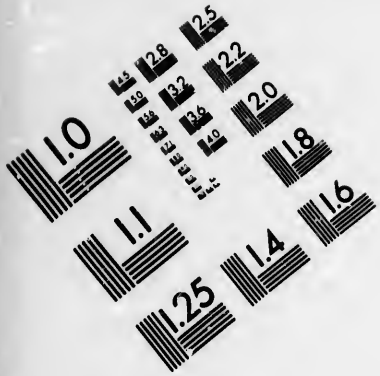

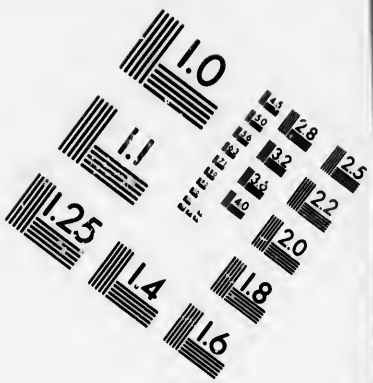

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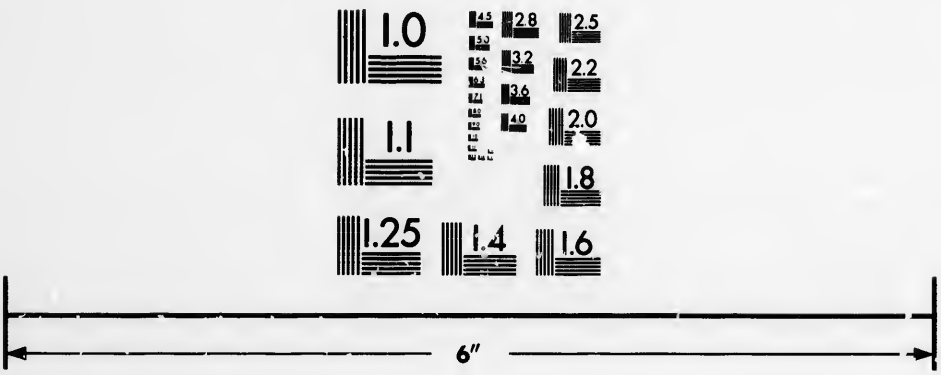

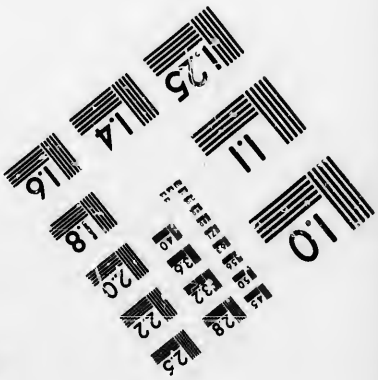

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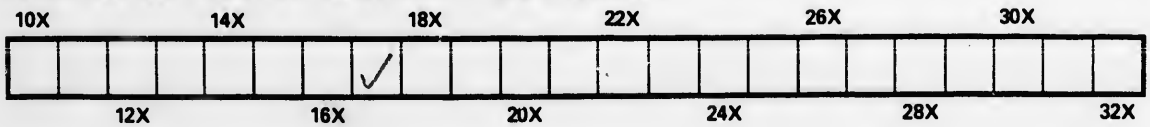

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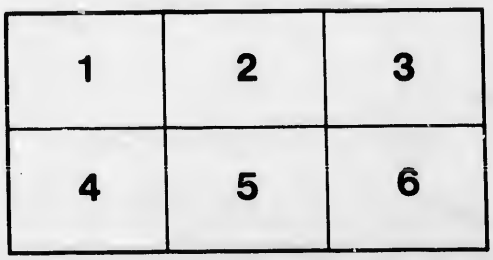

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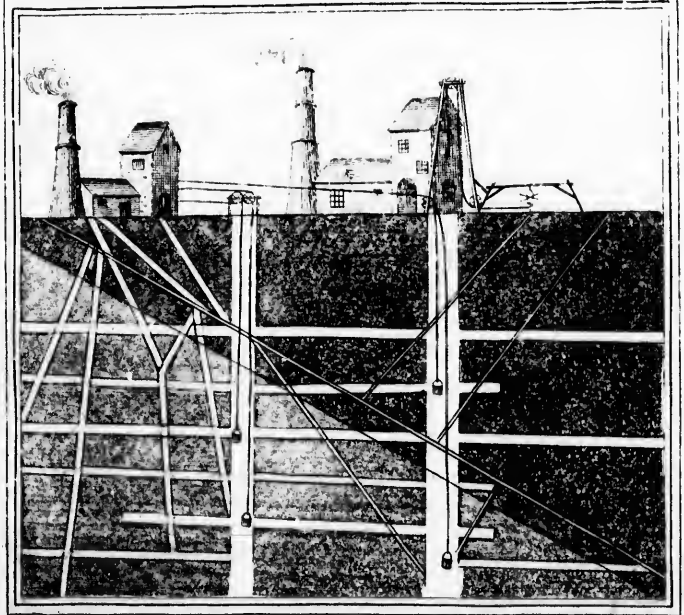

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To the Victoria College
with the Author's Respects

AN

INTRODUCTION

TO THE STUDY OF

MINERALOGY,

Or Students Pocket Companion.

BY

JOSEPH BACKWELL, ESQ.

HALIFAX:

Printed by EDMUND WARD, No. 4, Cheapside.

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PREFACE.

AMONG the various indications of a mind susceptible of attaining general knowledge, appears that which consists in the delight afforded by the study of Mineralogy ; and it has been my endeavour as much as possible, to present to the learner, a compendious view of the importance of that science. The proprietor of estates, the artisan and manufacturer, may all make it subservient to their respective pursuits and interests. I shall therefore give a brief description and concise explanation, by which a knowledge of this science may be formed ; without fatiguing the mind or distracting the attention, with the enumeration of its endless varieties.

Mineralogy is a science of modern date,—has within a short time made rapid advances,—and has now become a subject of general interest ;—it must therefore be considered as a necessary branch of education. These circumstances have attracted the attention of some of our first writers, to whom we are much indebted for an acquaintance with this science. Kirwan, whose System of Mi-

neralogy excited very general attention ; Dr. Kidd, who has distinguished himself ; Dr. Jamieson, Dr. Thomson, Murray, Aikin, Klaproth, Mawe, Brookes, Phillips, Williams and many others, have contributed largely towards its advancement.

It is not my intention, to occupy the time of my readers with a long Preface to this small Work ; but I shall conclude by expressing a hope,—that the simple experiments which are described in the following pages, may interest and instruct the student ; and that the object of compiling it,—namely, to promote an acquaintance with an elegant and refined pursuit, will meet with the approbation and support, of the liberal and accomplished portion of the community.

Halifax, March 1, 1826. J. BACKWELL.

AN

INTRODUCTION

TO THE STUDY OF

MINERALOGY.

I SHALL endeavour to explain what is meant by Fossils or Minerals, and to instruct the learner how to distinguish one substance from another ; Minerals may be defined to be bodies destitute of life and organization, and they are dispersed in the earth and on its surface ; and are commonly deposited in what are termed veins, which when worked are called Mines, whether at a great depth or in the alluvial soil. A distinct piece is denominated a specimen, and a number of substances a collection. Mineralogy is the science which has for its object the knowledge of the properties of Minerals, and to arrange and describe them. It is true that this science is not marked with those distinguishing laws, that are the leading features of the sister sciences ; yet a general knowledge of it may be attained with little difficulty ; and although the learner may find the path at first obscure, yet when that is once removed, a brilliant display of useful knowledge will be opened.

By attending to the following directions, considerable progress may be made in a short time, and students will afterwards be enabled to instruct themselves. I will endeavour to point out the most easy method for the learner, who may possess a few minerals, to discover their properties, and to determine what they are. Suppose I have a

piece of lead-ore or shining yellow pyrites, or rock-crystal (quartz,) or calcareous spar; those substances are the most common and generally met with. In the first place, how am I to know that this specimen is lead ore? Secondly, or this yellow pyrites which resembles gold? Thirdly, or this rock-crystal? Fourthly, or this calcareous spar?

In reply to the first,—observe its blue colour, and remark its great weight, in both of which it resembles common lead. Break a small piece, and notice the fragments and other metallic lustre; it will be soft if cut with the knife* and brittle, or if a bit the size of a pea be placed on a piece of charcoal, and the flame of the blow-pipe be applied, it will instantly discharge sulphureous vapours, and in less than half a minute melt into lead; leaving white and yellow powder upon the charcoal. Lead forms an insoluble compound with sulphuric acid, and hence that acid is sometimes used to detect the presence of this deleterious metal; a solution of sulphurated hydrogen is sometimes used as a test for lead. Lead generally contains a portion of silver, and it is mostly found in limestone. Ores of lead are white, green, yellow, red, &c. and may be dissolved in diluted nitric acid, and precipitated by zinc, which will become coated with the lead.

Secondly.—Shining yellow pyrites, commonly called Mundic, may be very readily distinguished from any other substance it may resemble, by the application of the knife or hammer; endeavour to cut the specimen, and if it is gold, it will be soft, and yield easily to the knife like lead; or if struck with the hammer it will be indented. Gold being maleable, and pyrites on the contrary is brittle and hard. Also, if a piece be placed on charcoal and acted upon by the flame of the blow-pipe, if it be

* The knife is indispensable in the examination of minerals to discover the hardness, brittleness, &c.

gold it will melt, and retain its yellow colour; while pyrites will generally decrepitate, and burn with a faint blue flame, emitting sulphur; and be reduced to a dark coloured scoria, that will be attracted by the magnet, and proves that pyrites is a combination of sulphur and iron. There is another way, which is by employing the aid of chemistry.—Put a few pieces into a glass tube, with a little nitric acid, and hold it over the flame of a candle until it boils; if it be gold no alteration will take place. But if it be pyrites, considerable agitation and change of colour will occur; which shews that the substance has been dissolved more or less by the acid. If the solution be thrown into a glass of water, and a few drops of prussiate of potass be added, the liquid will assume a blue colour; the iron contained in the pyrites being dissolved by the acid and held in solution, and is precipitated by the test in the form of Prussian blue; after which the waters again becomes perfectly clear.

Thirdly,—How am I to know that this is rock crystal? Apply the point of a knife; and if it makes no impression, it may be suspected to be quartz. Rock crystal when pure, is perfectly transparent; but it is subject to specks and flaws. It occurs generally in six-sided prisms, terminated by a short pyramid; when not crystallized, it has the appearance of a piece of broken glass, but it is not so heavy; its fracture is generally shining and uneven,—often curved; the fragments are short and irregular; heat has no effect on it, unless it be reduced to a fine powder and mixed with potass or soda, when it melts and forms glass. This substance and calcareous spar are common in mining districts, and are frequently combined together.

Fourthly,—How shall I know that this is calcareous spar, or (calc spar.)? What is called spar is one of the most common productions in the mining counties of England, and is generally considered to be a brittle shining

substance.—Spar is not a very definite term, as crystal or quartz is often called spar. There are also other varieties; adamantine spar, feld-spar, &c. To know if the specimen is calcareous spar (carbonate of lime,) apply the point of the knife, and if it is brittle and easily acted upon, and produces a white powder, we may consider it to be lime. It may also be known by placing a few pieces on a hot fire shovel, when it will become opaque and burn to lime; which may be known by its styptic taste, or by falling to powder with a hissing noise, when a piece is dropped into a glass of water. Calcareous spar has a smooth, glasslike, shining surface; it effervesces with acids, even with strong vinegar, when reduced to powder; if transparent, it has the property of presenting two images of an object seen through it, whence it has been called double refracting spar. This effect may be seen by placing a pin underneath it, when the two images will appear more or less distant from each other.

GOLD.

What is the nature of Gold, and how am I to know this metal from yellow pyrites? Gold is of a light yellow colour, inclining to red; is the heaviest of all metals except platinum; is not very elastic nor very hard; has neither taste nor smell. It possesses less tenacity than iron, copper, platinum, or silver; and very few metals have more lustre. When gold is alloyed with other metals it may be easily detected, put a small piece in a glass tube and pour nitric acid upon it; then hold it over the flame of a candle, until red fumes (nitric vapours) arise. If it be pure gold, the liquid will not become discoloured; but if it be pyrites, or brass &c. which resemble gold be mixed with it; the acid will become turbid, green and black, discharging bubbles of air. After the ebullition has ceased and the residue is washed with water; then, if more acid

be poured upon it, the same effect will be observed; if this be repeated till all effervescence ceases, it will leave the gold pure; the reason of this is, that nitric acid dissolves iron, brass, copper, &c. but has no effect upon gold, which can only be dissolved by nitro muriatic acid.

PLATINUM.

Platinum is generally found in grains in a metallic state; it is of a white colour and resembles silver, and may be easily known from its hardness and weight; the strongest of the pure mineral acids has no effect upon this metal, neither has the greatest fire, unless it be urged by a stream of oxygen gas. This metal may be melted by a burning lens, or dissolved in chlorine or nitro muriatic acid. If mixed with arsenic and then exposed to a great heat, it fuses readily. Platinum may be distinguished from all other metals, by adding a solution of muriate of ammonia to a solution of the metal in nitro muriatic acid, when a red-coloured precipitate will instantly appear, and may always be known by its superior specific gravity,—it being the heaviest body in nature.

SILVER.

Silver cannot be mistaken after having once been examined; it yields to the knife being a little harder than lead. There are eleven different ores of Silver, besides several sub-species:—Native silver, auriferous silver, antimonial silver, arsenical silver, bismuthic silver, corneous silver-ore, compact sulphuret of silver, brittle silver-glance, or antimonial sulphuret of silver, red silver-ore, white ditto, and carbonate of silver, or grey silver ore. It may be ascertained whether an ore contains silver, by pulver-

izing it and dissolving it in nitric acid, and afterwards adding a little muriatic acid. If it contains silver, the muriatic acid will instantly combine with the whole of it; and precipitate it from the nitric solution in white flakes of muriate of silver. If muriate of lead be mixed with it, the whole of the precipitate must be digested in diluted nitric acid, which will dissolve the lead, without acting upon the muriate of silver. In order to know the quantity of silver contained, it must be heated red and then weighed; every hundred grains of this precipitate, will contain seventy-five grains of pure silver.

Many ores of silver, frequently combine with other metals; the following experiments will detect its presence: if it be rich ore it will be soft to the knife, and melt with little difficulty under the blow-pipe; and by repeated fusion with borax the silver may be produced; the combinations will be driven off by heat or mixed with the borax, forming a slag. If the ore contains a large portion of copper, which is sometimes the case, it will show itself in melting, by colouring the borax green and burning away with a green flame, if the heat be continued. It may be precipitated from the solution, by immersing a rod of iron, which will become coated with metallic copper. Sulphur, arsenic, antimony, and bismuth are easily evaporated; the two former may be detected by the smell, bismuth, leaving a yellow-white oxide.

MERCURY.

How am I to know it in the natural state? Quicksilver cannot be mistaken. In the temperature of our atmosphere it is a white fluid metal, having the appearance of melted silver. In this state it has neither taste nor smell, and is so extremely divisible, that it may be strained, by moderate pressure, through the pores of leather.

It is the heaviest of all metals except platinum and gold, it is the only metal found in a fluid state, and is sometimes discovered in sand-stone, in semi-indurated clay, and other earthy productions; it sometimes occurs in globules attended with a red substance. The best ores are called cinnabar, and when rich are extremely heavy compared with iron;—it is of a light or brown red colour; some are dull and others bright and shining; rich ore may be known by the weight, or from the knife leaving a deep red streak, or by exposing a piece to the flame of the blow-pipe; when the mercury will exhale in white fumes which may be condensed on a plate of gold or bright copper, held over the vapour, when it will assume a silvery appearance and become bright by rubbing, and the mercury can only be removed by burning it off. I know of no better way of ascertaining the purity of mercury, than by mixing it with an equal weight of iron filing and distilling it, the mercury may be distilled like water.

COPPER.

Copper is found in various parts of the world and in great variety. This metal is not uncommon in its native state, and in this state it is generally found massive in different forms, in veins &c. There are different kinds of copper ore, which will be found more or less hard to the knife, the best being the softest. By placing a piece of it on some charcoal with a little borax, and directing the flame of the blow-pipe upon it; the ore will soon melt, and if rich will be formed into pure copper, colouring the borax green, and sometimes brown, and green and brown. There is another very easy method of detecting the copper; reduce the ore to powder, put it into a glass tube with a little nitric acid, the ore will soon be dissolved by the acid; then add a little water, and dip the point of a knife or a piece of clean iron in the solution, it will

become coated with copper. Copper ore dissolved in nitric acid, when diluted with water may be precipitated with iron, and in this way copper can be extracted from the ores; the gray ore is generally the richest. All ores contain more or less sulphur, iron, and other metals combined with it. The carbonates of copper are the most beautiful metal; their colours are green and azure-blue of various shades. Whenever we meet with a mineral of a blue or green colour, we may suspect the presence of copper, which may be detected by the blowpipe or the nitric acid. Phosphates of copper are of a dark green colour with black spots, and may be known by their easy fusion and leaving a brown slag. Muriate of copper when applied to the flame of the blowpipe, shews a beautiful blue colour, and afterwards an emerald-green. Ores of copper, if combined with arsenical acid or arsenic, may be known by being easily fused and giving vapours which smell of garlic. I have met with a black copper ore, very much like coal or petrified wood in Nova Scotia; this ore will yield from twenty-six to thirty per cent. of pure copper, and may be detected by applying the acid, I have also met with a gray ore, that will yield from fifty to eighty per cent. and in another part of the Province very pure copper.

IRON.

Ores of Iron shew themselves in great abundance, in different parts of England and Wales, and in many other parts of the world. I have not met with any better iron ore than I have seen in Nova Scotia, and have found some of the ore to contain from eighty to ninety three per cent. of pure Iron. There are many different kinds of Iron ore: that which is most common in England is clay Iron-stone, this I consider to be a deposit, as it often contains vegetable impressions. Iron is generally found near

coal, the presence of Iron may be detected by the reaction on the magnet; but this is not always the case, until it has been heated by the flame of the blowpipe and the sulphur driven off. Prussiate of potash is the usual test for iron ; when added to a liquid which contains iron, it will cause a blue precipitate ; if the iron be in the state of peroxide ; but if it is partially oxidized the precipitate will be gray. Succinate with precipitate of ammonia will precipitate oxide of Iron from its solution.

Pyrites is the most abundant of the Minerals ; it is of a yellow colour sometimes crystallized in brilliant groupes and detached cubes, &c. it occurs massive and is a combination of sulphur and iron, and is often found in fine particles in limestone, coal, and spar ; and it is found in almost every mine. Jasper and clay sandstone frequently contain this metal, which gives them their red and yellow colour ; the more the iron is decomposed, the more we find those substances becoming deeply tinged with brown or yellow.

The *hamatites* are of a red, black, or brown colour, kidney shaped, of fibrous or radiated structure ; they are very heavy, and have often a polished metallic appearance. There are other varieties of iron, micacious and common specular iron ore, loadstone, &c The beautiful ore from Elba presents itself in crystalized groupes of bright colours and of the greatest splendour.

The carbonate of Iron. Its colour is some shades of brown, and has generally a glistening pearly appearance, very unlike metal ; it is also found in chalybeate waters ; and such waters may be known by the dark orange coloured film which appears on the surface. The oxide of Iron is rendered soluble by an excess of carbonic acid.—This may be shewn by adding a few grains of quick lime to a small quantity of this water ; the lime will combine

with the carbonic acid, and the oxide of Iron will be precipitated. There is a combination of alumina iron, and silica ; this is found in native masses, and forms what is called emery.

Flaematite. This mineral is composed of 94 oxide of iron, 3 of silica, 2 of water, and 1 of lime ; and is used for making burnishers, &c.

MANGANESE.

There are five kinds of Manganese,—fibrous gray, manganese ore, radiated gray, foliated gray, compact gray and earthy gray. Manganese in its appearance is earthy brown or black ; it soils the finger, and frequently contains delicate fibres of a bright iron like lustre. Another kind is of a metallic appearance, and heavy ; it is soft to the knife, and may be distinguished from other minerals. The presence of manganese may be discovered, by putting a small portion pulverized into a glass tube, and adding a little muriatic acid, and holding it over the flame of a candle If it contains manganese, it will occasion a disengagement of gas, which may be known by its suffocating odour, and by its discharging the colour from printed linen, previously moistened and held over the fumes. A small piece of manganese placed on charcoal, with ten times its bulk of borax and fused with the blowpipe, forms a globule of a violet colour ; and if suffered to cool and is gently remelted, the colour will have vanished ; by again melting it with a little nitre, it may be reproduced ; this will be seen by drawing it while in a fluid state into fibres, and it cannot be reduced to a metallic state by the blowpipe. There is no doubt but their beautiful colours are given to amethysts, and other gems by manganese. Calcareous spar and quartz, derive their pink colour from manganese ; it is of the first importance in making glass, in

bleaching, and in glazing black earthenware. A violet colour may be given to flint-glass, by melting it with a large portion of the black oxide of this metal.

TITANIUM.

This metal is seldom found ; it resembles copper in colour and has great lustre, but is easily tarnished by exposure to the air ; it occurs under a variety of forms, and in crystals of a brown or red colour, sometimes it is imbeded in rock crystal ; it is as delicate as hair, and is sometimes called Venus hair. It is sometimes found wedgeshaped and if melted by the blowpipe with borax or alkali, it forms a hyacinth red transparent glass. Menacharite is oxide of iron, oxide of titanium, oxide of manganese and silica ; it may be fused by the blowpipe with borax, and tinges the borax a green inclining to brown colour, and is affected by the magnet, and sometimes found with sand resembling gunpowder.

COBALT.

The ores of cobalt consist of several kinds, some of which are rich and yield a great quantity of colouring matter, used for painting and enameling ; some specimens of this ore resemble lead ore, but are much harder to the knife ; this ore commonly contains arsenic, some of the ores are of a whitish gray colour, and metallic lustre, sometimes approaching to black. Some of the ores are found of a peach blossom red colour ; and others of a dark earthy and various colours. If a small piece be placed under the flame of the blowpipe, it gives out a copious arsenical vapour ; afterwards if it be reduced to powder, and a little borax melted with it, a deep coloured

blue glass will be produced; this ore may be fused with eight times its weight of soda, and brought into a metallic state. Nitrous acid is used for dissolving Cobalt; when the ore is dissolved, precipitate the iron by adding ammonia, and it may be separated from the solution by filtering; if nickel is mixed with the ore, it may be precipitated by adding a solution of potash, and can be separated in the same way as iron.

ZINC.

Zinc is one of the most abundant of metals, if we except iron; there are various kinds of ore, blind or black jack, and calamine; blende is black, brown or yellow,—sometimes crystalized; it is soft to the knife and produces a white powder, some specimens are yellow, and when rubbed with a pin will yield phosphorescent sparks. These ores are not so hard or heavy as tin, and may be known by a strong flame of the blowpipe; blende evaporates in white flakes. Calamine is earthy, and sometimes found not unlike bone; the weight will always lead to the detection of its metallic nature.

Zinc may be known by dissolving it when pulverized in mineral acid, and will be precipitated with ammonia, which will be of a white colour, sulphurated hydrogen added to this metal, will produce a lasting white precipitate; water will act on this metal, but slowly at the temperature of our atmosphere. This metal may also be dissolved with nitric acid, and precipitated with ammonia; the presence of zinc may also be known by mixing it with filings of copper and melting it before the blowpipe, which will form brass. There is a considerable quantity of sulphur in blend, and if this ore be made use of it must be heated first to drive off the sulphur.

TIN.

Tin generally occurs in granite stone and never in lime-stone and is hard to the knife; there are different specimens of tin, some are called stream tin and wood tin; this metal is soluble in all the mineral acids, and may be precipitated by potash; nitro muriate of gold is the best test for tin, added to a solution which forms a fine purple precipitate.—Tin is one of the oldest metals, and is often combined with copper, with blende and flaur; but never with lead, or calcareous spar. It is sometimes found in clay-slate and primitive rocks &c.

ANTIMONY.

This metal presents but few varieties; it sometimes occurs in long thin crystals, not unlike needles and of iridescent colours; it has a shining bright appearance, very much resembling lead ore, and occurs sometimes of a dull metallic gray colour, composed of acicular fibres; some is covered with a yellowish ochre, arising from decomposition. Antimony is soft to the knife and so brittle that when exposed to the flame of the blowpipe it melts instantly, and appears as a dark slag or scoria burning away in white fumes.

BISMUTH.

This metal is generally combined with sulphur, and expands as it coals; it is called by workmen tin-glass from its brittleness. This ore is generally found in veins in mountains, sometimes it is found in mica slate and clay slate, the oxide or (subsalt) of this metal, has

been used by ladies for whitening the skin. This metal when exposed to the flame of the blowpipe, will instantly melt into a white globule ; if the heat be continued it will leave a white deposite on the charcoal, eight parts of it with five of lead and three of tin mixed together, will melt in boiling water. Tea spoons have been made of this alloy, and will melt in hot tea.

TILLUNIUM.

Is a white shining mineral, not much unlike antimony; it is easily fused and shews a strong vapour. This metal will combine with its weight of sulphur, producing a mass the colour of lead. There are different kinds of ore, the black ore is generally rich with gold. Tillunium is soft to the knife, the gold may be obtained by melting it with borax ; some of the ores are steel gray, and burn with a green flame ; these ores are soluble in nitric and nitromuriatic acids, and are decomposed by water.

NICKEL.

Is a fine white metal and difficult to melt ; and is strongly attracted by the magnet. There is a great portion of arsenic combined with this metal, though it is capable of being dissolved in nitric acid. The most of these ores are combined with arsenic and sulphuret of iron. Nickel is hard and of a dark colour, similar to the ores of copper, easily scratched with the knife and heavy. Copper alloyed with nickel forms a compound metal resembling gold and is called petit ore.

ARSENIC.

Is a brilliant metal of a blue-white colour, and is easily tarnished ; the ore is found combined with acids, sulphur and oxigen ; it may be known by its rapid volatilization, and by the strong smell of garlic when heated ; some specimens are of a scarlet or orange red, and yellow colour ; it will melt in the flame of a candle. In its pure state it is brittle and very soft, and exhales white fumes when thrown on any thing red hot.

TUNGSTEN.

Is found of various colours, plumb-blue, pearl-gray, green and ash gray, green and yellow-white, and yellow-gray, red, and yellow brown, &c. It crackles before the blowpipe and becomes opaque, but does not melt without the addition of borax, which forms opaque white glass, the pure metal is hard and of a steel colour, and may be known by its great weight.

URANITY or URAN-MICA.

Its colours are grass-green, emerald-green, siskin-green and sulphur-yellow ; it occurs sometimes in flakes, and may be dissolved in nitric acid, of a lemon yellow colour; it decrepitates before the blowpipe and is of a brass yellow colour. This ore is extremely heavy, there is another ore that is black pitch like, and is accompanied with ochre.

TANTALUM OR CALUMBIUM.

Its colours are green and brownish-black; it is of a shining or glistening lustre, resinous, inclining to the semi-metallic adamantine; it is as hard as feldspar, and is brittle and insoluble before the blowpipe with glass of borax; and without borax it suffers no change except in lustre.

I have thus given a short account of the Metals, and it is not my intention to enter fully into the varieties of the different minerals in this small Work; but to give the learner some idea how to distinguish one mineral from another, I shall now give some account of the leading earthy and stony substances which are very numerous; will be impossible for me to enter largely into the explanations of those minerals. I shall first consider

THE DIAMOND.

The common colours are white and gray, sometimes they are found yellow-white, blueish-gray, greenish gray, and sometimes found blue, red, brown, yellow and green. Diamond when rubbed shews positive electricity; and becomes phosphorescent when exposed to the rays of the sun. The Diamond acts very extraordinarily in cutting glass;—however thick the glass is, it frequently separates in the operation; any other substance will only scratch it. The rock-crystal compared with the Diamond is only two thirds the weight, the diamond cannot be acted upon by a file, or by the lapidary's wheel, except with diamond powder; which is not the case with any other substance.

LAPIS LAZULI.

This mineral is of a rich blue colour and is susceptible of a very fine polish, it will scratch glass ; its color is said to be occasioned by the blue sulphuret of iron. Ultramarine is made from the native production.

GARNET.

The colour is dark-red, cherry-red, brownish-red, blue-red or red inclining to yellow ; it will melt before the blowpipe into a black scoria,

AGATE.

This is a hard stone and can only be cut with diamond powder, it will receive a high polish ; there are various kinds and colours. Agate is said to have first come from Sicily, and to have taken its name from the River Achate.

CERIUM.

Its colour is of a brownish-black, and red-brown, it is a mineral not much known and has been lately discovered ; it is hard to the knife and easily frangible, it froths before the blowpipe, and melts imperfectly into a black scoria ; acids have little effect on this metal.

CHROMIUM.

This is a beautiful and rare mineral; when this metal is pure, it is white and brittle ; it is in a slight degree magnetic and takes a good polish, and is not liable to change by exposure to the atmosphere ; and requires an intense heat to melt it. The only acid that acts on this mineral, is nitro-muratic acid, and this acts but slowly.

JASPER.

Jaspers are of various colours, red, brown, green, yellow, &c. They are tough and difficult to break, and contain a great portion of Iron.

CHALCEDONY.

Chalcedony is often found on the sea shore, it is of a close texture, and of a pale white-blue colour, and is often marked with white lines, and resembles white cornelian.

TOPAZ.

The name Topaz is derived from Topazos, a small island in the Red Sea ; the principal colours are pale yellow, yellowish white, greenish white, &c. it is harder than quartz or emerald, and softer than corundum ; it is easily frangible.

LIME.

Lime-stone is of various colours, brown, redish-brown, yellow-gray, greenish-gray, &c. It dissolves with effervescence in acids. Lime contains a great portion of carbonic acid; it consists of lime, carbonic acid, silicia, alumina, iron and water. It may be known by burning it, or by applying a little muriatic acid, which will act readily upon lime.

GYPSUM OR SULPHATE OF LIME.

Its colours are white, yellowish, redish or greenish white, blueish, &c. it is soft, sectile, and easily frangible. All varieties of Gypsum, when exposed to heat, are deprived of the water that it contains, and fall into powder; which when mixed with water, will very soon harden by being exposed to the air. It consists of lime, sulphuric acid and water.

COAL.

There are many varieties of Coal; I shall first name the cannel coal, the colour is between velvet and greenish black. It is brittle and easily frangible; and is harder than gypsum. This coal will receive a good polish, and is often made into snuff-boxes, &c.

FOLIATED COAL.

This coal is generally black, it is softer than cannel

coal and not very brittle ; it is very easily frangible, and is generally found with slate coal, and may be distinguished by its resplendent lustre, it frequently falls into pieces by the action of the weather, and will often catch fire.

SLATE COAL.

This coal is very soft, the streak is shining and the most frangible of all coal.

FIBROUS BROWN COAL.

The colour of this coal is dark, and pale, blackish-brown, sometimes approaching to redish ; it is soft and burns with a clear flame, and causes a bituminous smell ; it will not give a great heat.

SLATY GLANCE COAL.

The colour is dark iron black, and when exposed to a strong heat, it burns without flame ; it is void of sulphur or bitumen.

CALUMNAR GLANCE COAL.

This Coal will burn without flame or smoke. There are many other varieties of coal, which I shall not at present point out.

SPECIFIC GRAVITIES.

Platina, purified			20 . 336
Gold,			19 . 258
Mercury at 30 deg. of heat,			13 . 619
Silver,			10 . 474
Lead	11 . 352	to	11 . 445
Bismuth,	9 . 756		9 . 822
Nickel,	7 . 000		9 . 000
Copper,	7 . 788		8 . 878
Brass,	7 . 600		8 . 800
Cast Iron			7 . 207
Bar do.			7 . 788
Steel			7 . 833
Cobalt,	7 . 645	to	7 . 811
Tin,	7 . 170		7 . 291
Zinc,			7 . 190
Manganese	6 . 850	to	6 . 990
Antimony,	6 . 624		6 . 860
Arsenic,			8 . 310

THE DIFFERENT DEGREES OF HEAT

At which the Metals are Fused.

	Fahr.	Wedgwood
Cast Iron melts at	17977	160
Welding heat of Iron	13427	95
Fine Gold melts at	5237	32
Silver do.	4717	28
Copper do.	4587	27
Brass do.	3807	21
Mercury boils at	600	
Water	212	

THE FLUXES USED IN ASSAYING

THE DIFFERENT MINERALS.

SILVER ORE.

Red Tarter, Red Lead, Nitre, Borax.
Lime, Salt, Flaur Spar,

SILVER WITH COPPER.

Red Tarter, Nitre, Lime,
Red Lead, Flaur Spar,

COPPER ORE.

The Copper must be first calcined.

Borax, Lime, Red Tarter
Nitre, Glass, Flaur Spar,
Salt, and sometimes Sulphur.

TIN ORE.

Culm, Borax.

LEAD ORE.

Red Tarter, Borax, Salt, Lime.
Nitre, Flaur Spar,

CLASSIFICATION OF MINERALS.

METALS.

Platina	Titanium	Nickel
Palladium	Lead	Arsenic
Iridium	Chrome	Tungsten
Gold	Zinc	Tantelum
Mercury	Tin	Cerium
Silver	Bismuth	Cadmium
Copper	Tellurium	Selenum
Iron	Antimony	Wodanum.
Manganese	Molybdena	

EARTHY MINERALS.

Diamond	Felspar	Dolomite
Zircon	Clay-slate	Limestone
Ruby	Mica	Apatite
Schorl	Lithomarge	Flur
Garnet	Soapstone	Gypsum
Quartz	Talc	Boracite
Pitchstone	Hornblende	Barytes
Zeolite	Chrysalite	Strontian
Azurestone	Basalt	Hallite

SALINE MINERALS.

Alum	Sulphate of Soda
Epsum Salts	Reussite
Alkaline Salts	Rock Salt
Salts of Soda	Borax
Natron	Native Boracic Acid

SALTS OF AMMONIA.

Muriate of Ammonia,	Sulphate of Ammonia,

METALLIC SALTS.

Sulphate of Iron	Sulphate of Copper
Sulphate of Zinc	Sulphate of Cobalt

INFLAMMABLES.

Sulphur	Graphite
Bitumen	Resin
Coal	Retin Asphalt

MOH's

MINERAL SYSTEM, IN 1804.

CLASS I.—EARTHY MINERALS.

1 Diamond Family	16 Mica Family
2 Zircon	17 Trap
3 Chrysaberyl	18 Lithomarge
4 Augite	19 Bale
5 Garnet	20 Talc
6 Spinel	21 Actynalite
7 Hardstone (Hartstein)	22 Limestone
8 Schorl	23 Brown Spar
9 Quartz	24 Marl
10 Opal	25 Aphatite
11 Obsidian	26 Flaur
12 Zeolite	27 Gypsum
13 Feldspar	28 Baryte
14 Clay	29 Saltstone
15 Clay Slate	

Class II.—SALINE MINERALS.

30 Family of Carbonats
31 Family of Nitrats.
32 Family of Muriats
33 Family of Sulphats.

Class III.—INFLAMMABLE MINERALS

34 Sulphur Family
35 Amber Family
36 Coal Family
37 Graphite Family.

Class IV.—METALLIC MINERALS.

38	Family, Native Gold	49	Family of Iron earth
39	Mercurial Ores	50	Manganese
40	Native Silver	51	Manakan
41	Silver ores	52	Lead ore
42	Native Copper	53	Tinstan
43	Copper Pyrites	54	Cobalt
44	Malachite	55	Cobalt ochre
45	Copper emerald	56	Earthy Cobalt
46	Native iron	57	Native Arsenic
47	Iron pyrites	58	Antimony ores
48	Iron stone.	59	Uranium ores.

WERNER'S

MINERAL SYSTEM, IN 1815.

CLASS I.—EARTHY FOSSILS.

1. DIAMOND GENUS.

1. Diamond.

2. ZIRCON GENUS.

Zircon Family.

2. Zircon
3. Hyacinth
4. Cinnamon-stone.

3. FLINT GENUS.

Augite Family.

5. Chrysoberyl
6. Chrysolite
7. Olivine
8. Coccolite
9. Augite
   a. granular
   b. foliated
   c. conchoidal
   d. common
10. *Baikalite*
11. Sahlite
12. Diopside
13. *Fassaite.*

Garnet Family.

14. Vesuvian
15. Groussulare
16. Leucite
17. *Pyrenite*
18. Melanite
19. Allochroite
20. *Colophonite*
21. Garnet
    a. Precious
    b. Common
22. Staurolite or Grenatite
23. Pyrope

Ruby Family.

24. Automalite
25. Ceylanite
26. Spinel
27. Sapphire
28. Emery
29. Corundum
30. Diamond-spar

31. Topaz

Beryl Family.

32. Iolite
33. Euclase
34. Emerald
35. Beryl
    a. Precious beryl
    b. Common
36. Schorlous Beryl
37. Tourmaline

Pistacite Family.

38. Lievrite
39. Pistacite
40. Diaspore
41. Zoisite
42. Anthophylite
    a. Radiated
    b. Foliated
43. Axinite

Quartz Family.

44. Quartz
  a. Amethyst
    Common
    Thick fibrous
  b. Rock crystal
  c. Milk quartz
  d. Common quartz
  e. Prase
45. Iron-flint
46. Hornstone
  a. Splintery
  b. Conchoidal
  c. Woodstone
47. Flinty-slate
  a Common
  b. Lydian-stone
48. Flint
49. Chalcedony
  a. Common
  b. Cornelian
    Common
    Fibrous
50. Hyalite
51. Opal
  a. Precious
  b. Common opal
  c. Semi-opal
  d. Wood-opal
52. Menilite
  a. Brown menilite
  b. Grey menilite
53. Jasper
  a. Egyptian jasper
    Red
    Brown
  b. Striped jasper
  c Porcelain jasper
  d. Common jasper
    Conchoidal
    Earthy
  e. Opal jasper
  f. Agate jasper
54. Heliotrope
55 Chrysoprase
56. Plasma
57. Cat's-eye
58. *Faser Kiesel*
59. Elaolite.

Pitchstone Family.

60. Obsidian
61. Pitchstone
62. Pearlstone
63. Pumice

Zeolite Family.

64. Prehnite
  a. Fibrous
  b. Foliated
65. Natrolite

66. Zeolite
  a. Mealy Zeolite
  b. Fibrous do
  c. Radiated Zeolite
  d. Foliated do.
67. Ichthyophthalm
68. Cubicite
69. Cross-stone or Crucite
70. Laumonite
71. Schmelztein

Azurestone Family.

72. Azurestone
73. Azurite
74. Blue-spar.

Felspar Family.

75. Andalusite
76. Felspar.
  a. Adularia
  b. Labrador
  c. Glassy
  d. Common felspar
    Fresh
    Disintegrated
  e. Hollow spar
  f. Compact felspar
    Common
    Variolite
77. Spodumene
78. Scapolite
  a. Red scapolite
  b. Grey scapolite
    Radiated
    Foliated
79. Meionite
80. Nepheline
81. Ice-spar.

4. Clay Genus.

Clay Family.

82. Pure clay
83. Porcelain earth
84. Common clay
  a. Loam
  b. Potter's clay
    Earthy
    Slaty
  c. Variegated clay
  d. Slate clay
85. Claystone
86. Adhesive slate
87. Polishing or polier slate
88. Tripoli
89. Floatstone
90. Alum-stone

Clay Slate Family.

91. Alum-slate
    a. Common
    b. Glossy
92. Bituminous shale
93. Drawing-slate
94. Whet-slate
95. Clay-slate

Mica Family.

96. Lepidolite
97. Mica
98. Pinite
99. Potstone
100. Chlorite
    a. Chlorite earth
    b. Common chlorite
    c. Chlorite-slate
    d. Foliated chlorite

Trap Family.

101. *Paulite*
  2. Hornblende
     a. Common
     b. Basaltic
     c. Hornblende-slate
103. Basalt
  4. Wacke
  5. Clinkston
  6. Iron-clay

107. Lava

Lithomarge Family.

108. Green earth
109. Lithomarge
     a. Friable
     b. Indurated
110. Rock-soap
  11. Umber
  12. Yellow earth

5. Talc Genus.

Soapstone Family.

113. Native magnesia, or talc-earth
114. Meerschaum
115. Bole

116. Fuller's earth
117. Steatite
118. Figurestone

Talc Family.

119. Nephrite
  a Common nephrite
  b. Axe-stone
120. Serpentine
  a. Common
  b, Precious
    Conchoidal
    Splintery
121. Schillerstone
122. Talc
  a. Earthy
  b. Common
  c. Indurated
123. Asbestus
  a. Rock-cork
  b Amianthus
  c. Common asbestus
  d. Rock-wood

Actynolite Family.

124. Kyanite
125. Actynolite
  a. Asbestous
  b. Common
  c. Glassy
  d. Granular
126. *Spreustein or Chaff-stone*
127. Tremolite
  a. Asbestous
  b. Common
  c. Glassy
128. Sahlite
129. *Rhœtizite*

6. Calcareous Genus.

A. *Carbonates.*

130. Rock-milk
131. Chalk
132. Limestone
  a. Compact
    Common
    Roestone
  b. Foliated
    Granular
    Calcareous-spar
  c. Fibrous
    Common
    Calc-sinter
  d. Pea-stone
133. Calc-tuff
134. Schaum-earth, or foam earth
135. Slate-spar

136. Brown-spar
a. Foliated
b. Fibrous
137. Schaalstone
38. Dolomite
39. Rhomb-spar
40. *Anthracolite*
41. Stinkstone
42. Marl
a. Marl earth
b. Indurated marl
43. Bituminous marl-slate
44. Arragon
a. Common
b Prismatic

B. *Phosphates*

45. Appatite
46. Asparagus stone

C. *Fluates.*

47. Fluor
a. Compact
b. Fluor-spar

D. *Sulphates.*

148. Gypsum
a. Spumous Gypsum.
b. Earthy gypsum
c. Compact gypsum
d. Foliated gypsum
e. Fibrous gypsum
149. Selenite
150. Muriacite
a. Anhydrite
b. Gekrostein
c. Conchoidal Mur.
d. Fibrous Mur.
e. Compact Mur.

E. *Borates.*

151. Datolite
152. Boracite
153. Botryolite

7. Baryte Genus.

154. Witherite
155. Heavy-spar
a. Earthy heavy-spar
b. Compact heavy-spar
c. Granular heavy-spar
d. Curved lamellar heavy-spar
e. Straight lamellar heavy-spar
Fresh
Disintegrated
f. Columnar spar
g. Prismatic spar
h. Bolognese, or Bolognian spar.

8. Strontian Genus.

156. Strontian
  a. Compact
  b. Radiated
157. Celestine
  a. Fibrous
  b. Radiated
  c. Lamellar
  d. Prismatic

9. Hallite Genus.

158. Cryolite.

Class II.—FOSSIL SALTS.

1. *Carbonates.*

159. Natural Soda or natron
  Fibrous
  b. Lake-salt
162. Natural sal-ammoniac.

2. *Nitrates.*

160. Natural nitre

3. *Muriates.*

161. Natural rock-salt
  a. Stone-salt
  Foliated

4. *Sulphates.*

163. Natural vitriol
164. Hair-salt
165. Rock-butter
166. Natural Epsom-salt
167. Natural Glauber-salt

Class III.—INFLAMMABLE FOSSILS.

1. Sulphur Genus.

168. Natural sulphur.
  a. Crystallised
  b. Common
  Earthy
  Conchoidal
  c. Mealy
  d. Volcanic

2. Bituminous Genus.

169. Mineral or fossil oil
170. Mineral pitch
  a. Elastic
  b. Earthy
  c. Slaggy.
171. Brown coal
  a. Bituminous wood
  b. Earth coal
  c. Alum earth
  d. *Paper coal*
  e. Common brown coal
  f. Moor coal
172. Black coal
  a. Pitch coal
  b. Columnar coal
  c. Slate coal
  d. Cannel coal
  e. Foliated coal
  f. Coarse coal

3. Graphite Genus.

173. Glance-coal
  a. Conchoidal
  b. Slaty
174. Graphite
  a. Scaly
  b. Compact
175. Mineral charcoal

4. Resin Genus.

176. Amber
  a. White
  b. Yellow
177. Honey stone

Class IV.—METALLIC FOSSILS.

1. Platina Genus.

178. Native Platina.

2. Gold Genus.

179. Native gold
  a. Gold yellow
  b. Brass yellow
  c. Greyish yellow

3. Mercury Genus.

180. Native mercury
81. Matural amalgam
  a. Semi-fluid
  b. Solid
82. Mercurial horn-ore
83. Mercurial liver-ore
  a. Compact
  b. Slaty
184. Cinnabar
  a. Dark-red
  b. Light-red

4. Silver Genus.

185. Native silver
  a. Common
  b. Auriferous
186. Antimonial silver
87. Arsenical silver
88. *Molybdena-silver*
89. Corneous silver ore, or horn-ore
190. Silver-black
91. Silver-glance
92. Brittle silver-glance
93. Red silver-ore
  a. Dark
  b. Light
94. White silver-ore

5. Copper Genus.

195. Native copper

Family of copper Sulphurets.

196. Copper-glance
  a. Compact
  b. Foliated
97. Variegated copper-ore
98. Copper-pyrites
99. White copper ore
200. Grey copper-ore
201. Black copper-ore

202. Red copper-ore
  a. Compact
  b Foliated
  c. Capillary
203. Tile ore
  a. Earthy
  b. Indurated
204. Azure copper-ore
  d. Earthy
  b. Indurated or radiated
205. *Velvet copper-ore*
206. Malachite
  a. Fibrous
  b. Compact
207. Copper-green
208 Ironshot copper-green
  a. Earth
  b. Slaggy
209. Emerald copper-ore
210. Copper mica
211. Lenticular-ore
212. Oliven-ore
213. Muriat of copper
214. Phosphat of copper.

6. Iron Genus.

215, Native iron
216. Iron pyrites
  a. Common pyrites
  b. Radiated pyrites
  c. Liver or hepatic pyrites
  d. Cock'scomb pyrites
  e. Cellular pyrites
217. Capillary pyrites
218. Magnetic pyrites
219. Magnetic ironstone
  a. Common
  b. Iron-sand.
220. *Chrome-ironstone*
221. *Menac ironstone*
222. Iron-glance
  a. Common
  Compact
  Foliated
  b. Iron-mica
223. Red ironstone
  a. Red iron-froth
  b. Ochery red ironstone
  c. Compact
  d. Red hematite
224. Brown ironstone
  a. Brown iron-froth
  b. Ochery brown ironstone
  c. Compact
  d. Brown hematite
225. Sparry ironstone

226. Black ironstone
  a. Compact
  b. Black hematite
227. Clay-ironstone
  a. Redde
  b. Columnar clay iron-stone
  c Lenticular clay-iron-stone
  d. Jaspery clay-iron-stone
  e. Common clay-iron-stone
  f. Reniform clay-iron-stone
  g. Pea-ore, or pisiform ironstone
228. Bog iron-ore
  a. Morass-ore
  b. Swamp-ore
  c. Medow-ore
229. Blue iron-earth
230. Pitchy iron-ore
231. Green iron-earth
232. Cube-ore
233. Gadolinite

7. Lead Genus.

234. Galena or lead-glance
  a. Common
  b. *Disintegrated*
  c. Compact
235. Blue lead-ore
236. Brown lead-ore
237. Black lead-ore
238. White lead-ore
239. Green lead-ore
240. Red lead-ore
241. Yellow lead-ore
242. Lead-vitriol
343. Earthy lead-ore or Lead-earth
  a. Coherent
  b. Friable

8. Tin Genus.

244. Tin pyrites
245. Tinstone
246. Cornish tin-ore.

9. Bismuth Genus.

247. Native bismuth
248. Bismuth-glance
249. Bismuth-ochre
250. *Arsenical bismuth-ore*

10. Zinc Genus.

251. Blende
   a. Yellow
   b. Brown
      Foliated
      Fibrous
      Radiated
   c. Black
252. Calamine

11. Antimony Genus.

253. Native antimony
254. Grey antimony-ore
   a. Compact
   b. Foliated
   c. Radiated
   d. Plumose
255. Black antimony-ore
256. Red antimony-ore
257. White antimony-ore
258. Antimony-ochre

12. Sylvan Genus.

259. Native sylvan
260. Graphic-ore
261. White sylvan-ore
262. Nagyag-ore

13. Manganese Genus.

253. Grey manganese-ore
   a. Radiated
   b. Foliated
   c. Compact
   d. Earthy
264. Black manganese-ore
265. *Piedmontese manganese-ore*
266. Red manganese-ore
267. *Manganese-spar*

14. Nickel Genus.

268. Copper-nickel
269. *Capillary-pyrites*
270. Nickel-ochre

15. Cobalt Genus.

Family of Speiss-Cobalt.

271. White cobalt-ore
273. Glance-cobalt
275. Grey cobalt-ore

Family of Cobalt-Ochre.

274. Black cobalt-ochre
  a. Earthy
  b. Indurated
275. Brown cobalt-ocre
276. Yellow cobalt-ochre
277. Red cobalt-ochre
  a. Cobalt-crust
  b. Cobalt-bloom

16. Arsenic Genus.

278. Native arsenic
279. Arsenic pyrites
  a. Common
  b. Argentiferous
280. Orpiment
  a. Yellow
  b. Red
281. Arsenic bloom

17. Molybdena Genus.

282. Molybdena

18. Sheele Genus.

283. Tungsten
284. Wolfram

19. Menachine Genus.

285. Menachan
286. Octahedrite
287. Rutile
288. Nigrine
289. Iserine
290. Brown menachine-ore
291. Yellow menachine-ore

20. Uran Genus.

292. Pitch-ore
293. Uran-mica
294. Uran-ochre

21. Chrome Genus.

295. Acicular-ore
296. Chrome-ochre

22. Cerium Genus.

297. Cerium-stone.

TABULAR VIEW

of the

PELLUCID GEMS,

Arranged according to colour, with some of their more distinctive characters.

	Specific Gravities.	Hardness.	Refractions.
1			
WHITE & GREY GEMS.			
a. Diamond,	3 . 5	Scratches all other minerals.	Simple.
b. Sapphire,	4 0	Scratches Topaz	Feeble double refractions.
c. Topaz of Brazil,	3 55	Scratches rock crystal.	Double refractions, stronger than sapphire.
d. Rock crystal,	6 65	Scratches Feldspar.	Same as the preceding
2			
RED GEMS.			
a. Oriental ruby,	4 . 2	Scratches Topaz	Feeble double refraction.

	Specific Gravities.	Hardness.	Refractions.
b. Spinel Ruby,	3 . 7	Scratches Topaz but in a lower degree than oriental ruby.	Simple.
c. Brazilian Ruby or red topaz,	3 . 5	Scratches rock crystal ; but does not affect spinel.	Double in a moderate degree.
d. Precious garnet columbine red colour,	4 . 0	Scratches rock crystal in a moderate degree.	Simple.
e. Pyrope blood red colour,	3 . 7	Scratches rock crystal more readily than precious garnet.	Simple.
f. Tourmaline.	3 . 0	Scratches rock crystal but feebly.	Double in a moderate degree.
3			
Blue Gems.			
a. Oriental Sapphire.	4 . 2	Scratches Topaz	Feeble double refraction.
b. Beryl, or Aquamarine,	2 . 7	Scratches rock crystal feebly but not Topaz.	Feeble double refraction.

	Specific Gravities.	Hardness.	Refraction.
c. North American Tourmaline	3 . 0	Scratches rock crystal freely	Double refraction.
d Water sapphire or Dichroite.—When viewed in one direction violet blue, in another brownish yellow,	2 . 7	Same as preceding.	Feeble double refraction
4.			
GREEN GEMS.			
a. Oriental Emerald or green sapphire.	4 . 2	Scratches Topaz and spinel ruby.	Feeble double refraction.
b. Peruvian Emerald, or true emerald.	2 . 8	Scratches rock crystal, but not topaz.	Feeble double refraction.
c. Brazilian, or Columbian Emerald, a variety of tourmaline,	3 . 0	Scratches rock crystal feebly.	Double refraction.
d. Chrysoprase,	2 . 6	Scratches glass and feldspar.	

	Specific Gravities.	Hardness.	Refraction.
5. Bluish Green Gems.			
a. Oriental aquamarine, a variety of sapphire	4 . 0	Scratches Topaz	Feeble double refraction.
b. Siberian Beryl	2 . 6	Scratches rock crystal.	Feeble double refraction
6. Yellow Gems.			
a. Oriental Topaz, a variety of sapphire.	4 . 0	Scratches Topaz	Feeble double refraction.
b. Brazilian Topaz.	3 . 5	Scratches rock crystal, but not so deeply as spinel.	Feeble double refraction.
c. Yellow Zircon or Jargoon.	4 . 4	Scratches rock crystal, but not Topaz.	Strong double refraction.

	Specific Gravities.	Hardness.	Refractions.
7. YELLOWISH GREEN, AND GREENISH YELLOW GEMS.			
a. Oriental Peridote, a variety of sapphire,	4 . 0	Scratches Topaz.	Feeble double refraction.
b. Chrysoberyl, or Oriental Chrysolite.	3 . 8	Nearly as hard as Saphire.	Refracts double in a middling degree.
c. Beryl or aquamarine.	2 . 6	Scratches quartz but feebly.	Feeble double refraction.
d. Jargoon of Ceylon, or yellowish green Zircon.	4 . 4	Scratches rock crystal more easily than beryl.	Very perfect double refraction.
e. Chrysolite,	3 . 4	Scratches Feldspar but not rock crystal.	Refraction double in a high degree but not so powerfully as Zircon.
f. Yellowish green tourmaline, or peridote of Ceylon	3 . 0	Scratches rock crystal feebly.	Double refraction.

	Specific Gravities.	Hardness.	Refraction.
8.			
a. Oriental amethyst, a variety of sapphire.	4 . 0	Scratches Topaz	Feeble double refraction.
b. Amethyst	2 . 7	Scratches Feldspar.	Refraction double in a middling degree.
9.			
HYACINTH-RED GEMS.			
a. Cinnamonstone,	3 . 6	Scratches rock crystal feebly.	Simple.
b. Hyacinth garnet, or vermeille.	4 . 0	Scratches rock crystal in a middling degree.	Simple.
c. Hyacinth.	4 . 4	Scratches rock crystal in a middling degree.	Perfect double refraction.
d. Hyacinthine Tourmaline,	3 . 0	Scratches rock crystal feebly.	Double refraction.

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	Specific Gravities.	Hardness.	Refraction.
10.			
GEMS WHICH ARE OPALESCENT, OR DISPLAY A FINE PLAY OF COLOUR,			
a. Asterias, or Starstone, a variety of sapphire.	4 . 0	Scratches Topaz	
1. Ruby asterias red ground.			
2. Sapphire asterias, blue ground.			
3. Topaz Asterias, yellow ground.	8 . 5	Scratches Rock crystal.	
b. Opal.	2 . 1	Scratches white Glass feebly.	
a. Oriental Girasol, or Girasol corundum, with a milky ground from which there shoots blueish and yellowish pencils of light.	4 · 0	Scratches Topaz	

	Specific Gravities.	Hardness.	Refraction.
d. Moonstone, argentine, or fish-eye stone, is a variety of feldspar.	2 . 6	Scratches Feldspar, but not rock crystal.	
e. Sunstone or Oriental aventurine.	2 . 6		
f. Labradorstone.	3 . 0		

BLOWPIPE.

As the blowpipe is an instrument used in the analysis of minerals, it may be useful to give some description of it. The blowpipe is a brass tube; it is held in the mouth, and blown through by the breath The bore at the end held in the mouth is about ¼ of an inch, and at the other end so small that it will scarcely admit a pin. Those who use a blowpipe, soon acquire the necessary art of maintaining a continual stream of air through it for several minutes. This is effected by breathing through the nose, while the blowpipe is supplied by the breath in the mouth. To do this, the tongue must be applied to the roof of the mouth, so as to interrupt the communication of the mouth with the passage to the nostrils during the time of breathing. The candle used with the blowpipe should have a thick wick, and be bent a little forward in the direction of the breath; the flame will be of a neat conical shape, and blue colour, and the heat is the strongest at the extremity. The substance acted upon by the blowpipe, should not be larger than a small pea or peppercorn.

LAPIDARY APPARATUS.

The amusement of collecting pebbles on the sea-shore is general, and almost every one that visits the sea-coast is employed in searching for prettily marked stones, for forming a collection of their beautiful varieties. Mr. Mawe of London, has invented a complete Lapidary's Mill, which may be screwed on a parlour table, and stones may be cut and polished without any inconvenience and will afford instructive amusement. This Portable Machine is fixed in a small box, and will cut, slit, and polish pebbles of every description.

This machine may be had complete of Mr. Mawe, for from six to ten pounds according to the number of tools.

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Werner's Mineral System continued.

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ERRATA.

PAGE 8, 18th line, for "*distant*" read "*distinct.*"
— 13, 8th line, after succinct dele "*with precipitate.*"
— 14, 4th line from the bottom, for "*their*" read "*the.*"
— 17, Under the head Antimony 7th line, dele the word "*so*" ; 8th line, for the word "*that,*" at the beginning of the line, insert "*and.*"
— 20, 2d paragraph, 7th line, before "*will*" at the beginning of the line, insert "*it.*"