs in very small quantities in iron pyrites, and has been detected among the crystallizations formed in the lead chambers, where the production of sulphuric acid takes place. It exists up to the proportion of 19 per cent. in the mineral Crookesite, a Selenide of Copper and Thallium, found in Norway.

Thallium enters in the composition of a glass, to which it imparts a very strong refractive power, and which, in consequence, is used as an imitation of diamond.

LEAD.

Galena is the only abundant lead ore; it is a lead-gray brittle ore, yielding lead when heated with charcoal. There are many other ores of this metal, consisting of *Selenides*, *Vanadiates*, *Tungstates*, *Chromates*, *Sulphates* (of which *Anglesite* is the common one), *Phosphates*, *Arsenates*, *Molybdates*, &c.

Native Lead, nearly unknown in the old world, has been found in the alluvial deposits of Victoria and New South Wales, but still it is a rare mineral.

1656. **Native Lead**—Wermeland, SWEDEN.

GALENA or *Sulphuret of Lead.*

Chemical composition—Lead, 86·6; Sulphur, 13·4 per cent.

In cubes. Also granular, massive. Lead colour. Metallic lustre. Streak, metallic. Breaks into cubical fragments, with bright cleavage faces. Specific gravity, 7·4 to 7·7. Hardness, 2·5. Very easily scratched with a knife. Easily fusible. Before the blow-pipe, on charcoal, is reduced to a metallic globule of lead, giving off an odour of burning sulphur. Occurs in granite and stratified rocks. Often associated with copper and other ores. It is the principal ore of lead. It usually contains a small quantity of silver. (See Silver.)

1657. **Galena**—*in large modified crystals.*
1658. ,, *in large rugous crystals*—Gonderbath, Hartz.
1659. ,,
1660. ,,
1661. ,,
1662. ,, Cajon.
1663. ,, *in reticulated crystals*—Altenberg.
1664. ,, *with Pearl-spar (Dolomite).*
1665. ,, Somma, Vesuvius.
1666. ,, *with Cerussite and Tetrahedrite.*
1667. ,, *in large dodecahedrons, with Cerussite.*
1668. ,, *with Quartz.*
1669. ,, *with Carbonates of Copper.*
1670. ,, *with Blende, Quartz, and Fluorine*—Alston, Cumberland, ENGLAND.
1671. ,, *in octahedrons, with Siderite, Blende, Pyrites, and Quartz*—Matlock, Derbyshire, ENGLAND.
1672. ,, *Miroir (Slickenside)*—Matlock, Derbyshire, ENGLAND.
1673. ,, *Blue Lead-ore, pseudomorphous*—Cornwall, ,,
1674. ,, *with Siderite and Quartz*
1675. ,, *with Quartz and Calcite* } Neudorf, Hartz, GERMANY.
1676. ,,
1677. ,, *with Calcite*—Clausthal, Hartz, GERMANY.
1678. ,, *with Chalcopyrites*—Badenweiler, Baden, GERMANY.
1679. ,, *Bleischimmer*—Clausthal, GERMANY.

1680. **Galena**—*with Quartz*—Pontgibaud, Auvergne, FRANCE.
1681. ,, Przibram, Bohemia, AUSTRIA.
1682. ,, Wellingrove, New England, N.S.W.
1683. ,, *with Copper Pyrites*—Broadsound, QUEENSLAND
1684. ,, *with Quartz and Heavy-spar* ,,

CERUSSITE or *Carbonate of Lead.*

Latin, *Cerussa.*

Contains 77 per cent. of lead.

In prisms, sometimes united in four- or six-rayed crosses. White or gray. Transparent or opaque. Lustre, glassy. Specific gravity, 6·4 to 6·6. Hardness, 3·5. Flies violently to pieces in the blow-pipe flame. If placed in a cavity on charcoal and covered with carbonate of soda, then carefully fused by the flame, it yields a globule of metallic lead. In nitric acid it dissolves with effervescence. Usually occurs with Galena. It is a valuable lead ore.

1685. **Cerussite**—Berncastel, Mosel.
1686. ,, *in beautiful crystals*—Horcajo, SPAIN.
1687. ,, Przibram, Bohemia.
1688. ,,
1689. ,, } Friederick Siegen Grube, near Braubach, Nassau.
1690. ,,
1691. ,, *with Galena*—Mies, Bohemia, AUSTRIA.
1692. ,, Leadhill, SCOTLAND.
1693. ,, *with Galena*—Siegen, Prussia, GERMANY.
1697. ,, *massive, with Galena*—Clausthal, Hartz, GERMANY.
1699. ,, *with Quartz and Galena*—Mexico, NORTH AMERICA.
1700. ,, *with Galena*—Matlock, Derbyshire, ENGLAND.
1701. ,, ,, *in Quartz.*

LEADHILLITE.

From the locality Leadhill.

Chemical composition—Carbonate of Lead.

Crystallization. Orthorhombic system. Lustre, pearly; somewhat adamantine. White, passing into yellow, &c.

Maxite is very closely related to Leadhillite, of which it is probably an alteration. Besides the characters above stated for Leadhillite, Maxite is colourless, transparent, translucent, brittle, and splintery.

1701 *bis.* **Maxite**—Mala Culzetta, near Iglesias, Sardinia.

PYROMORPHITE or *Phosphate of Lead.*

From πυρ, *fire* ; μορφη, *shape*—because it crystallizes by fusion.

Chemical composition—Oxide of Lead, 74·0 ; Phosphoric Acid, 15·8 ; Chloride of Lead, 10·2.

In stout prisms, grouped together. Also massive. Bright green or brown. Opaque or semi-transparent. Lustre, resinous. Streak, white. Fracture, irregular. Specific gravity, 6·9 to 7·1. Hardness, 3·5 to 4. Easily scratched with a knife. Easily fusible. With carbonate of soda on charcoal the lead is reduced. Soluble in nitric acid. Occurs sparingly in veins with Galena.

1702. **Pyromorphite**—*in beautiful crystals.*
1702 *bis.* „ *crystals.*
1703. „ *green*—Dognaczka, Bannat.
1704. „ *in small crystals*—Ems.
1705. „ *in large crystals* „
1706. „ *green*—Usingen, Nassau.
1707. „ Friederick Siegen Grube, near Braubach, Nassau.
1708. „
1709. „ "The Rozier Mine," Auvergne, FRANCE.
1710. „ Keswick, Cumberland, ENGLAND.
1711. „ *with Black Manganese*—Keswick, Cumberland.
1712. „ Keswick, Cumberland, ENGLAND.
1713. „ Cornwall, ENGLAND.
1714. „ Zschopau, Saxony, GERMANY.
1715. „ *in small acicular crystals*—Hornhausen, Rhenish Prussia, GERMANY.
1716. „ Puebla, Mexico, NORTH AMERICA.
1717. „ Bleistadt, Bohemia, AUSTRIA.
1718. „ Huelgoët, Bretagne, FRANCE.
1719. „ „ „ „

MIMETESITE or *Arseniate of Lead.*

From μιμητης, *imitator*—because it resembles Pyromorphite.

Chemical composition—Arsenic Acid and Oxide of Lead.

Hexagonal prisms. Translucent. Lustre, resinous. Green, yellowish, yellow, white. Hardness, 3·5. Specific gravity, 7·18 to 7·28.

1719 *bis.* **Mimetesite**—*with Barytine*—Badenweiler, Baden, GERMANY.
1719 *ter.* „ Johann-Georgenstadt, Saxony, GERMANY.

ANGLESITE or *Sulphate of Lead.*

Named from Anglesea, in Scotland, where it occurs.

Contains 68 per cent. of Lead.

In slender brilliant crystals, upon Galena. Also massive. White or gray. Transparent or opaque. Specific gravity, 6·3. Hardness, 3. Before the blow-pipe fusible, but apt to decrepitate (fly to pieces); on charcoal, with carbonate of soda, yields a globule of metallic lead. Differs from carbonate of lead in not dissolving with effervescence in nitric acid. Usually occurs with Galena, and results from its decomposition.

1720. **Anglesite**—*in large crystals*—Monte Poni, Sardinia.
1721. „ „ „ „
1722. „ „ „ „
1723. „ *in fine crystals* „ „
1724. „ *with Limonite*—Anglesea, SCOTLAND.

LANARKITE or *Sulphato-Carbonate of Lead.*

Named from Lanark, Scotland.

1725. **Lanarkite**—*a rare mineral*—Lead Hills, SCOTLAND.

LINARITE or *Cupriferous Sulphate of Lead.*

Named from Linares, Spain, where it occurs.

Chemical composition—Besides Sulphate of Lead, contains Hydrate of Copper.

Blue.

1726. **Linarite**—*in large crystals*—Monte Poni, Sardinia.
1726 *bis.* „ Keswick, Cumberland, ENGLAND.

BEUDANTITE.

Dedicated to the mineralogist Beudant.

Chemical composition—Sulphuric Acid, Arsenic Acid, Phosphoric Acid (little), Peroxide of Iron, Oxide of Lead, and Water.

1727. **Beudantite**—*in small dark olive crystals*—Dernbach, Nassau.

TUNGSTATE, MOLYBDATE, VANADATE, AND CHROMATE OF LEAD.

1728. **Stolzite**—*Tunsgate of Lead, on Greisen*—Altenberg, Saxony, Germany.
1729. **Wulfenite or Melinose**—*a Molybdate of Lead*—Przibram, Bohemia.
1730. „ Bleyberg, Carinthia.
1731. „ „ „
1732. „ Utah, U.S.A.
1733. **Vanadinite**—*Vanadate of Lead*—Lanark, Scotland.
1734. „ „ Obier, Carinthia.
1735. **Crocoisite**—*Chromate of Lead*—Berezowsk, Ural.
1736. „ „ „ „
1737. „ „ Miask, Ural.

CHLORIDE OF LEAD, &c.

1738. **Cotunnite**—*Chloride of Lead*—Crater of Vesuvius, October, 1874.
1739. **Phosgenite**—*Chloride and Carbonate of Lead*—Matlock, Derbyshire.
1740. **Matlockite**—*Chloride and Oxide of Lead* „ „
1740 *bis*. „ Ekholmen, Sweden.

SELENID OF LEAD.

1741. **Zorgite**—*with Chalcomenite, a Selenid of Lead and Copper*—Cacheuta, La Plata.

ANTIMONIATE OF LEAD.

1742. **Nadorite**—*in small tabular yellow crystals*—Djebel Nador, Algeria.

(This mineral is an Antimonite of Lead with Chloride of Lead.)

SULPHIDES OF LEAD WITH ANTIMONY AND ARSENIC.

BOURNONITE.

Dedicated to Count Bournon.

Chemical composition—Sulphur, Antimony, Lead, and Copper, and may as well be considered as an ore of Copper. (See Copper, No. 1841.)

Brittle. Hardness, 2·5 to 3. Specific gravity, 5·7 to 5·87.

1743. **Bournonite**—*in fine prismatic crystals*—Liskeard, Cornwall.

JAMESONITE.

Dedicated to the geologist Jameson.

Chemical composition—Sulphur, Antimony, Lead, and a small percentage of Copper.

Hardness, 2 to 2·5. Specific gravity, 5·56 to 5·61. Bleinierite is an Antimoniate of Lead.

1744. **Jamesonite**—*with Bleinierite, in Quartz*—Endellion, Cornwall.

BOULANGERITE.

Dedicated to the chemist Boulanger.

Chemical composition—Sulphur, Antimony, and Lead.

Hardness, 3. Specific gravity, 5·8 to 6.

1745. **Boulangerite**—*massive*—Oberlar, PRUSSIA.
1746. „ *in capillary filaments resembling Asbestus*—Bohemia.

JORDANITE.

Dedicated to Dr. Jordan.

Chemical composition——Sulphur, Arsenic, and Lead.

1747. **Jordanite**—*on Sphalerite (Blende)*—Binnenthal, SWITZERLAND.
1747 *bis.* „ *with Realgar, on Dolomite* „ „

Division G.—SILVER CLASS.

(Roscoe's Class XI.)

COPPER, MERCURY, AND SILVER MINERALS.

These metals do not, like those of all the above classes [from Class I (Alkaline metals) to Class X] decompose water under any circumstances; they are oxidized by Nitric and strong Sulphuric Acids.

Copper deposits are often more or less connected with Serpentine eruptions.

Instances are very rare of Copper in its native state being the main ore in a deposit or in a mining region. Native Copper occurs generally as a secondary product. The chief instance of the occurrence of Native Copper as a regular ore is at Lake Superior, in North America. It has been much spoken of. These deposits were worked at an early date by the first inhabitants of that part of North America, the so-called "ancient miners," a race allied to the Aztecs. In fact, when such masses of Native Copper as 420 tons in one block are spoken of it seems to represent a great wealth, but in practice it is not workable. At the present time the deposits which give the best results at Lake Superior contain only from 1 to 5 per cent. of Native Copper, but this metal is distributed in small grains, strings, and nuggets in a conglomerate, which is easily mined and easily crushed by the heavy steam stamp-mills, whilst mass Copper would be very expensive, if not ruinous, to bore, blast, and quarry.

Dealing at length with such an extraordinary mode of occurrence is to show how comparatively the usual mode of occurrence of Copper, say in the state of combination with Sulphur (Copper Pyrites, Peacock Ore, &c.) is of a greater importance as being more universal.

As a rule, a small company which attempts to smelt Copper ores is working under very adverse circumstances. It cannot get the best experienced people, wants to make money quick, and is bound to smelt the best oxidized ores, which ought to have been left as a reserve for further proper mixtures with the more permanent ores of the depth (Sulphides). Roasting is a costly and delicate operation, but it ought to be resorted to when the oxidized ores (Carbonates and Oxides) are exhausted.

However, recent improvements in the manufacture of Copper dispense with the operation of roasting, and afford a considerable economy in the smelting of Copper.

The chief ore of Mercury is Cinnabar. It occurs in beds in slate rocks and shales, and rarely in Granite or Porphyry. It has been observed in veins with ores of Iron.

There are important deposits of Cinnabar at Kilkivan, near Gympie, in Queensland.

The study of Silver ores is very important, as Silver exists in a great number of different compounds that are not easy to distinguish; often a small quantity of a rich silver mineral, disseminated in small grains, being sufficient to make it valuable. As instances of it can be mentioned, the occurrence of Silver in small grains of Mispickel, and the very rich ores containing Silver in the state of Chlorid, nearly an invisible form when mixed in a decomposed earthy matrix, as in the case of the *pacos* and *colorados* of Peru.

Native Silver occurs often as accompanying other Silver ores, but is sometimes abundant enough to form the chief part of the ores, as at Konsberg (Sweden), in Peru, &c.

An important ore is the Sulphide or **Argentite**, and among the Sulpho-Antimonides, Pyrargyrite and Stephanite seem to play the greater part in the deposits. Pyrargyrite is said to occur in large masses in the Idaho, to be very abundant at Austin (Reese River), as well as in Mexico; whilst Stephanite forms an important part of the ore at the famous Comstock Lode (Nevada), where, on the other hand, Native Silver is considered a rarity.

Silver exists more or less in all the Galenas, but an assay is the only way to ascertain the percentage, as there is no character to distinguish the poor from the rich (Argentiferous) Galenas. Argentiferous gray Copper ores, accompanied with the different Arsenical and Antimonial Silver ores, form the chief characteristic of the Silver Mines in Saxony and Bohemia.

SUBDIVISION I.—COPPER MINERALS.

The more valuable species are Native Copper and Chalcopyrites, or *Copper Pyrites.* The last one is of a brass-yellow colour, scratched easily with the point of a knife-blade, and giving a greenish-black powder. Erubescite or *Purple Copper*, violet in the fracture; easily scratched with a knife-blade, and powder grayish. Copper Glance, or *Vitreous Copper* (Chalcocite) of a dark lead-gray colour, and powder similar; resembling some Silver ores, but yielding Copper and not Silver when heated on charcoal. Tetrahedrite or *Gray Copper* of a somewhat paler steel-gray colour and powder. Red Copper and Black Copper are the oxides. Malachite or *Green Carbonate of Copper* is of a bright-green colour, sometimes earthy in the fracture, and sometimes silky. Azurite or *Blue Malachite* of a rich deep-blue colour, either earthy or vitreous in lustre.—(All the above are acted on by nitric acid, and the solution deposits a red coating of Copper on a strip of polished Iron.) Chrysocolla or *Silicate of Copper* of a pale-blue colour, and usually having a close texture (never fibrous), a smoother surface, and somewhat waxy lustre, although occurring usually only as an incrustation. Atacamite or *Chloride of Copper*, of deeper green than Malachite. Sulphate of Copper is soluble, and often found in the waters of Copper Mines.

NATIVE COPPER.

Usually in strings, plates, or irregular masses; sometimes crystalline. Like ordinary Copper, but often tarnished. Specific gravity, 8·9. Easily scratched with a knife. Malleable (can be flattened out under a hammer). Occurs with Copper ores, rarely by itself as an ore (Lake Superior).

1748. **Native Copper**—Lake Superior.
1748 *bis*. „ *large specimen*—Lake Superior.
1749. **Crystallized Copper**—*in Calcite*—Quincy Mine, Lake Superior.
1750. **Native Copper**—*replacing boulder in conglomerate*—Calumnet and Hekla M. Co., Lake Superior, U.S.A.
1751. „ „ „
1752. „ *in conglomerate* „ „
1753. „ *in trap-rock*—Quincy Mine, Lake Superior.
1754. „ *laminar*—Kevenaw Point, „
1755. „ *filling cavities of Amygdaloid*—Quincy Mine, Lake Superior.
1756. „ *in compact Limestone, in trap*—Quincy Mine, Lake Superior.
1757. „ *with Calcite and Delessite, in trap*—Quincy Mine, Lake Superior.
1758. „ *in Calcite*—Quincy Mine, Lake Superior.
1759. „ Lake Superior.
1760. „ *with Calcite*—Ural Mountains, RUSSIA.
1761. „ *in Limonite*—Nischne-Tagilsk, Ural Mountains, RUSSIA.
1762. „ Nischne-Tagilsk, Ural, RUSSIA.
1763. „ Aconcagua, Chili, SOUTH AMERICA.
1764. „ Peak Downs Copper-mining Company, Peak Downs, QUEENSLAND.
1765. „ Peak Downs, QUEENSLAND.
1766. „ *with Cuprite and Red Oxide of Copper, in Quartz*—N.S.W.

1767. **Red Copper Ore** *and Native Copper*—Ophir Mine, Bathurst.
1768. **Native Copper** *and Red Oxide of Copper*—Peabody Mine, N.S.W.
1769. **Native Copper**—N.S.W.
1770. „ *and Cuprite—on Hornstone*—Rheinbreitbach, Prussia, GERMANY.
1771. **Smelted Copper**—*intended to imitate Native Copper. This trick is often detected in Collections for sale.*

OXIDES OF COPPER.

CUPRITE AND CHALCOTRICHITE, or *Red Oxide of Copper.*

Chemical composition.—Copper, 88·80 ; Oxygen, 11·20 per cent.

In octahedrons and dodecahedrons. Also in granular and earthy masses. Red. Lustre, adamantine, metallic, or earthy. Streak, red. Semi-transparent or opaque. Exhibits cleavage parallel with octahedral faces. Specific gravity, 6. Hardness, 3·5 to 4 ; can be scratched with a knife. Before the blow-pipe on charcoal it yields a globule of metallic Copper. With borax bead gives the indications of Copper. Forms a blue solution in nitric acid. These tests distinguish it from Red Oxide of Iron. Occurs in Granite and Slate, with Copper ores and Galena.

Tile Ore is the name applied to the earthy varieties of Red Copper, from its colour, which is usually brick-red or reddish brown. It consists of a Red Oxide of Copper, mixed with variable proportions of Hydrous Oxide of Iron or Limonite, and passes sometimes by the increase of the quantity of Iron into brown Ironstone. The red varieties contain the greatest amount of Copper, and the brown the greatest amount of Iron.

1772. **Cuprite**—*a fine specimen*—Virneberg, near Rheinbreitbach.
1773. **Red Oxide of Copper**—*with Tetrahedrite*—Liskeard, Cornwall, ENGLAND.
1774. **Red Oxide**—*with Green Carbonate*—Cornwall, ENGLAND.
1775. **Chalcotrichite**—Redruth, Cornwall, ENGLAND.

This variety of Red Oxide of Copper (Chalcotrichite) is formed of cubes elongated in the direction of the octahedral axis.

1776. **Red Oxide of Copper**—Nischne-Tagilsk, Ural, RUSSIA.
1777. **Tile Ore**—*Cuprite*—Atacama, Chili, SOUTH AMERICA.
1778. **Cuprite**—Huasco, Chili.
1779. **Chalcotrichite or Acicular Red Oxide**—*with Blue Silicate of Copper*—Cadiangulong Copper-mining Company, Orange, N.S.W.
1780. **Red Oxide of Copper**—*with Green and Blue Carbonate*—Wellington, N.S.W.

1781 **Chalcotrichite or Acicular Red Oxide of Copper**—*with Native Copper*—Cadiangulong, N.S.W.

1782. **Red and Black Oxide of Copper**—*and Green Carbonate of Copper*—Rockhampton, QUEENSLAND.

1783. **Red Oxide of Copper**—*and Green Carbonate of Copper*—Gawarral, QUEENSLAND.

1784. **Red Oxide of Copper**—*with Native Copper and Carbonates of Copper.*

1785. ,,

BLACK OXIDE OF COPPER or MELACONITE.

Μελας, *black.*

Heavy black powder or mass. Soft. Easily distinguished from Manganese by affording the indications of Copper by the blow-pipe tests. It results from the waste of various Copper ores.

1786. **Black Oxide of Copper**—Cadiangulong, N.S.W.

1787. **Melaconite**—*coating on Chalcopyrites*—Bathurst, N.S.W.

1788. **Black Oxide of Copper**—*with Red Copper and Malachite.*

SULPHIDES OF COPPER, &c.

CHALCOCITE or REDRUTHITE, or COPPER GLANCE or *Vitreous Copper.*

Χαλκιτις, Aristotle's name for the Copper ore of Cyprus. Found at Redruth, Cornwall.

Chemical composition.—Copper, 79·8; Sulphur, 20·2 per cent.

Sometimes in prisms, but usually massive. Also in twins formed of flattened or tabular crystals. Blackish lead-gray, tarnished. Streak, metallic. Specific gravity, 5·5 to 5·8. Hardness, 2·5 to 3. Very easily scratched with a knife. Fusible. Before the blow-pipe gives off an odour of Sulphur. When heated on charcoal a malleable globule of metallic Copper remains, tarnished black, but rendered evident on flattening under a hammer. With borax bead gives the indications of Copper. Dissolves in nitric acid, forming a blue solution. (These tests distinguish it from Sulphide of Silver.) Occurs with other Copper ores.

1789. **Chalcocite or Redruthite**—Redruth, Cornwall.

1790. ,, *in aggregated crystals of botryoidal shape.*

1791. ,, (crystallized variety)—Redruth, Cornwall, ENGLAND.

1792. ,, *with Epidote*—Szaska, Banat, AUSTRIA.

1793. ,, *passing into Malachite*—Nischne-Tagilsk, Ural, RUSSIA.

BORNITE or ERUBESCITE or *Variegated Copper Ore.*

Named after *Von Born*, a distinguished mineralogist of the last Century. The name Phillipsite, by which this mineral has been known, ought to disappear, having been previously used for the Lime Harmotome. *Erubescite* originates from the purple violet colour of this ore, when freshly broken.

Cubical. The crystals are generally cubes, of which the solid angles are replaced, and the faces are mostly curvilinear. Occurs both crystallized and massive. Colour of the latter, when recently fractured, between tombac-brown and copper-red, but it soon acquires an iridescent tarnish. Lustre, metallic. Streak, grayish-black, and somewhat shining. Slightly sectile. Easily frangible. Fracture imperfect, conchoidal. Hardness, 3. Specific gravity, 4·4 to 5. Soluble in nitric acid.

1794. **Bornite** or **Erubescite**—*massive*—Monte Catini, Tuscany.
1795. „ *massive*—Monte Catini, Tuscany.
1796. „ *crystallized*—Redruth, Cornwall, ENGLAND.
1797. „ *massive*—Tamaya, Chili, SOUTH AMERICA.
1798. „ *with Blende, Galena, and Chalcopyrites*—Freiberg, Saxony, GERMANY.
1799. „

CHALCOPYRITES or COPPER PYRITES.

χαλκος, *copper.*

Chemical composition.—Copper, 34·60; Iron, 30·50; Sulphur, 34·90 per cent.

In tetrahedrons or octahedrons. Usually massive. Brass-yellow, often tarnished. Lustre, metallic. Streak, unmetallic, blackish green. Fracture, uneven. Specific gravity, 4·1 to 4·3. Hardness, 3·5 to 4·0. Easily scratched with a knife. Fusible. Gives off an odour of Sulphur before blow-pipe. Does not give the indications of Copper with borax bead, or when heated upon charcoal with Carbonate of Soda. Dissolves in nitric acid, forming a blue solution. Distinguished from Iron Pyrites by being easily cut with a knife; and from Gold by not flattening under a hammer, and by its greenish powdery streak. Occurs in Granite and Slate, in lodes or veins. Valuable ore of Copper.

1800. **Chalcopyrites**—*with Galena*—Siegen, Prussia, GERMANY.
1801. „ Freiberg, Saxony, GERMANY.
1802. „ *with Blende*—Schwartzenberg, Saxony, GERMANY.
1803. „ Dillenburg, Nassau, GERMANY.
1804. „ *with Dolomite and Galena*—Pyrenees, SPAIN.

1805. **Chalcopyrites**—Kongsberg, NORWAY.
1806. ,, Arendal, ,,
1807. ,, Redruth, ENGLAND.
1808. ,, *with Siderite*—Copiapo, Chili.
1809. ,, *with Actinote*—Aconcagua, Chili.
1810. ,, Huasco, Chili, SOUTH AMERICA.
1811. ,, *with Blue and Green Carbonates*—Gippsland, VICTORIA.
1812. ,, Thomson River, Gippsland, VICTORIA.
1813. ,, *with Epidote*—Bathurst, N.S.W.
1814. ,, *octahedrons in black Limestone with Dolomite*—Molong, N.S.W.
1815. ,, Canoblas Mountains, near Orange, N.S.W.
1816. ,, Bathurst, N.S.W.
1817. ,, Canoblas, Orange, N.S.W.
1818. ,, Copper Hill, Molong, N.S.W.
1819. ,, *coated with Black Copper*—Ophir Copper Mine, near Bathurst, N.S.W.
1820. ,, *with crystals of Iron Pyrites in pseudomorphic cavities*—Morinisk, QUEENSLAND.
1821. ,, *in quartz*—Tung Kitta Mine, QUEENSLAND.

PANABASE or TETRAHEDRITE or *Gray Copper.*

Fahlerz (Germ.)

Παν, *all ; βασις, base. Tetrahedrite*, from its shape.

This term includes a variety of ores having a common crystalline form, generally the tetrahedron; also a definite chemical formula, though the ingredients are numerous, and may be variously combined within certain limits. Sulphur is an invariable ingredient; and Arsenic or Antimony, one or both, must be present; the other ingredients are Copper, Iron, Zinc, Lead, Silver, or Mercury, in variable proportions. The Copper ranges up to 40 per cent.; and in some kinds as much as 30 per cent. of Silver has been found. It also occurs massive. Steel-gray to iron-black. Lustre, metallic. Streak, black, or dark red when Zinc is present. Fracture uneven. Specific gravity, 4·5 to 5·2. Hardness, 3 to 4. Can be scratched with a knife. Fusible. Before the blow-pipe gives off an odour of Sulphur, also white inodorous fumes of Antimony, and occasionally Arsenic. The roasted mineral gives with the fluxes (Borax, &c.) reactions for iron and copper; with soda yields a globule of metallic copper. It dissolves in nitric acid, forming a greenish-brown solution. Occurs with Copper Pyrites, Galena, and Blende. This ore is wrought for Copper, and occasionally for Silver.

1822. **Tetrahedrite.**
1823. „ *large crystals coated with oxide*—Chili.
1824. **Gray Copper**—*with Blende, Galena, and Quartz*—Puebla, Mexico, NORTH AMERICA.
1825. „ Bathurst, New Brunswick, U.S.A.
1826. **Tetrahedrite**—*fine crystals*—Schwabengrube, near Mussen.
1827. „ „ *fine crystals*—Kapnick, Hungary.
1828. „ „ „ Dillenberg, Nassau.
1829. „ „ *crystals covered with Chalcopyrites*—Clausthal.
1830. **Gray Copper**—*with a coating of Copper Pyrites and with Galena*—Liskeard, Cornwall, ENGLAND.
1831. „ *with Azurite*—Serravezza, ITALY.
1832. „ *with Blue and White Fluorine*—Tuscany, ITALY.
1833. „ *with Pyromorphite*—Katharinenburg, Ural, RUSSIA.
1834. „ *with Dolomite and Quartz*—Isère, FRANCE.
1835. „ Croombit, N.S.W.
1836. „ Thomson River, Gippsland, VICTORIA.
1837. **Tetrahedrite**—*large crystals with Quartz.*
1838. „ *with grains of Chalcopyrites and Blue and Green Carbonates.*
1839. „ *with Blue and Green Carbonates.*

TENNANTITE. *Arsenikfahlerz* (Germ.)

Dedicated to the chemist Smithson Tennant.

Chemical composition.—Sulphur, Arsenic, and Copper.

Tetrahedrons and dodecahedrons. Blackish lead-gray or iron-gray. Dust, dark-reddish gray. Hardness, 4. Specific gravity, 4·3 to 4·5.

1840. **Tennantite**—Cornwall.

BOURNONITE.

Dedicated to Count Bournon.

Chemical composition.—Sulphur, 19·76; Antimony, 24·34; Lead, 42·88; Copper, 13·02.

Rhombic. Crystals often cruciform; also massive, granular, and compact Colour and streak, steel-gray, inclining to dull lead-gray, with a tinge of black. Opaque. Fracture uneven or flat conchoidal, with a brilliant metallic lustre. Brittle; yields to the pressure of the nail. Hardness, 2·5 to 3. Specific gravity, 5·7 to 5·9.

1841. **Bournonite or Wheel Ore**—*with Quartz*—Endellion, Cornwall, ENGLAND. (See No. 1743.)

CARBONATES OF COPPER.

AZURITE or CHESSYLITE, *Blue Copper.*

Named from its *azure-blue* colour ; also from the locality Chessy, near Lyons, France.

Chemical composition.—Oxide of Copper, Carbonic Acid, and Water.

Primary form, an oblique rhombic prism. Colour, azure blue passing into Berlin blue ; in earthy varieties, smalt blue. Lustre, vitreous. Yields easily to the knife. Streak paler than the colour. Structure, lamellar. Brittle. Fracture, conchoidal. Hardness, 3·5 to 4. Specific gravity, 3·5 to 3·8. Chessylite is a result of the decomposition of other ores of Copper. It generally occurs lining cavities in primary and secondary rocks, and associated with Malachite and Red Copper. Chessylite forms a valuable ore of Copper when abundant.

1842. **Chessylite**—Chessy, Lyons, FRANCE.
1843. ,, Coquimbo, Chili, SOUTH AMERICA.
1844. ,, Cadiangulong, N.S.W.
1845. **Azurite**—*in fine crystals*—N.S.W.
1846. **Earthy Azurite**—Peak Downs, QUEENSLAND.
1847. ,,

MALACHITE or *Green Carbonate of Copper.*

Μαλαχη, *mallow.*

Chemical composition—Oxide of Copper, Carbonic Acid, and Water ; the percentage of metallic Copper about 56.

Monoclinic. In crystals, but usually in fibrous, silky, globular, encrusting masses. Blue or green. Opaque. Glassy, silky, or dull. Specific gravity, 3·7 to 4. Hardness, 3·5 to 4 ; can be scratched with a knife. Blackens when heated. On Charcoal is reduced to a globule of pure Copper. Gives the indications of Copper with borax bead. Soluble in nitric acid with effervescence, forming a blue solution. Occurs with Copper Ores, and results from their decomposition. Valuable source of the metal.

Three splendid blocks of Malachite, from the Peak Downs Company's Mine, Peak Downs, Queensland, are exhibited in Room 12.

1848. **Malachite**—*polished slab.*
1849. ,, *polished.*
1850. ,, Schapbach, Baden, GERMANY.

1851. **Crystallized Malachite**—*in "Gossan"*—Belsdorf, Siegen.
1852. ,, ,, *with Melaconite*—Belsdorf, Siegen.
1853. ,, ,, ,, ,,
1854. ,, *with Cuprite.*
1855. **Malachite**—Dillenburg, Nassau, Germany.
1856. **Fibrous Malachite**—*with Melaconite*—Nischne-Tagilsk, Perm, Ural.
1857. **Malachite**—Nischne-Tagilsk, Ural Mountains, Russia.
1858. ,, Chester County, Pennsylvania, U.S., America.
1859. ,, Choros, Chili, South America.
1860. ,, Huasco, ,, ,,
1861. ,, Redruth, Cornwall, England.
1862. ,, *in fossil wood*—Tuscany, Italy.
1863. ,, *with Red Oxide of Copper*—Quedong, Bombala, N.S.W.
1864. ,, N.S.W.
1865. ,, ,,
1866. ,, ,,
1867. ,, Cadiangulong (?), N.S.W.
1868. ,, *and Chessylite*—N.S.W.
1870. ,, *with Azurite.*
1871. ,, *in small radiated crystals.*
1872. ,, *with Red Oxide of Copper.*
1873. **Earthy Malachite**—Gippsland, Victoria.
1874. **Malachite**—Burra Mine, South Australia.

HYDROUS OXICHLORIDE OF COPPER.

ATACAMITE or REMOLINITE.

From *Atacama*, Chili.

Orthorhombic prisms. In fibrous masses or granular. Translucent. Lustre, vitreous. Green. Hardness, 3 to 3·5. Specific gravity, 3·69 to 3·71.

1875. **Atacamite**—*small tabular crystals*—Atacama, Chili.
1876. ,, *with Chrysocolle.*
1877. ,, Cobar, N.S.W.

CHROMATE OF COPPER, &c.

VAUQUELINITE.

Dedicated to the French chemist Vauquelin.

Chemical composition.—Chromate of Copper with Carbonate of Lead. Small olive-green crystals.

1878. **Vauquelinite**—*with Crocoisite*—Berezowsk, Ural.

ARSENIATES OF COPPER.

OLIVENITE.

In consequence of its *olive* colour.

Contains a little water.

Very small or acicular crystals. A little translucent. Lustre, vitreous or resinous.

1879. **Olivenite**—Gwennap, Cornwall, ENGLAND.

EUCHROITE.

Ευχροα, *fine colour.*

Hydrous Arseniates of Copper.

Orthorhombic prism. Translucent. Lustre, vitreous. Emerald green.

1880. **Euchroite**—*of a beautiful emerald green*—Libethen, Hungary.

CHALCOPHYLLITE or *Kupferglimmer* (Germ.)

Χαλκος, *copper ;* φυλλον, *leaf.* The German name means *Copper mica.*

Contains more Copper than Euchroite and a little Alumina.

1881. **Chalcophyllite**—*with Lettsomite*—Garonne Mine, Var., FRANCE.
1882. „ Gwennap, Cornwall.

LIROCONITE or CHALCOPHACITE, *Linsenerz* (Germ.)

Λειρος, *pale ;* κονια, *dust.*

Contains less Copper than Euchroite and about 10 per cent of Alumina.

Monoclinic. The crystals have the appearance of rectangular octahedrons. Heaven blue.

1883. **Liroconite**—Gwennap, Cornwall.

CLINOCLASITE or APHANESITE.

The name *Clinoclasite* alludes to the basal cleavage being oblique to the sides of the prism. Αφανης, *invisible.*

Richer in copper than Chalcophyllite. The sides of the crystals are undulated. Deep green.

1884. **Clinoclasite**—Gwennap, Cornwall.

HYDROUS PHOSPHATES OF COPPER.

LIBETHENITE or APHERESE.

From the locality Libethen.

Small crystals, having the appearance of octahedrons. Lustre, resinous or vitreous. Deep olive-green ; dust, green.

1885. **Libethenite**—Libethen, HUNGARY.

HYDROUS SILICATES OF COPPER.

DIOPTASE or *Emerald Copper.*

Διοπτομαὶ, *to see through*—because the cleavage directions are distinguishable on looking through the crystal.

Oxide of Copper, about .50 per cent.

Rhombohedron combined with hexagonal prism.

1886. **Dioptase**—Altja Tuba, Kirghis Steppes.

CHRYSOCOLLE.

Χρυσοκολλα, *gold glue*—because it was used in the preparation of a soldering mixture for gold.

Amorphous. Green or bluish. Found in the copper mines with other secondary products.

1887. **Chrysocolle**—Hungary.
1888. „ Chili.
1889. „ "La Balade" Mine, New Caledonia.

HYDROUS SULPHATES OF COPPER.

LANGITE.

Dedicated to the mineralogist Lang.

Orthorhombic prisms. Small crystals or crystalline coatings. Greenish blue. Insoluble in water. Soluble in acids and Ammonia.

1889 *bis.* **Langite**—Cornwall.

LETTSOMITE.

Dedicated to the English mineralogist Lettsom.

Chemical composition—Hydrous Sulphate of Copper and Alumina.

Capillary crystals. Lustre, velvety. Light blue.

1890. **Lettsomite**—*silky radiated needles*—Garonne Mine, Var., France.
1891. „ *in velvety coating*—Moldawa, Bannat.

CHALCANTHITE or CYANOSE *(Blue Vitriol).*

Χαλκος, *brass ;* ανθος, *flower*—hence *Chalcanthum*, vitriol of any kind.

Chemical composition—Hydrous Sulphate of Copper.

Triclinic; also amorphous, stalactitic, reniform. Hardness, 2·5. Specific gravity, 2·21. Lustre, vitreous. Colour, Berlin-blue to sky-blue of different shades, sometimes a little greenish. Taste, metallic and nauseous.

1892. **Chalcanthite**—*earthy, light blue*—CHILI.
1893. ,, *mistaken for Coquimbite*—Aconcagua, CHILI.
1894. ,, *pale heaven-blue*—"La Balade" Mine, NEW CALEDONIA.

BROCHANTITE.

Dedicated to the French mineralogist Brochant de Villers.

It is another Hydrated Sulphate of Copper, in fact the one that contains the highest percentage of Copper. Emerald green, black green. Insoluble.

1895. **Brochantite**—*with Malachite*—Nischne-Tagilsk, Ural.

SUBDIVISION II.—QUICKSILVER OR MERCURY.

Cinnabar or Sulphide of Mercury is the only regular and valuable ore of this metal. It is of a bright-red to brownish-black colour, with always a red powder, and affording fumes of Quicksilver when heated on Charcoal. There are also *Native Quicksilver*, *Amalgam*, *Selenide*, *Chloride*, and *Iodide*. Tetrahedrite sometimes contains this metal. (See Copper and Silver.)

CINNABAR or *Sulphuret of Mercury*.

Chemical composition.—Mercury, 86·2; Sulphur, 13·8 per cent.

In granular, compact, and earthy masses. Sometimes in crystals, exhibiting adamantine cleavage faces. Opaque or semi-transparent. Vermilion or brownish red. Specific gravity, 8 to 8·2. Hardness, 2·5. Very easily scratched with a knife. Before the blow-pipe it volatilizes, giving off a strong odour of burning Sulphur. Mixed with dry Carbonate of Soda, and heated over a candle-flame, in an iron spoon, it gives off vapours of Mercury, which may be condensed on a gold coin held half an inch above the mixture. The surface of the coin appears whitish at first, but when rubbed between the fingers becomes brilliantly amalgamated. With care this test easily detects 1 per cent. of Cinnabar in an ore. The Mercury is removed from the gold coin by gentle heating. The blow-pipe tests distinguish it at once from Red Oxide of Iron and all other red Minerals. Occurs in talcose and argillaceous rocks. It is the principal source of the Mercury of commerce.

1896. **Cinnabar**—Moschel, Palatinate, GERMANY.
1897. ,, ,, ,, ,,
1898. ,, *massive*—Almaden, SPAIN.
1899. ,, *on Coal*—Idria, AUSTRIA.
1900. ,, Algiers, AFRICA.
1901. ,, Cudgegong River, 4½ miles from Rylestone, N.S.W.
1902. ,, *very rich*—New Almaden, CALIFORNIA.
1903. ,,
1904. ,, Ti-Ouaca, NEW CALEDONIA.

NATIVE MERCURY.

Native Mercury or Quicksilver in a pure state is rarely found, except in small globules accompanying Cinnabar. It occurs disseminated in liquid globules through sandstone and other rocks, in cavities of which it may accumulate. It is easily recognized. A rock suspected to contain Mercury may be tested by simply heating it as described under Cinnabar, but without the addition of Carbonate of Soda.

SUBDIVISION III.—SILVER.

The important Silver Ores are Native Silver, sectile and malleable like Gold; the only one that has a white colour. Silver Glance or *Sulphide of Silver*, blackish lead-gray, cutting (unlike the following) nearly like pure lead, cubic in crystallization. Pyrargyrite and Proustite, or *Ruby Silver Ore*, ruby red to black, always giving a bright-red powder. Freislebenite or *Gray Silver Ore*, steel-gray, rather brittle, and powder steel-gray. Stephanite, or *Brittle* or *Black Silver Ore*, iron-black, and giving an iron-black powder. Kerargyrite or *Horn Silver*, resembling a dark-coloured gray or greenish wax, and cutting like wax. Embolite or *Chloro-bromide of Silver*, like the last, but more greenish. These ores yield Silver easily when heated on charcoal. Besides these, Tetrahedrite or *Gray Copper* is often a valuable Silver Ore. In Europe, Galena, although seldom yielding more than 74 to 120 ounces to the ton, affords a considerable part of the Silver of commerce. There are also other rarer Silver Ores. (See Galena.)

NATIVE SILVER.

Occurring in strings, plates, and branching forms penetrating Quartz, Porphyry, Slate, and Granite. Silver white, but usually tarnished black. Malleable. Specific gravity, about 10·5. Hardness, 2·5 to 3. Fusible, without giving off any odour. Soluble in nitric acid, and on adding salt to the solution a white curd is thrown down which blackens on exposure to sunlight.

1905. **Native Silver**—*with Sulphuret of Silver in Quartz*—Chanarcillo, Chili, SOUTH AMERICA.
1906. **Silver**—*with Brown-spar, Quartz, &c.*—Chichas, near Potosi, SOUTH AMERICA.
1907. **Native Silver**—*in vein stuff*—Chili.
1908. „ *in Limestone* „
1909. „ „ „

1910. **Native Silver**—*in Quartz, with Argentite and Cobalt Ore*—Joachimsthal.
1911. „ *in capillary filaments, with Yellow Ochre and Galena, in thin laminæ*—Freiberg, Saxony.
1912. „ *in long filaments,* „ „
1913. „ „ Konsberg, NORWAY.
1914. „ *dendritic,* „ „
1915. „ *cubic crystals,* „ „
1916. „ *in flattened branches, in white calc-spar.*—Kongsberg.
1917. „ *in acicular crystals*—FRANCE.
1918. „ *in Rhodonite, polished*—Himmelsfürst, Erbisdorf.
1919. „ *on Barytes.*
1920. „ *in Quartz, polished.*
1921. „ *dendritic, on Quartz.*
1922. „ *capillary, in Quartz rock.*
1923. „ *dendritic crystals.*—Kongsberg, NORWAY.
1924. „ *on black quartz.*
1925. **Argentiferous Clay.**

SILVER AMALGAM.

Arquerite, from Arqueros, Chili.

1926. **Native Amalgam**—*in small crystal.*
(See Coll. of Crystals, Monoclinic System.)
1927. „ *in crystal*—Moschellandsberg, Palatinat.
1928. „ Moschellandsberg, Palatinat.
1929. „ *on the surface of indurated clay*—Stahlberg, Palatinat.
1930. **Indian Amalgam**—*Silver-works product*—Chili.

SILVER, AS CHLORIDE, BROMIDE, IODIDE.

1931. **Kerargyrite**—*Silver Chloride*—Chanarcillo, Chili.
1932. **Embolite**—*Silver Chloride and Bromide,* „ „
1933. „ Chanarcillo, Chili.
1934. **Bromyrite** (Bromargyre)—*in Limonite*—*Silver Bromide*—Chanarcillo, Chili.
1935. **Iodyrite** or *Silver Iodide*—Chanarcillo, Chili.

SULPHIDE OF SILVER.

ARGENTITE, ARGYROSE, or *Silver Glance.*

Chemical composition.—Sulphur and Silver.

The most important of all the Silver Ores. Black. Opaque. Easily sectile. Octahedrons.

1936. **Argentite**—*in Calcite*—Chili.
1937. „ Marienberg, Saxony.
1938. „ *in beautiful octahedrons*—Freiberg, Saxony.
1939. „ *dendritic, in heavy spar* (*Barytes*).
1940. „
1941. „ *in octahedrons lengthened out into a projecting pillar.*
1942. „ „
1943. „ *with Pyrites and Fluor-spar.*
1944. „
1945. „ *with Galena and Quartz.*
1946. „ *with Quartz, Copper, Nickel, &c.*
1947. „ *in Calcite.*
1948. „ *with capillary Native Silver and Pyrites in White Clay.*
1949. „ *coating Quartz crystals*—Hungary.
1950. „ *with Quartz, Galena, and Pyrites*—Schemnitz, Hungary.
1951. „ *with Galena, Blende, and Copper Pyrites*—Kuttenberg, Bohemia.

SULPHIDES OF SILVER, WITH ANTIMONY AND ARSENIC.

Several minerals of Silver contain Arsenic and Antimony, as well as Sulphur; the percentage of Silver in these minerals varies from 12 to 68. Red, gray, or black. Lustre, adamantine or metallic. Red streak. Specific gravity, 5 to 6. Hardness, 2 to 3. Easily scratched with a knife. Fusible. Before the blow-pipe gives off an odour of Sulphur, or arsenical fumes of a garlic odour, or fumes of Antimony. Heated on charcoal with Carbonate of Soda affords a globule of metallic Silver. Nitric acid extracts the Silver from these ores, forming a solution in which salt throws down a white curd, blackening on exposure to sunlight.

There are five principal minerals of Silver in this class. For ready identification they can be divided into two groups, as follows:—*Dust, black*—Stephanite, Polybasite; *Dust, red*—Pyrargyrite, Miargyrite, Proustite.

STEPHANITE, *Psaturose.*

Named after the Archduke Stephan, Mining Director of Austria.

Ψαθυρος, *brittle.*

Chemical composition.—Sulphur, Antimony, and Silver.

The crystals belong to the orthorhombic system. Hardness, 2·5. Specific gravity, 6·2 to 6·3.

POLYBASITE.

Πολυς, *many*, and *βασις*, *bases*.

Chemical composition.—Sulphur, Antimony, Arsenic, Silver, Copper, &c.

The crystals belong to the same system as *Stephanite.* Hardness, 2·5. Specific gravity, 6·08 to 6·20. The presence of Copper and Arsenic, easily detected before the blowpipe, readily distinguishes Polybasite from Stephanite.

PYRARGYRITE, *Red Silver*, *Ruby Silver*, *Argyrithrose.*

Πυρ, *fire*, and αργυρος, *silver.*

Chemical composition.—Sulphur, Antimony, and Silver.

The crystals belong to the rhombohedral system, and are often hexagonal prisms. Hardness, 2 to 2·5. Specific gravity, 5·75 to 5·85.

PROUSTITE, *Red Silver*, *Ruby Silver.*

Dedicated to the chemist Proust.

Chemical composition.—Sulphur, Arsenic, and Silver.

The crystals belong to the same system as Pyrargyrite. Hardness, 2 to 2·5. Specific gravity, 5·5 to 5·6. Will be distinguished from *Pyrargyrite* and *Miargyrite* before the blowpipe by exhibiting the characters of *Arsenic* instead of *Antimony.*

MIARGYRITE.

Μειον, *less*; and αργυρος, *silver*,—containing less Silver than Pyrargyrite.

Chemical composition.—Sulphur, Antimony, Silver, &c.

Crystallizes in the Monoclinic system. Hardness, 2·5. Specific gravity, 5·40.

1952. **Antimonial Arsenical Silver Ore**—Moruya, N.S.W.
1953. **Stephanite**—*in Rhodonite.*
1955. ,, *with Quartz.*
1956. ,, *with Galena*—Freiberg, Saxony.
1957. ,, Chili.
1958. **Polybasite**—*in small prismatic crystals*—Chili.
1959. **Pyrargyrite**—*with Native Silver* ,,
1960. ,, *in hexagonal prisms, on Calcite*—Andreasberg, Hartz.
1961. ,, *in large hexagonal prisms* ,, ,,
1962. ,, Johann-Georgenstadt, Saxony, GERMANY.
1963. ,, Freiberg, Saxony, GERMANY.

1964. **Red Silver**—Freiberg, Saxony, Germany.

1965. „ Braunsdorf, „ „

1966. **Pyrargyrite**—*in large tabular hexagonal crystals*—Ratiboritz, Bohemia.

1967. „

1968. „ Zacatecas, Mexico, North America.

1969. **Red Silver**—*with Stephanite.*

1970. „ *in Calcspar, with Galena*—Hartz.

1971. **Miargyrite**—*in small crystals on Quartz*—Braunsdorf, Saxony.

1972. **Proustite**—Copiapo, Chili.

1973. „ *with Native Silver*—Chili.

1974. „ „ „

1975. „ *in beautiful crystals.*

1976. „ *in large crystals*—Przibram.

1977. „ Gohanngeorgenstadt.

1978. „ *in Quartz* „

ARGENTIFEROUS MISPICKEL.

(See Arsenic Ores.)

WEISSERZ, *Werner* (*ex parte*).

Chemical composition.—Sulphur, Arsenic, and Iron, with a small percentage of Silver.

1979. **Argentiferous Mispickel** and *Blende*—Aullagas, Bolivia, South America.

1980. „ *in Quartz*—Freiberg, Saxony, Germany.

ARGENTIFEROUS GRAY COPPER ORES.

This class includes Tetrahedrite and varieties. The name of this mineral refers to its crystalline form. Brittle. Opaque. Lustre, metallic, steel-gray, or iron-black. Dust, black or deep-red, in varieties rich in zinc. They exhibit the presence of copper before the blow-pipe, as well as Polybasite.

TETRAHEDRITE, *Fahlerz* (Germ.), Freybergite.

Panabase. Παν, *all* ; Βασις, *bases.*

Chemical composition—Sulphur, Antimony, Arsenic (little), Copper, &c.

Hardness, 3 to 4. Specific gravity, 4·5 to 5·2.

1981. **Argentiferous Tetrahedrite**—*very rich in Silver*—Cerro de Pasco, Peru.

1982. „ Mine de Rosier, Puy de Dôme, France.

1983. „

„ *massive*—Bischedtgluck, Saxony.

1985. „ *in hollowed crystals*—Freiberg, Saxony.

This variety of Tetrahedrite is called by Germans *Weissgultigerz*, and contains more silver than Tetrahedrite proper—from 3 to 30 per cent.

TENNANTITE.

Dedicated to the mineralogist Tennant.

Chemical composition—Sulphur, Arsenic, Copper, &c.

Hardness, 4. Specific gravity, 4·3 to 4·5. Same crystalline system as Tetrahedrite, but more often in dodecahedrons.

1986. **Sandbergerite** (a variety of Tennantite according to Dana)—Libertad.

This variety, however, is considered as belonging to Tetrahedrite by Pisani, who has made an analysis of it, whilst Dana did not (Dana pp. 104, 105).

ARGENTIFEROUS GALENA.

(See Lead Ores.)

Chemical composition—Sulphur, Lead, with a small percentage of Silver.

1987. **Galena**—*Argentiferous*—Goulburn, N.S.W.
1988. ,, ,, Moruya, ,,
1989. ,, ,, ,, ,,
1990. ,, ,, Braidwood, ,,
1991. ,, ,, 50 miles from Adelaide.
1992. ,, ,, FRANCE.
1993. ,, ,, Mine de Rosier, Puy de Dôme, FRANCE.

Division II.—GOLD CLASS.

(Roscoe's Class XII; Selenium, Tellurium (metalloids), and their compounds, have been placed among Silver and Gold Minerals, although not belonging to this Class.)

GOLD, PLATINUM, AND ALLIED METALS.

These metals are not acted upon by nitric acid, but only by chlorine or *aqua regia*, and the oxides are reduced by heat alone; and they, with Silver and Mercury, constitute the so-called Noble Metals.

Mr. J. A. Phillips, in his work on "The Mining and Metallurgy of Gold and Silver," gives the following modes of occurrence of Gold:—

Native Gold.—An alloy of Gold and Silver, associated with small quantities of Copper, Iron, and other metals.

Palladium Gold.—Gold and Palladium, or Porpezite (Brazil).

Rhodium Gold.—Gold and Rhodium.

Gold Amalgam.—A native amalgam of Gold and Mercury.

Sylvanite, or *Graphic Tellurium.*—An ore, being a Telluride of Gold and Silver.

Nagyagite.—An ore; Telluride of Lead, containing Gold, Silver, and Copper.

In addition to these, Gold is found associated with Copper and Iron Pyrites, with Stibnite (Sulphide of Antimony), Mispickel, Galena, &c.

In the "Transactions of the Royal Society of New South Wales for 1874," Mr. J. Latta stated that Gold in Pyrites exists in the free state, probably intermixed between the crystalline layers, so that it is almost impossible to see it.

In Victoria, Mr. Cosmo Newberry arrived at the same conclusion.

When Pyrites are decomposed in honeycombs of quartz it is frequent to find Gold mixed with the remaining oxide of Iron.

It does not seem to have been yet proved that Gold occurs in actual combination with Sulphur or other metalloid, or Antimony, except in the case of the two above-mentioned minerals, where it occurs in combination with Tellurium.

As to the presence of Gold in Mispickel, it appears that it is also in the free state (Professor Liversidge, on the formation of Moss Gold, in "Transactions of the Royal Society of New South Wales, 1876").

Platinum is a comparatively rare metal which always occurs in the native state, and generally alloyed with five other metals, viz. :—Palladium, Rhodium, Iridium, Osmium, and Ruthenium. It has not been found *in situ*, in the original rock, but from some specimens found in the Ural Mountains, with a serpentine gangue. Professor Daubrée is of opinion that serpentine is the mother rock of Platinum.

Platinum has been found in several parts of New South Wales. A small nugget weighing about $1\frac{1}{3}$ oz. was obtained from Wiseman's Creek, county of Westmoreland, with alluvial gold.

SUBDIVISION I.—GOLD MINERALS.

Native Gold, distinguished from all minerals it resembles by its flattening under a hammer, its cutting like lead, although considerably harder, its resisting the action of nitric acid, hot or cold, and its high specific gravity. Occurrence : In dust, grains, or nuggets, in rivers and ; or in wiry, branching, and irregular forms, in Quartz. Yellow, pale or deep. Malleable. Specific gravity, 15 to 19. Hardness, 2·5 to 3. Fusible without blackening, and without giving off any odour. Imparts no colour to boiling nitric acid. The minerals commonly accompanying Gold are Iron Pyrites, Arsenical Iron, Oxides of Iron and Manganese, Galena, and Copper Pyrites in Quartz veins ; and Magnetic Iron, Titanic Iron, Chromic Iron, Tin Ore, Quartz, Zircon, Topaz, Corundum, Diamond, in alluvial deposits.

FREE GOLD and GOLD IN PYRITES.

1994. **Crystallized Gold Nugget**—*octahedrons*—Ballarat, VICTORIA.
(See Coll. of crystals Isometric System.)

1995. **Gold**—*crystallized, dendritic*—Vöröspatak, Transylvania.
1996. ,, *hexahedron crystals* ,, ,,
1997. ,, ,, Zalathna, ,,
1998. ,, *in very small crystals*—Felsobanya, ,,
1999. ,, *in Wood, dendritic crystals*—Nagybanya, Hungary.
2000. ,, *crystallized, dendritic, and elongated octahedrons*—Galarino, NEW CALEDONIA.
2001. ,, *in Quartz*—SOUTH AMERICA.

2002. **Auriferous Quartz**—Victoria.
2003. ,, "White Horse Reef," Amherst, Victoria.
2004. ,, Sandhurst, Victoria.
2005. ,, North Star Claim, Energetic Reef, Lauriston, Victoria.
2006. ,,
2007. ,, *with Galena and Pyrites*—New North Clunes Mining Company, Clunes.
2008. ,, *with laminated Slate, argentiferous Arsenical Pyrites, and Galena*—New North Clunes Mining Company, Clunes.

The two last specimens were taken at the depth of 500 feet, the reef being 6 to 9 feet wide there, averaging 18 dwts. to the ton. Underlay, West 1 foot in 2 feet. Strike, North 5° East.

2009. **Auriferous Quartz**—*with Clay-Slate, Pyrites, and Galena*—New North Clunes Mining Company, Clunes.

This specimen was taken at the depth of 240 feet, the reef being 30 to 40 feet wide there, and averaging 8 dwt. of gold to the ton. This level (No. 1, 240 feet) is about 20 feet below the cap of the lode, which underlays slightly to West, and strikes North 6° East.

2010. **Auriferous Quartz**—*with Pyrites, Gold in cavities*—"New Flagstaff Reef G. M. Co.," Maryborough.
2011. **Auriferous Banded Quartz**—Victoria.
2012. **Auriferous Quartz**—*with Slate* ,,
2013. ,, ,, *with laminated Slate Pyrites and Galena*—"New North Clunes M. Co.," Clunes.

These specimens were taken at the depth of 590 feet, the reef being 8 feet wide there. Underlay, 1 foot in 2 feet. Strike, North 5° East.

2014. **Auriferous Quartz.**
2015. ,, ,, Stanley, Hurdle Flat, Victoria.
2016. ,, ,, "Lucky Reef," Mount Pleasant, Victoria.
2017. **Gold**—*on Sandstone*—Thames River, New Zealand.
2018. ,, *in Calcite*—Gympie, Queensland.
2019. **Argentiferous Gold** ,, ,,
2020. **Auriferous Quartz**—"Perseverance G.M. Co.," Watt's Reef, Tarnagulla, N.S.W. The following relate to this specimen :—

Soapy micaceous clay slates are said to traverse the quartz irregularly. Gold is found in the slate and in the quartz, where there are evidences of the decomposition of sulphides. Depth, 160 feet; depth of water-level, 107 feet; width of reef, 8 feet; average yield of gold per ton, 1 oz. 17 grs.

2021. **Auriferous Quartz**—280 *feet from surface, very rich*—Lower Adelong Creek, N.S.W.

2022. **Auriferous Calcite**—Lucky Hit Reef, Tuena, N.S.W.

2023. **Auriferous Quartz**—*Native Gold in cavities*—N.S.W.

2024. **Auriferous Pyrites**—*disseminated in Phorphyritic Rock*—Huasco, Chili, SOUTH AMERICA.

2025. ,, *and Blende*—Mine de Toro, Chili, SOUTH AMERICA.

2026. **Auriferous Limonite**—*from decomposition of Pyrites*—Pasco, MEXICO.

GOLD NUGGETS.

Models.

Name of Nugget.	Depth from Surface.	Gross Weight (troy).	Approximate Value.	Particulars as to discovery and locality.
	Feet.	ozs. dwts.	£	
2027. "**Platypus**" ...	3	377 6	1,508	March 1861, Robinson Crusoe Gully, Bendigo.
2028. "**Beauty**" ...	9	242 0	968	About 1858, Kangaroo Gully, Bendigo.
2029. "**Viscount Canterbury.**"	15	1,121 10	4,420	31st May, 1870, John's Paddock, Berlin.
2030. **Unnamed** ...	...	......	......	Gulgong, N.S.W.
2031. **Unnamed** ...	12	113 12	452	23rd May, 1878, Killias Creek, Woods' Point.

These nuggets are all from Victoria, except No. 2,030.

2031*a*. **The Hargreave Nugget**—Found 1851, N.S.W. Weight: 8 ozs.

2031*b*. **The Cadia Nugget**—Found at Cadia, near Orange, N.S.W. Weight: 60 ozs.

2031*c*. **Nugget**—Found at Temora, N.S.W., 1884. Weight: 168 ozs.

2032. **Gneiss Boulder**—*containing Gold*—N.S.W.

2033. **Granitic Rock** ,, ,,

2034. **Quartz Boulders**—*with Pyrites containing Gold*—Laloki River, Port Moresby, NEW GUINEA.

2035. **Ironsand**—*containing Gold*—Laloki River, Port Moresby, NEW GUINEA.

2036. **Alluvial Gold**—*cemented on Mica-schist and Agate*, 23 *feet from surface*—Spiller's Gully, Junee, N.S.W.

2037. ,, Great Northern Tin-mining Co., Oban River, New England, N.S.W.

2038. ,, *in Cement*—N.S.W.

TELLURIUM AND TELLURIDES OF SILVER, GOLD, &c.

2039. **Hessite**—*Tellurium and Silver*—Botesberg, Zalathna, Transylvania.
2040. **Silvanite**—*Tellurium, Gold, and Silver*—Offenbanya, ,,

Called *Graphic Tellurium*, in consequence of a resemblance in the arrangement of the crystals to writing characters.

2041. **Nagyagite**—*Tellurium, Gold, and Lead*—Offenbanya, Transylvania.
2042–3. **Native Tellurium** (See Metalloids) Faczebay ,,

The properties of Tellurium, as well as Selenium, place these bodies among the Metalloids, close to Sulphur, but in consequence of their rarity and frequent association with Gold and Silver they have been put in this place.

SUBDIVISION II.—PLATINUM AND THE ALLIED METALS.

(Spanish: Platina signifying Small Silver.)

Native Platinum, the source of the Platinum of commerce, is distinguished by the same tests as Gold, and it is mainly on account of its malleability that it occurs in flattened grains or scales. Platiniridium is another ore, somewhat harder. Iridosmine resembles Platinum, but it scratches glass, and gives the reaction of Osmium, besides being rather brittle. In flattened or angular grains or nuggets, which are *malleable.* Steel-gray. Lustre, metallic. Specific gravity, 17 to 19. As heavy as Gold, and therefore easily distinguished and separated from lighter materials. Infusible. Insoluble in nitric acid. Occurs in quartz veins, but principally in alluvial deposits with Gold. Used chiefly for philosophical apparatus. Of great value.

2044. **Platinum**—*in flattened scales*—Columbia, SOUTH AMERICA.
2045. ,, *in small grains* ,, ,,
2046. ,, *in crystal*—Miask, Ural.
2047. ,, *nugget* ,, ,,
2048. ,, *in grains and scales*—Nischne-Tagilsk, Ural.

APPENDIX I.

GEMS AND PRECIOUS STONES.

ACCORDING to Webster's Dictionary a *Gem* is a *precious stone* of any kind; therefore little attention is to be made to that distinction, though the term *gem* appears to be the more technical term for the most valuable precious stones.

A collection of eighty-four specimens of imitated cut gems will serve as an introduction to the collection of genuine jewel stones, as well as an illustration of the processes of imitation. Besides that, by carefully looking at the specimens composing this collection it will be easy to distinguish some good imitations and some bad ones.

The first row (Nos. 1 to 14) is intended to represent imitations of cut diamonds. However, some of the shapes, especially Nos. 1 and 2, and up to No. 5, are old or fancy ones, being never used in modern jewellery; they could not display the full value of a diamond. The shape in general use, which is the result of a long experience, and is calculated to multiply the effect of light, is better represented by Nos. 6 and 8, in which, besides the top surface, called *the table*, there are generally thirty-two cut facets on the upper side. There are twenty-four facets, besides a small *table*, on the lower side. Some of the specimens of cut quartz in the collection, and especially No. 2051, imitate the ordinary shape of cut diamond. See also No. 2158, an imitation of diamond.

However, the shape to be given to cut diamonds in great part depends upon the primitive shape of the crystal or piece of diamond. This stone, being generally crystallized in octahedrons, or in modifications of that shape, advantage is taken of that shape and of the cleavages of the stone, so that a simple octahedron with two cleavages on two opposite angles, representing the two tables, will determine the general shape of a diamond without the facets.

Broken diamonds, as well as diamonds assuming a flat or tabular shape in consequence of distorted crystallization (as in two of the specimens, Nos. 2156 b, c, from the Cape), cannot be cut into *brilliants;* they are cut into *roses.* They are left quite flat underneath, and the convex upper side is cut into a great number of facets, generally twenty-four. Instances of this shape are to be seen in the collection of imitations of Gems, Nos. 13 and 14.

It is easily understood that, besides the defects, such as spots of foreign substances in the rough diamonds, there is a large amount of matter to be cut off. Therefore it is a fair result when a rough diamond has not lost more than the half of its weight by cutting; and a great experience is necessary to give a value to rough diamonds as well as to rough gems generally. A standard rule or formula has been given by Jeffries for calculating the value of cut diamonds of a given weight, but the results of the calculation have to be altered according to the quality of the stone or its defects. If the stone be *off-coloured*, or if it contains cloudy imperfections known as *milk* or *salt*, its value is very greatly diminished. The fashion or fancy for some peculiar shapes or styles of jewellery has also a great share in the determination of the price. Lastly, the formula cannot be applied for such diamonds of exceptional sizes which can be only acquired by a very limited number of purchasers. Most of them are therefore estimated at a lesser value than would give the formula. It is the contrary for stones of an exceptional rarity or perfection; for instance, a blue diamond of 44½ carats and the Regent of 136 carats. The unit of weight is the carat, which is divided into four grains and other subdivisions. 132 carats make 1 ounce troy.

Let w be the weight in carats, P the price or the value in pounds sterling; the formula is:—$P = 8 \times w^2$.

If applied to stones of 1, 2, 3, 10, and 20 carats respectively, and to the two above mentioned, it will give the following results (column of P.):—

W.	P.	1606.	1865.	1867.
	£	£ s. d.	£	£
1 carat....................	8	21 13 0	18	21
2 carats	32	86 13 0	65	80
3 ,, ...	72	195 0 0	125	140
4 ,, ...	128	260 0 0	220	240
5 ,, ...	200	346 13 0	320	350
10 ,, ...	800	....	.. ...	......
20 ,, ...	3,200	....	......	......
44½ ,, ...	15,840	... .	......	......
136 ,, ...	about 140,000	....	......	......

Whilst the blue diamond is estimated nearly the double of the calculated price (say) £30,000; and the Regent £160,000, or £20,000 over the calculated value.

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44½ ,,	15,840	....	......	......
136 ,,	about 140,000	....	......	......

Whilst the blue diamond is estimated nearly the double of the calculated price (say) £30,000 ; and the Regent £160,000, or £20,000 over the calculated value.

The last three columns give, according to Harry Emanuel, the value of diamonds up to 5 carats, at different dates, showing how the prices are variable. In the same book we find that the prices given for the year 1750 agree with the formula, as they are taken from David Jeffries' tables. Diamonds and other gems ought to be weighed with very sensible balances, but jewellers and lapidaries who have a great use of gems can very closely approximate the weight of a stone by looking at it, provided it is not set on.

The size of a diamond of 1 carat can be given about by the average size of the eight quartz-stones under No. 2051. These quartz-stones are cut into the shape of *brilliants*, and the total weight of diamonds of the same sizes would be about $8\frac{6}{10}$ carats; one of the largest would be $1\frac{3}{10}$ carat. As quartz the weight of course is only three-fourths of what it would be if they were true diamonds.

No. 2064, a Cairngorm or brown smoky quartz, if a diamond, would weigh about 39 carats. No. 2053, an oval colourless quartz-stone, would weigh, if a diamond, about 50 carats. The imitation of diamond in paste represented by No. 2169, if a true diamond, would weigh from 9 to 10 carats, and would be worth about £800 or more.

Among the uncut diamonds a few have been approximately weighed, with the following results:—

No. 2167*a*. Cape Diamond, an octahedron, weighs about $3\frac{7}{10}$ carats.

Nos. 2167 *b*, *c*. Cape Diamonds, in flattened crystals, weigh—the smallest, $4\frac{1}{10}$ carats; the largest, $5\frac{9}{10}$ carats.

No. 2168. Cape Diamonds, in a small tray, the largest an octahedron, $1\frac{7}{10}$ carat.

No. 2165. New South Wales Diamonds, in a small tray; the largest a flat bright colourless diamond, $2\frac{4}{10}$ carats; a small yellow one in the same tray, $\frac{7}{10}$ to $\frac{8}{10}$ carat.

The following are instances of weights of some of the other stones in the collection:—

No. 2134. A White Topaz; approximate weight, $13\frac{6}{10}$ carats.

No. 2126. An oval Emerald, the largest of three, $2\frac{6}{10}$ carats.

No. 2153. A Blue Sapphire, $4\frac{7}{10}$ carats.

No. 2161. Sixteen Rubies, in the whole nearly 3 carats.

No. 2079. An oval Opal, the largest $1\frac{6}{10}$ carat.

Further details on each kind of stone will be given further on in separate notes, but few more details on the collection of imitated stones are needed.

The labels of that collection are written in German, but they can be understood with very few additional explanations :—

No. 30. Wassertropfen means *water-drop*, and applies to White Brazilian Topaz.

No. 34. Gebrannter means *burnt*, and applies to Burnt Topaz.

No. 36. Kaneelstein means *Cinnamon-stone*, and is probably intended to imitate *Essonite*, a variety of Garnet.

No. 40. Vermeille is a kind of Garnet.

No. 53. Bouteille-stone means *Bottle-stone*, and probably is intended for Chrysolite or Olivine.

It is to be remarked in this collection that the stones of less value, precious stones such as Nos. 51, 52, 56, and 77, are the worst imitations.

Though some of the good imitations might be mistaken for the true gems, a very simple test will always suffice—it is hardness. It is not meant by imitations the artificial production of some gems by chemical processes, resulting in the production of small minerals identical in composition and mineralogical properties with the natural ones. What is meant and represented here are imitations of stones in coloured glass.

The base of all the imitations is a kind of glass called *Strass*, from the name of the inventor, a German. It is composed of Silica, Potash, Borax, Oxide of Lead, and occasionally Arsenic. In fact there are numerous *recipes* which all come to the same principle : the manufacture of a glass to which brightness is imparted by lead. As the quantity of lead increases the brightness increases, but the hardness decreases.

The hardest numbers of the scale of hardness are the following, to which some intermediate numbers have been added :—

Nos.
5. **Apatite**—scratched by steel.
5, 5. The hardest glass.
6. **Orthose**—scratched by highly hardened steel.
6, 5. Chrysolite or Peridot........................
7. **Quartz** (Amethyst) .... Tourmaline, Garnet and varieties.
7, 5. Zircon, Garnet, Phenacite,
Euclase........................ Dichroite.
Beryl or Aquamarine.
8. **Topaz**—Spinel, Emerald ....
8, 5. Chrysoberyl or Cymophane.
9. **Corundum**—Sapphire, Ruby.
10. **Diamond.**

Therefore any imitated stone can be scratched by Quartz, and even by well-hardened steel, and they get easily worn on their edges.

Though specific gravity is a good test for distinguishing some gems from others, it cannot be depended upon when glass imitations are concerned, as they can be made as heavy as Diamond and Sapphire by increasing the quantity of lead.

A few specimens of coloured glass have been placed in the collection under No. 2049 *bis.* Most of them are made by dropping the melted glass on a flat surface, so that this process is made evident by looking at these beads. Others are larger, rubbed, and exhibit a coarse grain which is rather deceiving. The idea of placing these valueless articles in the collection arose from the fact that they were sold in a gem-producing country, probably Ceylon; and that most probably many travellers, in order to get a "*souvenir*" from such a rich place, have given many *rupees* and *ticals* for what is not worth one-half *anna.*

Yellow Topaz can be imitated by adding to *Strass* some antimony glass and Purple of Cassius (a compound of tin with gold).

Blue Sapphire is obtained by addition of oxide of cobalt.

Emerald—by adding Oxide of Copper and Oxide of Chromium, or Oxide of Antimony, Oxide of Cobalt, and Oxide of Chromium.

Amethyst—by adding Oxide of Manganese, Oxide of Cobalt, and Purple of Cassius.

Garnet—by adding Antimony Glass, Oxide of Manganese, and Purple of Cassius.

2048 *bis.* The collection of **Imitations of Precious Stones.** It has not been judged necessary to include the details of this collection in the Catalogue. The above notes deal briefly with it.

2049 (*a-u*). A collection of **Rough Gem-stones**, chiefly from Ceylon. In twenty-one glass cups. It includes Topaz, Rubies, Sapphires, Zircons, Chrysoberyls, Garnets, &c.

2049. *bis.* Coloured glass sold as rough gems.

QUARTZ *and its Varieties.*

The name *Cairngorm,* given to brown or smoky quartz, is derived from a mountain of that name in Invernesshire, where it is found. *Cairngorm* is used for adorning the handles of dirks, powder-horns, snuff-mulls, and other articles of a similar kind, which form part of the Highland costume.

Amethyst is derived from αμεθυστος, which the Greeks supposed to be formed of α, *negative*, and μεθυω, *to inebriate*, from some supposed quality of the stone in resisting intoxication. It is usually worn as ring-stones by bishops and archbishops. It has always been esteemed, notwithstanding its low degree of hardness, on account of its beauty, as a gem, and as possessing the advantage of being almost the only stone that can be worn with mourning. It appears to the greatest advantage when set in gold and surrounded with pearls, but when of a vivid tinge it will sustain the presence of the diamond, and may in consequence be set round with brilliants.

QUARTZ or *Rock Crystal.*

Colourless.

2050. **Quartz**—*two, cut oval, &c.*
2050 *bis*. ,, *or Brighton diamonds.*
2051. ,, *cut in the shape of diamonds.*
2052. ,, *small natural crystals.*
2053. ,, *a beautiful large oval specimen, handsomely cut.*
2054. ,, *two, light-yellowish.*
2055. ,, *small long octagon.*

QUARTZ.

Shaded, Smoky or Yellow.

2056. **Cairngorm or Smoky Quartz.**—BRAZIL.
2057. ,, ,,
2058. ,, ,, *various shapes.*
2059. **Citrine Quartz**—*oval and rectangular.*
2060. **Smoky Quartz**—*A large oval specimen, pale.*
2061. ,, *a round cut specimen.*
2062. ,, ,,
2063. **Cairngorm or Brown-yellow Quartz, Brazil Quartz**—*of a beautiful deep topaz colour, cut oval.*
2064. **Cairngorm or Brown-yellow Quartz, Brazil Quartz**—*of the same colour as above, cut round, thick.*
2065. **Citrine Quartz or Light-yellow Quartz.**
2066. **Imitation of the same.**

AMETHYSTS.

Among these some are fine large specimens cut in various shapes. There is one cut "*en cabochon*," and another "*en poire*" (pear-shaped).

2067. **Small Amethysts.**
2068. **Amethyst**—*a large specimen.*
2069. **Rock Crystal**—*very pale, with a shade of Amethyst.*

QUARTZ, *varied.*

2070. **Rose Quartz**—*cut "en cabochon."*

2071. **Sealstones**—*four, in one box—Quartz, Citrine Quartz, and Amethyst.*

2072. **Cat's-eye** (a variety of Chalcedonic Quartz)—*eight specimens cut "en cabochon."*

(Not to be mistaken for the true Ceylon Cat's-eye, which is Chrysoberyl).

2073. **Green Aventurine**—*cut into slabs.*

2074. **Imitation of Common Aventurine.**

2075. **Prase** (a green variety of Quartz).

2076. ,, *a small Sealstone.*

2077. **Cat's-eye or Crocidolite**—*a fine stone cut "en cabochon."*

This is probably from the Cape Colony or Germany, and has preserved the name of *Crocidolite*, which belongs to a variety of *Asbestos*; but it is in reality a partly decomposed Crocidolite metamorphosed into Quartz; hence it is no more an Asbestos—it is Quartz.

OPAL.

The precious Opal stands high in estimation, and is considered one of the most valuable gems, the size and beauty of the stone and the variety of the colours determining its value. The best Opals are those of Hungary, and, moreover, they are harder than others.

The so-called "Mountain of Light," in the Great Exhibition of 1851, weighed 526½ carats, and its value was estimated at £4,000 or over £7 10s. per carat.

In Vienna is a precious Opal weighing 17 ozs., from Czernowitza. It is said that a jeweller of Amsterdam offered about £45,000 for it, which was refused. That offer amounted to about £20 per carat.

In Turkey Opals are sometimes sold for the same price as diamonds of equal size.

Small Opals are generally sold from £1 to £1 10s. per carat.
Middle-sized ones ,, £2 to £3 ,,
Larger ones ,, £3 to £5 ,, (Streeter.)

Fine ring or brooch stones bring from £40 to £100, and smaller ones from 5s. to £20 per piece (H. Emanuel).

Opals which appear quite red when held against the light are called by the French *Opal de feu* (Fire Opal) or *girasol.* Good Opals occur in Queensland and near the northern boundary in New South Wales; they are found in a kind of melaphyric rock. The rock being thoroughly penetrated with the silicious matter appears to be sufficiently hard, as it is often taken advantage of, and cut and polished together with the Opal, to the effect of which it helps as a darker background. Some nice cameos mounted as pins are made in that way.*

2078. **Common Opal**—*white, cut*—N.S.W.

2079. **Noble Opals**—*cut, one weighing* $1\frac{6}{10}$ *carat, and another very small.*

2080. „ *a larger one among others.*

2081. **Opal.**

2082. **Uncut Opals**—*some in matrix*—Northern Boundary, N.S.W.

SPODUMENE or TRIPHANE.

Hardness, 6·5 to 7, or between Felspar and Quartz.

2083. **Spodumene**—*Colourless.*

2083 *bis.* „ *Yellowish white.*

ORTHOCLASE FELSPAR.

It is a very soft stone, being below Quartz in the scale of hardness, (say) 6. The finest Moonstones come from Ceylon; the most valued are those which when cut in a very low oval present the silvery spot in the centre.

2084. **Felspar**—*colourless Adularia.*

2085. **Moonstone**—*cut in small "cabochon."*

2086. „ *cut "en cabochon."*

2086 *bis.* **Sunstone** *or Aventurine Felspar, polished and mounted.* (See also Felspars, No. 881.)

OBSIDIAN or VOLCANIC GLASS.

This stone was used to make mirrors by the Romans and by the ancient Peruvians and Mexicans; it is now used for fancy articles and mourning jewellery.

2087. **Obsidian**—*Black Volcanic Glass.*

HYPERSTHENE.

Hardness, 6. Used as ring-stones and brooches.

2088. **Hypersthene**—*Blackish, with bronze violet reflections, cut into a stud.*

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* The Australian Opals are remarkable for their display of colours, the peacock green, fiery, and red, constituting the best qualities. Next come Whitish Opals, semi-opaque, of less value. Opals of medium colours, cut, but very shallow, (say) from $\frac{1}{20}$th to $\frac{2}{20}$ths of an inch (some with matrix left at the back), ranging from $\frac{9}{20} \times \frac{5}{20} \times \frac{2}{20}$ to $\frac{12}{20} \times \frac{17}{20} \times \frac{1}{20}$, will fetch in Sydney about 15s. for such sizes as above, or about 5s. per carat. Smaller Opals will fetch the same price for good colours, and the half for inferior qualities. Fiery Opals of good sizes and deep ($\frac{4}{20}$th to $\frac{6}{20}$ths of an inch in depth) will fetch from 10s. to 15s. per carat. Some of these, from half an inch in diameter to $\frac{14}{20} \times \frac{8}{20}$, are sold for £2 10s (3 to 5 carats) and over. Perfect Opals of the same size and mounted, however, occasionally would fetch from £10 to £20. Being rather brittle, an Opal when mounted has alone a far greater value than unmounted.

The *matrix* or opalized melaphyric rock, in which holes and crevices are filled with nicely coloured and pure opal matter, are much praised, and fetch sometimes a comparatively higher price than pure Opals. I have been shown a good matrix of Opal cut pear-shaped, of nearly $\frac{1}{2}$ inch in diameter and $\frac{18}{20}$th of an inch in length, estimated from £5 to £6, whilst charms and brooches of the same material, of average quality, will come to about 30s. a piece. These prices are far lower than those given by Streeter (1867).

BRONZITE.

Not so valuable as Hypersthene, the hardness being that of glass, 5·5.

2089. **Bronzite**—*gray silky lustre, cut " en cabochon."*

SPHENE.

Sphene is very rarely cut into a gem. It is not valuable enough. Its hardness, 5 to 5·5, is not greater than that of glass.

2090. **Sphene**—*smoky yellow.*

OLIVINE, PERIDOT, or CHRYSOLITE.

It is not much used in consequence of its brittleness. Moreover, it is deficient in hardness and play of colour; but when the stones are large and of good colour, and well cut and polished, it is made into necklaces, &c., with good effect. From its softness, which is little less than glass, it requires to be worn with care, or it will lose its polish. H. Emanuel writes in 1867 about the price of Peridot:—"The value both of the Chrysolite and Peridot is very small; fine specimens of good size may be bought at from 1s. to 15s. the carat. A few years ago they were in tolerable demand for jewellery purposes, when they commanded a much larger price than at present."

2091. **Olivine**—*pale greenish, oval.*
2092. „ *small, pale greenish, various shapes.*
2093. „ *oval.*
2094. „ *oblong octagon.*
2095. „ „
2096. „
2097. „

GARNET and CINNAMON-STONE.

Hardness from 6·5 to 7·5, (say) between Chrysolite and Tourmaline. Garnets are much valued when the colours are rich. The colour should be blood or sherry red, on the one hand, often mixed more or less with blue, so as to present various shades of crimson, purple, and reddish violet; and on the other hand, with yellow, so as to form orange-red and hyacinth-brown.

When Garnets are larger than a nut they are scarcely free from flaws, or sufficiently pure for the purposes of the jeweller.

The most esteemed kinds are called Syrian Garnets, not because they come from Syria, but from Syrian, the capital of Pegu, and formerly the chief mart for the finest Garnets. The colour of the Syrian Garnet is violet-purple, in some rare instances rivalling that of the finest Oriental Amethyst (Corundum), from which it may be distinguished, however, by acquiring an orange tint by candle-light. The Syrian Garnet may be also distinguished from all the other varieties of Garnet in preserving its colour (even when of considerable thickness, and unassisted by foil), unmixed with the black tint which usually obscures the gem. The Bohemian Garnet is generally of a dull poppy-red colour, with a very perceptible hyacinth-orange tint when held between the eye and the light. When the colour is a full crimson it is called Pyrope or Fire-Garnet, a stone of considerable value when perfect and of large size. The best manner of cutting Pyrope is "*en cabochon*," with one or two rows of small facets round the girdle of the stone. The colour appears more or less black when the stone is cut in steps, but when cut "*en cabochon*" the point on which the light falls displays a brilliant fire-red.

Garnet is easily worked, and, when facet-cut, is nearly always (on account of the depth of its colour) formed into thin tables, which are sometimes concave or hollowed out on the under side. Cut stones of this latter description, when skilfully set with bright silver foil, have often been sold for rubies. Good Garnets occur in New South Wales. About the price of Garnet, the only thing found in H. Emanuel's book on Precious Stones (1867) is the following:—"These stones are greatly esteemed in Austria, Transylvania, and Turkey (but not in other European countries), and are sold at very high prices; for a necklace of beads about the size of peas £60 was asked in Vienna."

2098. **Garnets**—*cut.*
2099. „ *rectangular or oblong octagonal.*
2100. „ *cut, of various shapes*—Abercrombie River, N.S.W.
2101. „ *cut "en cabochon."*
2102. „ *cut, of various shapes.*
2103. **Essonite** (a variety of Garnet).
2104. **Green Garnet.**
2105. **Green Garnet.**

TURQUOISE.

Originates from Persia.

Odontolite is fossil bone coloured by Copper, and occurs in cave deposits. By carefully looking at the unpolished surface the fibres which compose the bones become visible. True Turquoise occurs in some sandstone formation, where it forms groups like currant seeds.

A Turquoise of the proper size to fit a ring costs from £10 to £40. A Turquoise of the diameter of a shilling costs about £400. A good Turquoise, sky-blue and oval cut, five lines long and four and a half lines broad, costs about £10; a light blue greenish lustre and oval cut, five and a half lines long and five lines broad, costs about £20. Odontolites reach about half that price. Pale-green Turquoise occurs in Nevada, and impure varieties in Silesia.

Imitations of Turquoise can be distinguished by their glassy lustre, and by examining the unpolished surfaces. In the real stones there are generally minute conchoidal fractures round the girdle, where it has been left rough in order to receive the setting.

2106. **Turquoise**—*three large (one blue, two green), and smaller ones*—PERSIA and other localities.

The two green ones are probably not Oriental Turquoises.

LAPIS LAZULI or ULTRAMARINE.

This mineral is found in crystalline Limestone on the banks of the Indus, and in Granite in Persia, China, and Siberia. It is used in mosaics and in the manufacture of costly vases, as well as a jewel.

"The value of the finest Lapis—of a deep blue, not too dark, without any admixture of white or golden specks—varies from 10s. to 50s. per ounce, according to the size of the piece." (H. Emanuel, 1867.)

2107. **Lapis Lazuli**—*cut, one large oval, two small round.*

CORDIERITE, DICHROITE, or IOLITE.

The transparent variety found in small rolled masses in Ceylon is the *Sapphire d'eau* of the jewellers. It is of a clear white mingled with celestial blue, forming a sort of mixed colour when viewed in different directions, in consequence of its property of dichroism.

2108. **Iolite.**

ZIRCON or HYACINTH.

The name *Hyacinth* is especially reserved to the light variety of Zircon, orange-red passing into poppy-red. Many of the stones used in jewellery under the name of Hyacinth are nothing more than Hyacinth-coloured Garnets, belonging to the variety known as *Cinnamon-stone* or *Essonite.* This false Hyacinth may be readily distinguished from the true gem by difference of specific gravity, that of the Cinnamon-stone being only about 3·6, whilst the specific gravity of the true Hyacinth rises as high as 4·7. It is the heaviest of the gems. Both substances have about the same degree of hardness. Though not much worn at the present time, it is a valuable gem, and makes a superb ring-stone when of a bright tint and free from flaws.

Zircon occur in worn angular pieces, or in small detached crystals, rarely exceeding 6 or 8 carats in weight, chiefly in the sand of a river in Ceylon.

The surfaces of the crystals are smooth, and possess a lustre more nearly approaching that of the Diamond than any other gem. At the present day, though out of fashion and in no request, it is still occasionally sold in Ceylon for inferior diamonds. Zircons occur in New South Wales.

2109. **Zircon**—*reddish.*
2110. „ *light green.*
2111. „ *cut*—Mudgee, N.S.W.
2112. „ *yellow.*
2113. „ *smoky yellow.*

TOURMALINE.

Blue and green Tourmaline are called *Brazilian Sapphire* and *Brazilian Emerald.*

Tourmaline, though classed amongst the least valuable of the gems, is highly prized in Brazil, where it is worn in rings, chiefly by dignitaries of the church. Its hardness is rather greater than Quartz, being 7 to 7·5. A good red Tourmaline (Rubellite) of 5 carats is valued at about £20. (Streeter.)

2114. **Black Tourmaline.**
2115. **Rubellite.**
2116. **Tourmaline**—*two rectangular, one oval ; dark green.*
2117. **Rubellite or Red Tourmaline**—*cut in diamond shape.*
2118. **Black Tourmaline.**
2119. „ „
2120. **Green** „
2121. **Reddish** „

AXINITE.

This stone is seldom cut as a gem. Its hardness is only 6·5 to 7, (say) between Orthose and Quartz. Its colour is not perfect, as even when it is violet it has a shade of brown. Its value consequently is not great.

2122. **Axinite.**

BERYL or AQUAMARINE.

The commercial value of this stone is very small, as it is inferior to the value of Emerald ; the hardness is only a little over the hardness of Quartz. It is sometimes substituted for Topaz, but is not so hard, nor so heavy. It does not become electric by friction as Topaz does.

2123. **Beryl**—*pale blue green ; two oval, one rectangular.*
2124. „ *two crystals uncut*—Berg Milnitza, Alabaschka.

EMERALD.

Its hardness is between that of Tourmaline and Topaz. It occurs in a Mica-schist. When just out of the mine it is very soft. The mines of Muzo, New Granada, were opened in 1864, and leased to a French Company for ten years, at £3,000 per annum.

The price of an Emerald of 1 carat is £4 to £5, of $3\frac{3}{4}$ carats about £60. An Emerald of 6 carats was sold for about £100. (Ure's Dictionary of Art and Manuf.)

H. Emanuel, about Emerald, gives (1867) the following prices:—"The value, when of a deep rich grass-green, clear, and free from flaws, is from £20 to £40 the carat; those of lighter shade are worth much less, the price ranging from 5s. to £15 the carat." It may be added that at that time Emerald was made a fashionable stone in France.

2125. **Emeralds**—*small.*
2126. „ *one ogive, one rectangular, one oval.*
(The largest weighs $2\frac{6}{10}$ carats.)

PHENACITE.

From Siberia.

Resembles Quartz, but is brighter. About the same hardness as Topaz, so that it is not easy to distinguish from White Topaz; its specific gravity is however smaller, that of Topaz being 3·5, whilst that of Phenacite or Phenakite is only 3.

2127. **Phenacite**—*colourless.*
2128. „ „

TOPAZ.

Topaz, though its hardness is marked 8, is softer than Spinel Ruby. Its value is not very great. The Topaz of the Great Mogul, which weighs 157 carats, is estimated by Tavernier at £20,000, (say) about the tenth of a diamond of the same weight.

On Topaz, H. Emanuel says (1867):—"This gem is not in vogue at the present day for the purposes of the jeweller, although fifty years ago it was exceedingly fashionable."

The commercial value of the Topaz as a jewel is consequently entirely fictitious. For optical purposes the rough stones fetch about 5s. to 10s. per pound avoirdupois. The pink Topaz bring considerably more—from 40s. to £20 per ounce, the price depending on the depth of the pink colour.

The most common yellow topaz are from Brazil and from Saxony, the Brazilian ones being much darker, whilst the others are of a light and dull yellow.

Some Brazilian Topaz become red when heated, and preserve that colour ; they are called Burnt Topaz. Topaz becomes electric by friction.

2129. **Topaz.**
2130. „ *light rose.*
2131. „ *colourless.*
2132. „ *light rose, heart-shaped.*
2133. „ „ *oblong octagon.*
2134. „ *white, diamond-shaped, well cut.*
2135. „ *diamond-shaped, dark.*
2136. „ *oval, light colour.*
2137. „ „ *lighter in shade.*
2138. „ *ogive, pale.*
2139. „ *oval rounded, burnt.*
2140. „ *Madeira wine, oval oblong.*
2141. **Blue Topaz**—*rolled, uncut*—Macintyre River, N.S.W.
2142. **White** „ *uncut irregular crystal.*
2143. **Light-blue Topaz**—*uncut.*
2144. **White Topaz**—*rolled crystal.*

SPINEL.

The value of Red Spinel or Spinel Ruby is less than the value of true Ruby (Corundum), as it is not so hard, the hardness of Corundum being 9, and that of the Spinel being marked 8, as well as that of the Topaz, but a little harder than this stone. It is said that when a good Spinel exceeds 4 carats it is valued at half the price of a Diamond of the same weight.

Small Spinels will be worth from 5s. to 10s.
Middle sized „ 20s. to 40s.
Large ones „ 60s. to 100s. per carat. (Streeter.)

The following is extracted from H. Emanuel (1867) :—"The value of the Spinels or Balas Rubies is extremely uncertain and variable. At times they are much sought after for the Eastern markets, and then command a considerable price ; on other occasions they are worth comparatively little. As an instance, a stone weighing 40 carats, of good quality and clear, was sold in 1856 for £400 ; in 1862 it realized by public auction £80, and was lately sold for £240. The present (1867) value of Spinels varies from 10s. to £8 per carat ; but it is impossible to say what the intrinsic worth of this gem may be, or what one would fetch, as the value is fictitious, dependent entirely on caprice and fashion."

2145. **Purple Spinel Ruby**—*over 1½ carat.*
2146. **Spinel Ruby**—*dark-red wine, about ½ carat.*
2147. **Spinel Rubies**—*rough octahedrons, very small.*
2148. **Spinel Ruby**—*pale wine-red, about 2 carats.*
2149. **Pale-blue Spinel**—*violaceous, over 1 carat*—Aker, SWEDEN.
2150. **Dark** ,, ,, *about* $1\frac{2}{10}$ *carat*—Aker, SWEDEN.
2151. ,, ,, ,, *about 1 carat,* Aker, SWEDEN.

CHRYSOBERYL or *True Cat's-eye.*

This is one of the hardest stones. Its hardness is 8·5; Diamond and Corundum (Sapphire, Ruby) being the only stones harder than Chrysoberyl. This stone, as a gem, is remarkable for its peculiar display of colours. It is valuable. According to Streeter a ring-stone is worth from £10 to £100, and there are large stones worth £1,000. (See Alexandrite, No. 414.)

2152 **Alexandrite** (a variety of Chrysoberyl)—*mascled crystal*—Strelinsk, Ural.

CORUNDUM (*Ruby, Sapphire, &c.*)

After Diamond, the Red Sapphire or Ruby is the more valuable, and whilst Blue Corundums occur of large sizes, rubies larger than 8-10 carats are rare. The value of rubies below the weight of one carat range from £2 to £8 per carat. A perfect Ruby above 3½ carats is more valuable than a Diamond of the same weight.

The following list will show the differences of value between Blue and Red Sapphires :—

Ruby.			Blue Sapphire.
Weight.	From Ure's Dictionary.	After H. Emanuel, 1867.	After H. Emanuel.
		£	
1 carat	10 guineas	14 to 20	£20 (the best)
2 carats.........	40 ,,	70 to 80	
3 ,, ...	130 to 150 ,,	200 to 250	
			From Ure's Dictionary :—
4 ,, ...	about 300 ,,	400 to 450	8 guineas.
6 ,, ...	1,000 ,,	....	about 16 ,,
10 ,, ...	....	....	50 ,,
20 ,, ...	....	....	200 ,,

Thus, the largest Sapphire in the collection, weighing about $4\frac{7}{10}$ carats, will not be worth much more than 10 or 11 guineas, whilst a Ruby of the same size would be worth from 400 to 500 guineas. A fine, perfect, evenly-coloured spread Sapphire, weighing one carat, of a deep rich blue colour by night as well as by day, is worth £20; whilst a Sapphire equally fine, of 100 carats, would not be worth more than £2,000 to £3,000. (H. Emanuel.)

In consequence of the greater hardness of Corundum, Oriental Topaz (Yellow Corundum) has a much greater value than a Topaz of equal size. (See No. 2159.)

Oriental Emerald (or Green Corundum), though not so perfect in colour than a good Emerald, has a very great value for the same reason. It is a very rare gem.

2152 *bis.* **Sapphires**—*small, cut*—Ceylon.
2153. **Dark Blue Sapphire**—*the largest, oblong octagon, weigh about* 4 *carats*—N.S.W.
2154. **Sapphires**—*rough crystals, very small*—N.S.W.
2155. ,, *four small, dark blue, cut* ,,
2156. ,, *oblong-shaped*—N.S.W.
2157. **Pale Sapphires**—*four, cut "en cabochon."*
2158. **Sapphires**—*five, various shades.*
2159. **Yellow Sapphire**—*Oriental cutting (irregular)*—Ceylon.
2160. **Sapphire**—*Pale blue, milky.*
2161. **Rubies**—*small, weight of the lot of sixteen, nearly* 3 *carats.*
2162. **Indian Rubies**—*three larger, the other very small.*
2163. **Oriental Topaz**—*two, colourless, cut, very small*—Two-mile Creek, Mudgee.

DIAMOND.

(For weights and other details see the above notes on gems.)

Though some of the cut stones in the collection, as White Topaz, Phenacite, and imitation of Diamond, have a great brilliancy, it is not to be compared with a good Diamond. Among the uncut ones in No. 2165, a flattened crystal of New South Wales, stated to weigh about $2\frac{4}{10}$ carats, is very bright. Others are dull through impurities, some being nearly black, and others yellowish.

2164. * **Diamond Cube**—*gray, non-transparent*—Brazil.
2165. † **Diamonds**—*eleven crystallized, one yellow*—N.S.W.
2166. ,, *eight crystallized; dark* ,,
2167. ,, *one octahedron, one curved sides, one rough*—Cape Colony.
2168. ,, *eight octahedrons, three unshaped*—Cape Colony.
2169. **Imitation of Diamond**—*probably "Strass."*

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* See Collection of Crystals: Isometric System.

† The largest weighs $2\frac{4}{10}$ carats, the smallest, a yellow one, about $\frac{8}{10}$ carat.

A better imitation is made by using *Thallium* instead of Lead. As above stated, it is Lead which imparts to glass its brilliancy, such compounds having a great refractive power. This refractive power is said to be greater in *Thallium* Glass.

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Besides the stones represented in the general collection, there are some imitations represented among the eighty-four specimens forming a special collection, which have not been dealt with in the preceding notes. As for instance, Coral and Pearl. These are not, however, to be included as minerals, as they originate from living organisms. The same could have been said about Odontolites or Turquoise of new formation. (See Turquoise.) They are, notwithstanding, considered as precious stones in the usual language.

JET *and other Black Stones.*

Jet appears to be fossil wood in a high state of bituminization. It occurs in the Upper Lias shale, in the neighbourhood of Whitby, Yorkshire. In 1860 the jet trade of Whitby amounted to £45,000; in 1873 it was more than double. The best hard jet occurs in the lower beds; an inferior soft kind is found in the upper beds. This stone is used for making mourning jewels.

Bog-Oak, which is found in Ireland, is wood impregnated with iron-ore. It is also manufactured into small ornamental articles and jewels, but is of a small value comparatively to Jet.

Hematite, which is Anhydrous Peroxide of Iron, possesses the metallic lustre of steel, and is also cut into ornamental stone, such as buttons, &c. (See No. 2322.)

CORAL.

It is said that in Hindostan Red Coral beads for necklaces are sold, when of large size, by their weight of Silver. This article is represented in the collection of imitations of stones.

The following is taken from H. Emanuel's book (1867):—"The Red Coral, once the most valuable, is now worth far less than the colour which formerly was nearly worthless—the pale delicate pink, similar to that of the inside of a pale rose leaf. Coral of this tint is very valuable; a large bead or drop will realize £30 to £40, and smaller pieces are worth from £120 to £150 the ounce."

PEARLS.

Pearls are extensively fished on the coast of Ceylon; but Pearls of considerable beauty are also found in Scotland, in the rivers Teith, Forth, Dee, Don, Earn, Tay, Tweed, and the rivers of Ross and Sutherland shires. Country people often bring these treasures to town and sell them for prices varying from a few shillings up to £25. Scottish Pearls are easily known from the fine Oriental Pearls; they are of a different shade of colour. Pearls about the size of a pea bring as much as £15 to £25.

The only specimen to be mentioned is an imitation of Pearl in the collection of false stones. This manufacture is extensively carried on in France, where false Pearls are made of the scales of a small freshwater fish called "*ablette.*" False Pearls are also manufactured in Germany and Italy; in the last country from a process invented by Chinese.

(See in the Museum the collection of shells, and especially *Avicula margaritifera*, the large Pearl oyster, a sea-shell, and some other Pearl-producing shells of the fresh waters, especially *Margaritana margaritifera* of the North of Europe and America.)

In 1867, true Pearls of good quality were estimated as follows:—

1 carat	28/- to 35/-
2 carats	£5 to £6
3 ,,	14 to 16
4 ,,	20 to 30
5 ,,	40 to 50
6 ,,	60 to 72
7½ ,,	80 to 100

Larger pearls, if perfect, are rarities of a very great value.

APPENDIX II.

ORNAMENTAL AND LARGE SPECIMENS.

(All in Special Show-cases.)

THESE have been arranged as far as possible in groups, including specimens of the same mineral substance. When information is wanted about the composition, physical properties, or mode of occurrence, people will have to refer to the Alphabetical Table at the end of the Catalogue.

QUARTZ, *and especially* AGATES.

Agates are rarely found forming veins; they are more generally found under the shape of nodules formed by deposition, in geodes of amygdaloids. By the decomposition of amygdaloids, Agates are often set free in alluvial soils, where they are collected at a small expense.

The concentric disposition of the differently coloured layers of silicious matter show that the formation of Agates has been a slow process. That it has been deposited from waters holding silica in solution under heat and pressure is not to be doubted; but the details of the process are the object of different theories, the development of which cannot take place within the limits of these notes.

The principal localities for Agates are the neighbourhood of Oberstein, Palatinate, several localities in Scotland (Scotch pebbles), Cambay in India, Uruguay (Brazilian Agates), and North Queensland.

Oberstein is the chief place where Agates are cut, polished, and worked into ornamental articles. The importance of this trade at Oberstein in 1867 can be estimated from the following figures:—

The Agates shipped from Monte Video and Buenos-Ayres cost from there to Oberstein from 3s. to 6s. per cwt. Uruguay raises an export duty of 6 per cent., and Brazil of 10 per cent. *ad valorem.*

The stones are sold at auction about once a week, and though the prices vary very much according to quality, ordinary Agates may be bought on an average for about 15s. a cwt. In 1867, the auction sales for the year realized a gross sum of nearly £16,000, and the total number of people living on the Agate industry in the neighbourhood of Idar and Oberstein was more than 3,000.

An important branch of the Agate trade is that of artificially colouring the stones. But this art seems to have begun a long time ago. Pliny states, that in Arabia Agates are purified and prepared by being heated in honey for a few days. It is probable that the process did not end there, as the most important changes to be produced in some Agates was the artificial formation of black zones as in onyx, for the purpose of cutting them into white *cameos*, in which the figure may be white on a black ground.

For that purpose advantage is taken of the difference in porosity of the successive layers of the stone. Thus the more porous ones absorb the organic substance, which may be afterwards burnt, by the use of sulphuric acid, or by exposure to heat. It is probable that these processes were the only secrets handed down traditionally for ages by the Italian cameo-workers. Many of the specimens of onyx in the collection ought to have undergone a similar process.

It will necessitate entering into too many details to give the formula of some of the processes used in staining Agates. Let it be said, that in general the colour is obtained by using successively two different chemical substances, which are calculated to give the desired colour as a precipitate.

QUARTZ *of various kinds worked into necklaces.*

2170. **Necklace of Rock Crystal.**

(The cracks are produced by making the crystal hot, and then throwing it suddenly into cold water.)

2171. **Necklace of Rock Crystal**—*artificially stained red.*
2172. ,, **Dark-red Carnelian.**
2173. ,, **Red Carnelian**—*Indian workmanship.*
2174. ,, ,,
2175. ,, **White Carnelian**—*artificially stained green, to imitate Chrysoprase.*
2176. ,, **Onyx**—*black and white.*
2177. ,, **Jasper**—*artificially stained blue.*

COLLECTION OF AGATE SLABS (*Variegated Chalcedony*).

Exhibiting the difference of porosity of the layers, and the process of staining in various colours.

2178. **Specimens** from same blocks as the following, showing its natural colour before being stained—white and gray.
2179. **Specimen**—*stained—chestnut, and dark brown.*
2180. ,, ,, *green and gray.*
2181. ,, ,, *carnelian red and gray, with shade of red.*
2182. ,, ,, *dark brown and black.*
2183. ,, ,, *blue and dark blue.*
2184. ,, ,, *bluish-gray banded, and dark gray.*

It will be seen by the inspection of the above specimens that the white layers in the centre are but slightly altered by the colour, and that the lighter part of the last specimen, being more distinctly white-banded than the others, is probably due to difference in the strength of the solution more than to a slight difference in the relative porosity of the layers, though the last might be the case.

AGATE and CHALCEDONY.

Various ornamental and useful specimens.

2185. **Agate Mortar and Pestle**—*used by chemists for powdering hard substances.*
2186. **Agate Pillars**—*for ornamental block case.*
2187. **Agate**—*three balls on yellow marble block.*
2188. **Bowmen's Guards made of Chalcedony**—*artificially stained.*

AGATES and ONYX (*various specimens.*)

2189. **Onyx**—*studs, links, seals, and buttons. One box.*
2190. **Agates**—*cut and polished. One box.*
2191. ,, ,, ,,
2192. ,, *four in filtrated slabs. One box.*
2193. ,, *one unpolished specimen, cut.*
2194. **Onyx**—*cut and polished. Various shapes. Five specimens.*
2195. ,, *one cut "cameo."*
2196. ,, *three specimens artificially stained. One of them shows hollow left by the removal of Quartz crystals.*

2197. **Agates**—*artificially stained, banded. Four specimens, red and yellow; Four specimens, black and white.*
2198. ,, *two specimens.*
2199. **Moss-Agates**—*eleven various specimens. Markings due to metallic oxides.*

CARNELIAN, SARDONYX, ONYX, and CHALCEDONY.

2200. **Sealstones**—*made of Carnelian and Sardonyx. One box.*
2201. ,, ,, *Onyx* (four Red Carnelians, one White Carnelian, two Carnelian Onyx, one Onyx).
2202. **White Carnelians**—*cut* (one round, six oval, two fancy escutcheon).
2203. **Red** ,, ,, (four specimens).
2204. **Red-banded Carnelian**—*cut* (six specimens).
2205. **Chalcedony**—*cut. Artificially stained yellow, probably with Urane.*
2206. **Lilac Carnelian**—*cut, stained.*

INDIAN CUT AGATES and CARNELIANS.

2207. **Several specimens of cut Agates and Carnelians**—*mostly banded yellow.*
2208. **Two specimens Red Carnelian.**

[This word is also spelt Cornelian, but Carnelian is the true orthography.—*Webster's Dict.*]

JASPER.

The variety of Jasper, the most in use in jewellery and fancy works, is the deep green, with red spots, hence the name Bloodstone, though this name is also given to Hematite, an iron ore, occasionally used as an ornamental stone. The variety of Green Jasper referred to is also called *Heliothrope.* This name is said to have been given to it because, when immersed in water, it was said to make the image of the sun to appear in it of the colour of blood.

Agate-Jasper consists of Jasper, with veinings and cloudings of Chalcedony. *Striped* or *Ribbon Jasper* presents the colours in broad stripes. *Egyptian Jasper* is zoned of brown and yellowish colours.

Jasper is highly prized in China, the Seal of the Emperor being made of it. In Europe its commercial value in the rough is from 1s. to 50s. per lb., depending on the quality, evenness, and colour.

2209. **Heliothrope or Bloodstone**—*specimens, cut.*
2210. **Yellow Jasper**—*two specimens, cut.*

2211. **Heliothrope**—*two small stones, cut into slabs.*
2212. **Various Jaspers**—*cut and polished.*
2213. **Jasper (Heliothrope or Bloodstone)**—*Sealstones.*
2214. „
2215. „ *cut and polished.*
2216. **Agate Jasper**—*of a yellow colour (two specimens).*
2217. **Black Jasper**—*one specimen.*
2218. **Black and Red Jasper**—*one specimen.*
2219. **Red Green and Jasper**—*one specimen.*
2220. **Jasper**—*various, cut and polished.*
2221. **Ribbon Jasper**—*White, Red, and Green bands, cut.*
2222. **Egyptian Jasper**—*six specimens, cut.*
2223. **Spotted Yellow Jasper**—*three specimens, cut.*

AGATE, ONYX, and SARDONYX.

Paper-weights of Agate are worth about 2s. or 3s.

Paper-weights of Onyx from 5s. to 7s.

Large ones from 8s. to 15s.

Cups and dishes of Onyx and Sardonyx fetch, of course, high prices.

A small dish with stand, about 3 inches in diameter, 16s.

An oval dish of pale Sardonyx, about 4 inches, 48s.

A round dish, Carnelian Onyx, 5 inches, 40s.

Small boxes range from 3s. to 8s., and larger ones from 8s. to 17s.

These are about the prices at Oberstein.

2224. **Paper-weight**—*made of Agate, showing zones of Quartz crystal.*
2225. **Large Paper-weight**—*with ball; Onyx.*
2226-7. **Two Oval Paper-weights**—*made of Onyx.*
2228. **Two Paper-weights** (rectangular)—*Onyx.*
2229. **Small Dish**—*made of Onyx.*
2230. **Oval Dish**—*made of pale Sardonyx.*
2231. **Round Dish**—*made of Carnelian Onyx.*
2232-4. **Three Dishes and Cups**—*of various shapes, made of Onyx and Sardonyx.*
2235. **One large Vase of Brown Onyx**—*with stand.*
2236. **One large rectangular Cup**—*without stand, made of Black and White Onyx.*
2237. **Box of Sardonyx.**

2238. **Box of Agate**—*artificially stained blue to imitate Lapis Lazuli.*

2239-41. **Three small boxes of Sardonyx and Onyx.**

ALABASTER.

A Sulphate of Lime and Water.

It is generally white, more or less translucent, and much estimated when of a pure snow-white. Such a variety as occurs at Volterra, in Tuscany, is much used for manufacturing works of art in Florence and Leghorn.

A variety occurs in Derbyshire, which is extensively worked for ornamental purposes. It is usually slightly streaked with red, and is used by the potters to make their moulds. For that use it is known under the name of *Potters' Stone*, and sells at about 9s. per ton.

Of all the Alabasters the Florentine merits the preference on account of its beauty and uniformity. It is also called *Satin-spar*, and found in Gloucestershire, of a pale blue colour. This variety of Gypsum is much used for ornamental purposes, and when cut *en cabochon* and polished it bears a certain outward resemblance to Cat's-eye, but is much softer.

The name Alabaster is also applied to concretions of carbonate of lime formed by deposition or in the way of Stalactites and Stalagmites. Such are the so-called *Oriental Alabaster*, *Algerian Onyx*, *Onyx Marble*, *Gibraltar Stone*, *Californian Marble.*

2242. **Ornaments made of Satin-spar or Alabaster**—*one cross, two necklaces, two eggs.*

2243. **Two Candlesticks of Alabaster**—Derbyshire, ENGLAND.

2244-5. **Four Candlesticks**—*smaller* ,, ,,

2246. **Two large Vases**—Derbyshire, ENGLAND.

2247. **Two wineglass-shaped Vases**—Derbyshire, ENGLAND.

2248. **Two short-shaped Vases** ,, ,,

2249. **Two small Cups with Saucers** ,, ,,

FLUOR-SPAR.

The violet Fluor-spar, improperly called by miners "Blue-John," has been obtained from Tray Cliff, near Castleton, Derbyshire. The beautiful colour of the natural Fluor-spar has been successfully imitated by exposing some of the common varieties to heat.

There are in the collection handsome vases of Fluor-spar, which are of a genuine colour, from Castleton.

2250. **Large Vase of Fluor-spar**—*with enclosed Galena, in a stand of black marble.*

2251. **Large Vase of Fluor-spar**—*smaller than the above.*

2252-4. **Three small Vases of Fluor-spar.**

2255-7. **Three small Cups of Fluor-spar.**

2258. **Violet Fluor-spar**—*with Quartz*—Alston, Cumberland.

2259. ,, ,, ,, ,,

2260. ,, *in large crystals, with Quartz*—Alston, Cumberland.

2261. **Honeycombs**—*left by decomposed Fluor-spar, with Quartz and Galena*—Alston, Cumberland.

2262. **Fluor-spar**—*one face polished*—Castleton, Derbyshire.

2263. ,, *with Pyrites, &c.* ,, ,,

CHRYSOPRASE.

An apple-green variety of Chalcedony, the colour of which is due to oxide of Nickel.

Prase is not the same; it is of a dull leek-green, and its colour is due to Amphibole.

This stone is made into brooches, rings, bracelets, seals, snuff-boxes, cane-heads, &c. It should be cut *en cabochon*, as it is spoiled if cut in facets, and appears to most advantage by candle-light. Chrysoprase is apt to loose its colour and to become dark and clouded if kept in a dry warm situation, or if it be long exposed to the light of the sun; but the colour may be restored by keeping the stone in a damp place.

2264. **Small Dish made of Chrysoprase**—*cost* 30s.

JASPER.

2265. **Paper-weight of Brownish Jasper**—*with light veins.*

2266. ,, **Red-veined Jasper.**

2267. ,, **Variegated Brownish and Yellowish Jasper.**

ANTIQUE MARBLES.

2268. **Sarcophage of Antique Marbles**—*very rare.*

Basin of deep red marble with grayish veins. Stand of yellow variegated marble.

2269. **Two Vases of Antique Marbles**—*very rare.*

Cup of deep red marble, with grayish veins. Column of light yellow, with darker veins. Foot formed of two square blocks,—one black, the other variegated green.

LIMESTONE.

2270-1. **Two Concretions of impure Limestone**—*presenting the accidental appearance of a leg and of a foot*—Lincolnshire.

2272. **Concretion of Limestone**—*polished specimen, exhibiting fissures filled with crystallized Calcite*—Lincolnshire.

2273. **Concretions of impure Limestone**—*from the lias*—Lincolnshire.

2274. **Two Stalagmites**—Castleton, Derbyshire.

2275. **Stalactites**—*incrustations on stones*—Castleton, Derbyshire.

2276. ,, *semi-transparent.*

2277. **Limestone**—*coralliferous.*

2278. **Two Polished Slabs of Encrinitic Limestone.**

2279-2304. **Twenty-six Specimens of Marble**—from Derbyshire and Devonshire.

2305. **Stalactites of Limestone.**

2306. **Limestone**—*coralliferous, cut and polished in the shape of eggs.*

SERPENTINE, FIGURE-STONE, &c.

2307. **Serpentine**—*spotted variety, representing two snakes.*

This variety exhibits the peculiar colour and spotted appearance which made the name Serpentine to be given to the stone.

2308. **Eleven Specimens of Serpentine Slabs**—from Cape Lizard, Cornwall.

2309. **Vase of Serpentine.**

The Vase is of green Serpentine, and the pedestal of red and gray Serpentine, from Cape Lizard, Cornwall.

2310. **Vase of Serpentine**—from Cape Lizard, Cornwall.

2311. **Official Chinese Seal made of Agalmatolite.**

2312. **Vase made of Jade**—fixed pieces (flowers, &c.), of stained Agalmatolite. Base of jet, Chinese work.

PORPHYRY.

2313. **Vase made of Violet Porphyry**—*white spotted*—SWEDEN.
2314. **Large Vase of Porphyry.**
2315. **Napoleonite or Orbicular Porphyry of Corsica or Obicular Diorit-Porphyry**—*in polished slabs.*

This Porphyry is formed of Hornblende (green or greenish black) and Felspar (white).

QUARTZ, *and varieties.*

2316. **Apple made of cut Quartz**—*Japanese work.*
2317. **Seal-handle made of Quartz.**
2318. **Small oval Dish of Chrysoprase**—30*s.*
2319. **Box of Agate**—*artificially stained blue, to imitate Lapis Lazuli.*
2320. **Brooch-stone of Chalcedony**—*artificially stained to imitate Chrysoprase.*

MISCELLANEOUS ORNAMENTAL STONES.

2321. **Rhodonite**—*cut and polished, egg-shaped.*
2322. **Hematite**—*cut and polished into buttons.*

LARGE CRYSTALS.

2323. **Apatite**—*a very large crystal*—CANADA.
2324. **Beryl** ,, New Hampshire.
2325. **Quartz**—SWITZERLAND.
2326. **Calcite**—ICELAND.
2327. **Rock Salt**—Stussfurth, GERMANY.

COAL.

2328. **Coal**—Labuan, BORNEO.

GRAPHITE.

2329. **Graphite**—CEYLON.

OIL SHALES.

2329 *bis.* **Two large blocks of Oil Shale** (at the entrance of the first floor, New Wing, Room No. 7 of the plan)—Hartley, N.S.W.
2330. **Torbanite** (a variety of Oil Shale)—Torban Hill, SCOTLAND.

MISCELLANEOUS SPECIMENS.

2331. **Apatite**—*large crystal, white, earthy*—Snarum, NORWAY.
2332. **Hydroapatite**—*with Hornblende* ,, ,,
2333. **Orthite**—*or Cerium Epidote*—Fahlun, SWEDEN.
2334. **Allanite** ,, Snarum, NORWAY.
2335. **Pyrolusite**—*in Geode*—Siegen.
2336. **Chalybite**—*Citrate of Iron.*
2337. **Fluor-spar**—*group of specimens*—Cumberland and Derbyshire.
2338. **Labradorite** ,, Labrador.
2339. **Geode of Quartz**—Hamm, near Siegen.

MALACHITE.

2340. **Geode of Malachite**—*splendid specimens in a special case*—Peak Downs, QUEENSLAND.

SUPPLEMENT.

8*a*. **Graphite**—*on green crystalline rock*—Piconderoga.
10*a*. **Anthracite**—Pennsylvania.
36*a*. **Ozokerite**—Boryslaw, Galicia.
38*a*. **Amber**—Baltic Coast.
44*a*. **Schraufite**—*a fossil resin*—Buckowina, AUSTRIA.
45*a*. **Albertite**—Hillsborough, Albert Co., New Brunswick.
55*a*. **Native Sulphur**—SICILY.
64*a*. ,, *with corroded Aragonite*—SICILY.
78*a*. **Crystallized Rock Salt**—Kalush, Galicia.

144*a*. **Celestite**—*with Sulphur*—Girgenti, SICILY.

231*a*. **Calcite**—*a beautiful specimen*—St. Louis, U.S.
238*a*. **Aragonite**—Girgenti—SICILY.
286*a*. **Dolomite or Pearl-spar**—St. Louis, U.S.

316*a*. **Gypsum or Selenite**—Grand Rapids, Michigan.
332*a*. **Apatite**—*two-pointed crystal*—CANADA.

400*a*. **Corundum**—U.S.
411*a*. **Pleonaste**—U.S.
423*a*. **Wavellite**—Arkansas.
428*a*. **Svanbergite**—Lofstrand, SWEDEN. *Chemical composition*—Phosphate, with Sulphate of Alumina, Lime, Soda, &c.
429*a*. **Herderite**—*with a micaceous mineral*—Stoneham, Maine. Probably an Anhydrous Phosphate of Alumina and Lime, with Fluor.
429*b*. **Herderite**—Stonehenge, Maine.
433*a*. **Cryolite**—*with Siderite, Copper Pyrites, and Galena*—West Greenland.
433*b*. **Pachnolite** (a variety of Cryolite containing Lime and Cryolite)—West Greenland.
433*c*. **Hagemannite, Fluoride of Calcium and Aluminium**—West Greenland.
433*d*. **Nocerina**—*in volcanic bomb*—Vesuvius. *Chemical composition*—Fluoride of Calcium and Magnesium.

433*e*. **Nocerina**—*in volcanic bomb, with Mica*—Vesuvius.
469*a*. **Smoky Quartz**—Colorado.
475*a*. **Quartz**—*two-pointed crystals*—NEW CALEDONIA.
477*a*, *b*. **Rose Quartz**—New York Co.
489*a*. **Green Chalcedony**—Uruguay.

501*a*. **Agate**—*polished*.
501*b*. „ *showing Quartz in the centre.*
501*c*. **Onyx**—*polished*—Mexico.
529*a*. **Hydrophane** (a variety of Opal)—Vorosvagas, Hungary.
532*a*. **Opal**—*in matrix*—Queensland Border, N.S.W.
551*a*. **Wood Opal**—*fossil wood*—California.
552*a*. **Geyserite**—Wyoming.
556*a*. **Muscovite or Potash Mica**—Orange Co., U.S.
556*b*. „ Orange Co., U.S.
596*a*. **Jeffersonite**—*remarkable crystals*—New Jersey.

623*a*. **Actinolite or Actinote**—NEW CALEDONIA.
625*a*. „ *with Talc*—Rhode Island.
641. See No. 2315 of the Catalogue.

700*a*. **Garnet**—*forming a rock, with Mica and Glaucophanite*—NEW CALEDONIA.
700*b*. „ —*forming a rock, with Mica and Chlorite*—NEW CALEDONIA.
739*a*. **Biotite** (a variety of Mica)—New York Co.
739*b*. „ *a large specimen* „
750*a*. **Phlogopite** (a variety of Mica)—Warwick, New York Co.
756*a*. **Margarodite** (a variety of Muscovite, on Quartz)—Bergan Hill, New Jersey.
768*a*. **Talc**—Maryland.
777*a*. **Pyrophyllite**—North Carolina.
777*b*. „ Zermatt, SWITZERLAND.
799*a*. **Hydrotalcite**—New Jersey.

800*a*. **Bowenite** (a variety of Serpentine)—Rhode Island.
810*a*. **Serpentine and Chrysotil or Fibrous Serpentine**—Montville.
823*a*. **Jefferisite**—Chester Co., Pennsylvania.
826*a*. **Ripidolite** (a variety of Chlorite)—Pennsylvania.
829*a*. **Protovermiculite**—*a decomposed product*—Magnet Cove, U.S. Related to Vermiculite. The last mineral is so named from its peculiar mode of exfoliation before the blowpipe. *Chemical composition.*—Silica, Magnesia, Alumina, and Water. Hexagonal. Micaceous structure.

833*a*, *b*. **Masonite or Chloritoid**—Rhode Island. *Chemical composition*—Silica, Alumina, and Water. Monoclinic. Very closely related to the Micas, especially to Margarite. It includes several other varieties.

835*a*. **Aglaite**—*alteration of Triphane*—Goshen, Massachusetts.

845*a*, *b*. **Wernerite**—Connecticut.

845*c*. ,, *a remarkable crystal*—St. Lawrence Co.

879*a*. **Amazon-stone or Amazon Felspar**—Pike's Peak, Colorado. Colour due to an organic salt of iron, according to König; to copper according to others.

879*b*. **Amazon-stone**—Pike's Peak, Colorado.

881*a*. **Sunstone** (a variety of Orthoclase)—Pennsylvania.

903*a*. **Orthoclase**—*with Tourmaline and Quartz*—Elba.

903*b*. ,, Fleims, Tyrol.

903*c*. ,, Hirschberg, Silesia.

904*a*, *b*, *c*. **Microcline** (a triclinic variety of Orthoclase)—Colorado. ωικρος, *small*; κλινω, *I incline*, in consequence of its mode of cleavage. *Chemical composition.*—As Orthoclase. Triclinic, while Orthoclase is monoclinic. Besides very near Orthoclase in form and habit, twinning, &c. A large part of Potash Felspar is in fact Microcline. Here belong the Chesterlite, from Chester, Pennsylvania, the beautiful Amazon-stone from Peake's Peak, Colorado; as also that of other localities, &c. The Perthite of Canada is in part Microcline.

904*d*. **Microcline** (variety Chesterlite)—Pennsylvania.

904*e*. ,, *with Quartz*—Colorado.

904*f*. See No. 928, page 77 }
904*g*. See No. 929, page 77 } Wrongly placed.
904*h*. See No. 930, page 77 }

906*a*. **Obsidian or Volcanic Glass.** It is vitreous Felspar.

915*a*. **Zygadite** (a variety of Albite)—Andreasberg.

927*a*. **Labradorite**—Coast of Labrador.

948*a*. **Disthene or Cyanite**—North Carolina.

975*a*. **Apophyllite**—*in Copper Sandstone*—Lake Superior.

983*a*. **Natrolite**—*on Diorite*—Bergan Hill.

1033*a*. **Stilbite or Desmine**—Gibbisbach, Wallis, SWITZERLAND.

1034*a*. **Epistilbite**—*with Stilbite*—ICELAND.

1034*b*. ,, ICELAND. It is an hydrous silicate of Alumina, Lime, and Soda.

1054*a*. **Aerinite**—*a Silicate of Alumina, Iron, &c., of indefinite composition*—Aragon, SPAIN.

1059. **Datolite**—*on Diorite*—Bergen Hill.

1082*a*. **Black Tourmaline**—*with Mica.*

1082*b*. **Brown** „ *a remarkable specimen.*

1097*a*. **Chondrodite**—*with spinel and magnetic pyrites, in Calcite*—New Jersey.

1111*a*. **Beryl**—North Carolina.

1123*a*. **Helvite**—*in Gneiss, with Blende, Calcite, Quartz, and Fluor-spar*—Schwarzenberg, Saxony.

1123*b*. **Helvite**—*in Rhodonite?*—Kapnick, Hungary. Helvite is a silicio-sulphide of Manganese and Glucina. It has also been placed among Manganese minerals.

1123*c*. **Melinophane**—*in Zircon Syenite*—Brevig, NORWAY.

1135*a*. **Allanite**—Amherst, Co. Virginia.

1135*b*. „ „ „

1154*a*. **Xenotime**—Hitteröe, SWEDEN—*a Phosphate of Yttria and Cerium.*

1157*a*. **Columbite**—Middleton, Connecticut.

1161*a*. **Zincite**—*Red Oxide of Zinc*—Hamburg, New Jersey.

1161*b*. **Artificial Oxide of Zinc.**

1172*a*,*b*. **Zincblende**—Leadhill, SCOTLAND.

1177. The specimen contains the rare metal Indium.

1183*a*,*b*. **Zincblende**—*on Dolomite*—Binnenthal.

1199*a*,*b*. **Kapnite** (a variety of Smithsonite)—Altenberg.

1211*a*. **Calamine**—*Silicate of Zinc*—Moresnet, near Aix-le-Chapelle.

1216*a*. „ *on granitoid rock*—New Jersey.

1216*b*. „ New Jersey.

1217*a*. „ *in small crystals on honeycombed quartz, with copper pyrites and malachite*—SPAIN?

1226*a*. **Manganese Oxide**—*on quartz leader*—Galarino, NEW CALEDONIA.

1237*a*. **Braunite**—Ilmenau, Thuringia.

1241*a*. **Lithiophorite** (a variety of Psilomelane containing Lithium)—Ringersdorf, Silesia.

1241*b*. **Manganese Oxide**—*in quartz breccia*—Tangil, Gippsland.

1242*a*. **Rhodochrosite**—Oberneisen, Nassau.

1245*a*. „ —*mammillated*—Dietz, Nassau.

1256. **Helvine or Helvite**—*containing also Glucina*—Saxony.

1257*a*. **Meteoric Iron**—*polished, showing the Widmanstætten figures or markings of crystallization*—Augusta Co., Virginia.

1266*a*. **Magnetite or Lodestone**—Arkansas.

1274*a*. **Hematite**—*large crystals*—Elba.

1274*b*. „ Elba.

1275*a*. **Micaceous Hematite**—Michigan.

1286. **Hematite**—*a remarkable pseudomorph, after scalenohedron of calcite*—Sundwig, near Iserlohn, Westphalia.

1287*a* **Franklinite**—*a remarkable crystal*—Hamburg, New Jersey.

1287*b*. „ *with Zincite*—Hamburg, New Jersey. *Chemical composition*—Peroxides of Iron and Manganese, with Oxide of Zinc. Isometric, also granular or massive. Lustre, metallic. Colour, iron-black, opaque. Hardness, 5·5–6·5. Specific gravity, 5·09.

1310. **Limonite**—*in copper-bearing rock.*

1312*a*. „ *Pseudomorph, after Iron Pyrites*—Elba.

1313. „ „ *after Ilmenite.*

1313*a*. „ „ *after Siderite*—Knappenberg.

1314. „ „ *after Calcite.*

1314*a*. **Clayey Hematite**—Bohemia.

1315*a*. **Limonite**—Michigan.

1315*b*. „ *probably auriferous*—Cerra de Pasco.

1315*c*. „ *Iridescent ; probably auriferous*—Cerra de Pasco.

1315d. „ *granular, slightly magnetic and chromiferous*—NEW CALEDONIA.

1315*e*. **Melanosiderite**—Pennsylvania. Considered as a Silicious Limonite by Genth ; as a true Silicate of Iron by Cooke.

1334*a*. **Pyrites**—*massive ; probably auriferous*—SPAIN ?

1334*b,c*. „ *cubic*

1334*d*. „ *grouped crystals.*

1338*a*. **Mispikel or Arsenopyrite**—*with Galena and Pearl Spar.* This mineral, although placed in the Arsenic Class in consequence of being an ore of Arsenic, ought to be also represented in the Iron Class.

1361*a*. **Siderite or Chalybite**—*with Mesitite and Pyrrhotite*—Brazil. **Mesitite** is a Carbonate of Magnesia and Iron isomorphous with Siderite.

1361*b*. **Siderite**—*with Cryolite*—GREENLAND.

1361*c*. „ *with Galena.*

1368*a*. **Dufrenite**—*Hydrous Phosphate of Iron and Manganese*—Virginia.

1374*a*. **Ludlamite**—Wheal Jane, Cornwall.

1384*a*. **Glaucodote**—*Hemitrope*—Hakansbo, SWEDEN.

1384*b*. „ „ „

1385. **Earthy Cabalt Bloom**—GERMANY.

1394*a*. **Millerite**—*on Dolomite or Pearl-spar*—St. Louis, Missouri.

1407*m*. **Konarite**—*a Silicate of Nickel, &c.*

1407*n*. „ **and Rœttisite**—*Silicates of Nickel, &c.*—Roettis, Voigtland.

1407*x*. **Alloy of Nickel and Iron with Carbon**—*from the smelting of New Caledonian Nickel Ore at Noumea.*

1409*a*. **Tin Ore**—*white ; from lode*—Cornwall.

1456. **Tin Ore**—*grayish ; from alluvial*—Cornwall.

1539*a*. **Wiserine** (a variety of Octahedrite)—*with Magnetite*—Alp Lerchelting, Binnen.

1547*a*. **Rutile**—North Carolina.

1547*b*. **Brookite**—Arkansas.

1569*a*. **Lederite** (a variety of Titanite)—Renfrew, CANADA.

1573*a*. **Chromite or Siderochrome or Chrome Ore**—Baltimore, U.S.

1575*a*. **Molybdenite**—Skhmolen, SWEDEN.

1576. **Wolfram**—Eastpool Mine, Cornwall.

1578*a*. ,, *with Pyrites, Quartz, and Dolomite*—Felsobanya, HUNGARY.

1591*a*. **Uranocircite**—*yellow green ; contains Baryta*—Bergen, near Falkenstein, Saxony.

1591*b*. **Zeunerite**—*Hydrous Arseniate of Copper and Uranium*—near Schneeberg, Saxony.

1595*a*. **Arsenolite**—*artificial, with Realgar*—Andreasberg. (*See* No. 1600.)

1596*a*. **Voglite**—Joachimsthal, Bohemia.

1600. **Realgar**—*artificial, with Arsenolite*—Andreasberg.

1620*a*. **Nadorite**—Province of Constantine, ALGERIA. Named from the locality Djebel Nador. *Chemical composition*—Antimony, Lead, Oxygen, and Chlorine.

1650*a*. **Emplectite**—Tannenbaum Mine, near Schwarzenberg, Saxony.

1650*b*. ,, ,, ,, ,,

1650*c*. **Bjelkite**—*Sulphide of Bismuth and Lead*—Nordmarken, Wermland.

1654. **Walpurgite**—*is an Arseniate of Bismuth and Uranium.*

1657*a*. **Galena**—UNITED STATES.

1658*a*. ,, *remarkable Crystals*—Joplin, Missouri.

1659. ,, *with faces of the Octahedron and Cube*—Much, GERMANY.

1661*a*. ,, *with Tetrahedrite.*

1685. ,, *Pseudomorph after Pyromorphite*—Kaltenbach, near Berncaster.

1701*a*. **Cerussite**—Nertschinsk, SIBERIA.

1747*a*. **Jordanite**—*a large Crystal on Sphalerite (blende), with Hyalophane and Baryta Celestite*—Binnenthal, SWITZERLAND. Hyalophane is near Orthoclase and Monoclinic ; it contains Baryta.

1840*a*. **Enargite** (variety of Tenantite)—N.S.W.

1841*a*. **Whitneyite**—*Arsenide of Copper*—Houghton, Lake Superior.

2278–2304. These specimens are square wall slabs, except two rectangular slabs of encrinitic Marble from Derbyshire. Fourteen specimens from Derbyshire consist of Encrinitic, Coralline, Gray, and Black **Marbles.** Twelve specimens from Devonshire consist of Yellow and Red and Varied Marbles.

2242*a–k*. These eleven specimens consist of Green, Red, and Varied **Serpentines**, from Cape Lizard, Cornwall. They form part of the above collection of ornamental stones.

ALPHABETICAL TABLE.

SYDNEY:
THOMAS RICHARDS, GOVERNMENT PRINTER.—1885.