

SILVER MINE OF SAN PEDRO NOLASCO, IN THE ANDES.

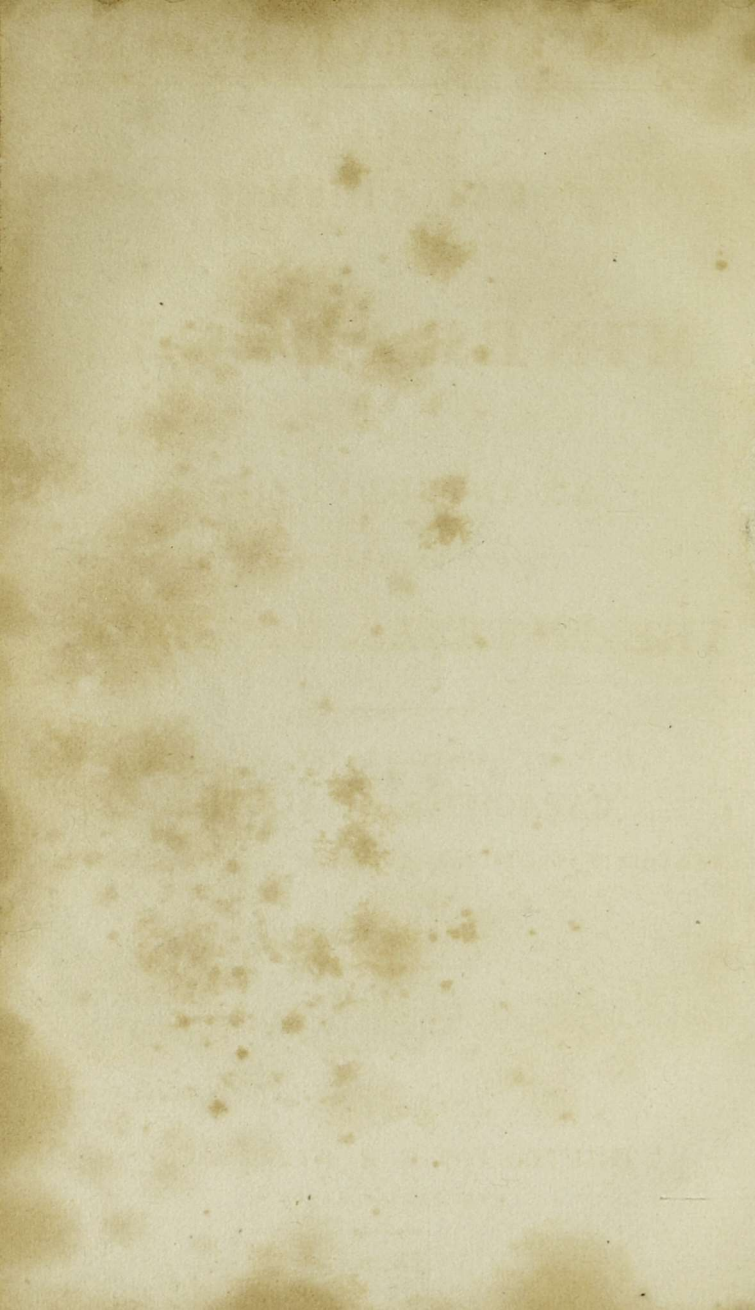
PINNOCK'S
CATECHISM
OF
MINERALOGY.

LONDON.

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AVE MARIA LANE,

1831.



PINNOCK'S CATECHISMS.

A

CATECHISM

OF

MINERALOGY;

OR,

AN INTRODUCTION

TO THE KNOWLEDGE OF

THE MINERAL KINGDOM.

ADAPTED TO THE

CAPACITIES OF YOUTH,

AND CALCULATED NO LESS TO AMUSE THAN TO INSTRUCT
THEM.

FIFTH EDITION.

LONDON:

PRINTED FOR G. B. WHITTAKER,

AVE-MARIA-LANE.

1828.

PREFACE.

THE Author of this Catechism having received the sanction of a discerning and indulgent Public, in his attempt to render the study of the Animal and Vegetable Kingdoms both easy and entertaining; and being aware that no branch of the Science was more interesting, or less understood, than that which treats of the various unorganized bodies composing the Globe we inhabit, submits the following pages to their candour and judgment: and if this elementary performance should only stimulate the Pupil to seek for further information on a subject of real importance to mankind, though hitherto much neglected, he will have the conscious satisfaction of having performed a duty, incumbent on all who write for the instruction of Youth, and the advancement of useful knowledge.

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A
CATECHISM
OF
MINERALOGY.

CHAPTER I.

Introduction.

Q. PREVIOUS to our entering upon the subject of Mineralogy, as a science, will it not be proper to take a brief view of the various substances which compose this terrestrial globe ?

A. Yes ; before we attempt to explore the hidden treasures of the earth, it will undoubtedly be right to ascertain what are its constituent parts ; and we shall find that an acquaintance with the one will materially assist us in discovering the other.

Q. Of what then is the earth composed ?

A. The *surface* of the earth generally consists of a rich black mould, formed wholly of the remains of animal and vegetable substances; underneath its surface are deposited, in beds or *strata*, at various depths, clay, gravel, sand, &c.; and as we descend, we shall find an infinite variety of the different mineral substances, which I shall afterwards describe.

Q. Have we any means of ascertaining what is contained in the inmost parts of the earth?

A. No: our knowledge of the earth's contents is confined to a very limited depth, no excavation ever made by human art being half a mile below its surface. The miner seldom descends more than fifteen hundred feet, which is but little more than the thirty-thousandth part of the earth's diameter; yet in that space enough has been discovered to prove to us that the all-wise Creator has so disposed and arranged the materials of which he formed the globe, as to contribute to the comforts and necessities of his creatures.

CHAPTER II.

*Great Revolutions visible in every part of the
Globe.*

Q. DOES not the globe exhibit evident traces of some great convulsions of nature ?

A. Yes : it undoubtedly does ; whether we excavate the plains, or penetrate into the caverns or mountains, we shall every where find the spoils of organized bodies buried in those beds which form the coat of our earth.

Q. What do you mean by the spoils of organized bodies being buried in the earth ?

A. I mean, that at a great distance from the sea we may find immense masses of shells ; in quarries of stone we may discover fish, in beds of coal the remains of vegetables, &c. Under the equator, we find the shells and bones of fish and quadrupeds belonging to the north ; and in the icy regions, we discover the remains of those which, when alive, inhabited the torrid zone.

Q. How do you account for this ?

A. The only rational way of accounting for

these mighty changes, is, the effects of *the Deluge*. Impious as it may seem, it is no less true, that many modern speculatists, miscalled philosophers, have denied the reality of the Deluge, recorded by Moses, and vainly endeavoured to establish their own fanciful opinions, which frequently more resembled dreams than the conceptions of sober reason.

Q. Have not their opinions been exploded by recent discoveries ?

A. Yes ; the most patient and accurate examinations of detached mineral substances, and of the strata of the globe, which late inquirers have made, added to the discoveries made by modern voyagers and travellers, afford every reason to believe that the earth was for a considerable time wholly overflowed with water.

Q. Then, independent of the authenticity of sacred writ, we have the means of proving the absolute certainty of that tremendous inundation ?

A. Undoubtedly. *Marine shells* have been discovered in situations so elevated, and under circumstances so remarkable, as to prove that they were left there by a flood extending over the whole globe ; and what confirms this conclusion is,

that shells, peculiar to different shores and climates very distant from each other, have been found in promiscuous heaps. The bones of *elephants* and the *rhinoceros* have been also found, in a multitude of instances, far distant from the regions in which they are found to live, and where, from the nature of the climate, they could never exist in a living state, and too many mountains intervened to suppose them carried thither by any other means than a *general deluge*.

CHAPTER III.

General Characters of Minerals, and Divisions of the Mineral Kingdom.

Q. WHAT are Minerals?

A. Minerals, strictly speaking, are those substances which are found in mines, but, in a more extended view, is meant to characterize that class of inanimate bodies found in or upon the earth, and derived either from animal or vegetable origin. These form what naturalists have denominated the *Mineral Kingdom*.

Q. What are the general characters of Minerals?

A. Their general characters may be thus defined: they possess neither life nor motion, nor do they exhibit any phenomena dependant on external organization. They may increase in size, but their growth is exceedingly different from the growth of organic beings. The subjects of the mineral kingdom are absolutely passive, they are acted on by external agencies only, and possess no power of changing that action.

Q. What is the nature of Mineralogy?

A. Mineralogy is that department of the science of natural history which makes us acquainted with the characters of Minerals. It teaches the art of distinguishing and the mode of describing them, so as to recognize them with facility whenever they occur.

Q. How is the Mineral Kingdom divided?

A. The Mineral Kingdom is divided into four parts: namely, 1. *Earths* and *Stones*; 2. *Salts*; 3. *Combustibles*; 4. *Metals*.

CHAPTER IV.

Of EARTHS.

Q. ARE there not several kinds of Earth, called *Simple Earths*, which are incapable of being con-

verted, or analyzed, either into each other, or into any other substance?

A. Yes; there are nine Simple Earths, to which Mineralogists have assigned the following names; 1. *Silex*; 2. *Alumine*; 3. *Zircon*; 4. *Glucine*; 5. *Yttria*; 6. *Barytes*; 7. *Strontian*; 8. *Lime*; and 9. *Magnesia*. These nine earths enter, in different proportions, into the composition of our globe; their natural colour is white, and whatever other colours are found in them proceed from inflammable or metallic substances.

Q. Give me some account of the first you mentioned.

A. The first is *Silex*, which is a Latin word, signifying *flint*; common flints being almost wholly composed of siliceous earth. It is much more abundant than any of the other earths, being the chief ingredient of rocks and sand. It has the appearance of very fine white sand, and is nearly three times heavier than water.

Q. What are its uses?

A. It is an essential part of glass, the purest sand being used in the manufacture of that valuable article. It is also used in making artificial gems; and in various states of combination is applied to many serviceable purposes.

Q. What is *Alumine*?

A. Alumine earth is so called from its forming the basis of common alum. It is never found in its pure state, though it forms a part of the finest clays. In that valuable mineral called fullers' earth, the presence of Alumine may be easily discovered, by its having a smell when breathed on peculiar to all clayey substances, and which to Mineralogists is a sure test of Alumine being a part of its composition. Its weight is twice that of water.

Q. What are the uses of Alumine?

A. Alumine is of great use to us, as bricks, pottery ware, and even the finest porcelain, partake of it in a great degree; and it is also indispensable to dyers and calico printers, to prevent their colours from fading or washing out.

Q. Which is the third sort of earth you mentioned?

A. *Zircon*; which, when pure, is a rough powder, insipid, and not to be dissolved in water. It is found combined in the jargoon and hyacinth (two precious stones), but it has never been put to any useful purpose.

Q. What is *Glucine*?

A. Glucine takes its name from a Greek word

signifying *sweet*; and forms a soft, light, and white powder, of a sweetish taste. It is found in the emerald and beryl, but its uses are as yet undiscovered.

Q. What is *Yttria*?

A. *Yttria*, when divested of those substances with which it is combined, is a fine white powder, without any smell; and is five times heavier than water.

Q. What is *Barytes*?

A. *Barytes* in its pure state is very heavy, but is never found unmixed with other substances. It is very harsh and burning, possessing in some respects the properties of lime, and if swallowed it proves a strong poison. Like alkalies, it has the property of changing blue vegetable colours into green.

Q. What is *Strontian*?

A. *Strontian* is an earth which has some of the properties of *Barytes*, as it converts blue vegetable colours into green, but is not poisonous. It occurs in great abundance in various parts of the world, but is always combined with sulphuric or carbonic acids.

Q. What is *Lime*?

A. *Lime*, or calcareous earth, when unmixed

with any other substance, is of a white colour; and moderately hard substance, though easily reducible to powder. When put into water it quickly absorbs it, becomes hot, and falls into powder. If exposed to the open air, it soon attracts moisture. It is found in abundance in every country, but always combined with some acid, sulphuric, or other substance.

Q. What kind of earth is *Magnesia*?

A. *Magnesia* is a very fine light white earth, and is found in various clay, stones, and salts, particularly Epsom salts, which consists of *Magnesia* in union with sulphuric acid. The slightly acrid taste observable in the *Magnesia* used in medicine arises from a portion of lime which it contains. It does not dissolve in water, but is soluble in every kind of acid.

CHAPTER V.

STONES.

1. HARD STONES, or those which will scratch Glass.

Gems, &c.

Q. WHAT are gems?

A. Gems are precious stones, for the most part

transparent, and have a shining glassy appearance. Their different colours are occasioned by the metals with which they are impregnated. The most estimable of all the species are the Diamond, the Ruby, the Emerald, and the Sapphire.

Q. Cannot real Gems be imitated?

A. Yes, most Gems may be imitated by artificial preparations of glass, coloured by different metallic substances; they are discoverable by a deficiency of lustre, and being much softer; but it is not easy by mere inspection to distinguish some of them from real gems.

Q. Describe the *Diamond*.

A. The Diamond is the hardest of all bodies, and is perfectly transparent, and infinitely more brilliant than Crystal. In their rough, or native state, Diamonds have usually the form of rounded pebbles, or double four-sided pyramids, called octohedrons. They are generally colourless, but sometimes are blue, green, yellow, or rose-coloured.

Q. Where do Diamonds come from?

A. The best Diamonds are brought from the East Indies; and the principal mines are those of Raolconda and Coulour in the province of Golconda; and that of Soumelpour, in Bengal. They

are found in the deep crevices of rocks at Raolconda: and at Soumelpour they are found amongst the sand and gravel of the river. In the island of Borneo, and some other parts of South America, Diamonds have been found.

Q. Are not Diamonds immensely valuable?

A. Yes; their value is determined by their weight in *carats* (a carat being equal to four jeweller's grains, seven grains of which are equal to six grains troy.) The largest Diamond ever known is in the possession of the Crown of Portugal, and weighs 1680 carats, or more than *eleven ounces*. It has never been cut, and is valued at 5,644,800*l*.

Q. What kind of gem is the *Jargoon*?

A. The Jargoon has some resemblance to the Diamond, and they are sometimes sold for Diamonds of an inferior quality. It is usually of a dusky yellow, or brownish colour. The Jargoon is principally brought from the island of Ceylon, but is also found in France and some other parts of Europe.

Q. What is a *Hyacinth*?

A. The Hyacinth is indebted for its name to a supposed resemblance in colour to that flower; it is brought from Ceylon, and when bright and

free from flaws is a very handsome ring stone. It is a variety of the Jargoon; but its colour is a dark orange-red.

Q. What is a *Chrysolite*?

A. A Chrysolite is the softest of all gems, scarcely harder than glass, and consequently inferior to most others in lustre. It is usually of a greenish colour, and is generally found in fragments and rounded pieces. When well matched, and properly polished, the effect is very good for necklaces and ornaments for the hair. We import them from the Levant.

Q. What kind of gem is the *Chrysoberyl*?

A. When properly polished the Chrysoberyl is capable of receiving a lustre nearly equal to the Diamond. Its colour is a yellowish or brownish green, sometimes transparent, but often only semi-transparent. They are found in various parts of South America.

CHAPTER VI.

Gems, &c. continued.

Q. What kind of gem is the *Precious*, or *Noble Garnet*?

A. The Precious or Noble Garnet is a red-coloured gem, and is found abundantly in many mountains in various parts of the world. In Bohemia there are regular mines of Garnet, and from thence we derive the best. The finest Garnets are cut in the manner of other precious stones, and set upon a foil of the same colour; but others are cut into beads, and strung for necklaces. Garnets vary much in size, some being an inch in diameter, while others are not larger than a pin's head.

Q. What stone is that which is called the *Common Garnet*?

A. A very inferior stone, found chiefly among the rocks near Huntley, in Aberdeenshire, Scotland. It is of a brown, or greenish brown colour, and in general is too soft to be of much service to the lapidary.

Q. What is the *Oriental Sapphire*?

A. The Oriental Sapphire is a gem of blue colour, varying in its shades, from a deep tint to a nearly colourless appearance. It is nearly as hard as the ruby, and is very valuable; a good Sapphire weighing 10 carats, being worth 50 guineas. It is brought from the East Indies, and it is said that when Sapphires are subjected

to the heat of a fire, they lose their colour, and become so transparent as sometimes to be sold for diamonds.

Q. Is not the *Oriental Ruby* a very valuable gem?

A. Yes; it is both valuable and scarce. Its colour is a bright red, occasionally varied with blue, and sometimes party-coloured. Rubies are found in the sand of certain streams near the town of Sirian, the capital of Pegu, and with Sapphires in the sand of rivers in Ceylon; but they are so seldom seen of a large size, that one weighing 30 carats is considered even more valuable than a Diamond of that weight.

Q. What is the *Oriental Amethyst*?

A. The Oriental Amethyst is a gem usually of a purple colour, and was well known to the ancient Greeks and Romans, by whom it was held in great esteem, and who ascribed many superstitious qualities to it. It is now so rare as to be seldom brought into Europe.

Q. Are not the *Oriental Topaz* and *Emerald* varieties of the *Oriental Ruby*?

A. Yes, they are so considered; the Oriental Topaz is of a straw colour, the Emerald green. The latter is a very rare gem.

Q. What is *Adamantine Spar*?

A. Adamantine Spar is a very hard stone, varying very much in colour, but is chiefly grey, with a bluish, green, or brown tint. Its name has been given to it by our lapidaries, from its extreme hardness, which is nearly equal to that of a Diamond. It is found in China and the East Indies. It has been used in a powdered state by the artists of India, for cutting and polishing precious stones; but our engravers consider it very inferior to diamond powder.

Q. What is *Emery*?

A. Emery is a Mineral, in hardness nearly equal to Adamantine Spar, and is of a blackish or bluish grey colour. It is found in the Grecian islands in the Archipelago, in some parts of Spain, and is obtained from a few iron mines in this country. It is used by lapidaries in polishing precious stones, by opticians in smoothing the surface of glass, by masons for polishing marble; and by cutlers, locksmiths, and others, in their respective businesses.

CHAPTER VII.

Gems, &c. continued.

Q. WHAT are *Spinelle* and *Balass Rubies*?

A. They are two handsome gems; the *Spinelle Ruby* being of a brilliant, but dark red, and the *Balass Ruby* of a rose colour. They are softer than the *Oriental Ruby*, and less valuable; but the *Spinelle Ruby* takes a high polish, and is a very beautiful gem.

Q. What is a *Topaz*?

A. A *Topaz* is a gem, generally of a wine yellow colour, though sometimes orange, pink, blue or even colourless. The island of *Topaz*, in the *Red Sea*, gave this name to the stone, the ancients having found it there. The best *Topazes* are obtained from *Brazil*, and are of a deep colour. *Saxony* and *Siberia* both produce *Topazes*; but they are very different in their nature from the *Brazilian gem*; for if the latter be exposed to a strong heat in a crucible, it will become red or pink, while the *Saxon Topaz* will, by the same process, become white.

Q. Are there any other sorts of Topazes ?

A. Yes ; the *Blue Topaz* from Brazil, which is very rare and valuable, and the *White Topaz* from the same country. There are also small white stones of this description found at St. Michael's Mount, in Cornwall.

Q. What is the *Emerald* ?

A. The Emerald is one of the softest of all gems, and is chiefly indebted for its value to its charming colour, which is a pure green. Indeed, the green of the emerald is so lovely, that having glanced at all the varied hues of other precious stones, the eye seldom fails to rest with delight on this. The best are brought from Peru.

Q. What is the *Beryl* ?

A. The Beryl, or *Aqua Marine*, is a light variety of the Emerald. These stones are so common and have so little the brilliancy of the other gems, that they are considered of very inferior value. The most beautiful kinds are brought from China, Siberia, and Brazil. They are also found in Saxony, France, and North America.

Q. For what are these stones used ?

A. They are usually made into necklaces, but are likewise employed for brooches and seal stones.

In Turkey the large ones are much esteemed for the handles of stilettoes.

Q. What is the *Tourmaline*?

A. The *Tourmaline* is a stone generally of a smoky blackish colour, though it is sometimes green, red, blue, or brown; when not very thick, it is transparent. It is sometimes cut and worn as a gem, but on account of the muddiness of its colours, is not in general much esteemed. It is principally found in the island of Ceylon.

Q. Has not the *Tourmaline* some singular properties?

A. Yes; when strongly heated, it becomes electric; it has the properties not only of attracting ashes from the burning coals, but it also repels them again, which is very amusing; for as soon as a small quantity of ashes leaps upon it, they in a little time spring from it again. In the British Museum there is a magnificent specimen of Red *Tourmaline*, which has been valued at 1000*l*. It was a present from the king of Ava to the late Colonel Symes, when on an embassy to that country.

CHAPTER VIII.

Gems and Hard Stones continued.

Q. WHAT is Quartz ?

A. Common Quartz is a hard foliated substance, usually of a white or grey colour, and more or less transparent. It is found in large shapeless masses generally, and weighs three times heavier than water. It forms a constituent part of many mountains, and is very common in our own, and in most other countries.

Q. Of what use is Quartz ?

A. Quartz is employed in place of sand, for making the finer kinds of glass ; and also in the manufacture of porcelain. After having been burnt and reduced to powder, it is also mixed with clay, and formed into bricks for the construction of glass furnaces, which are capable of resisting the effects of the intense heat requisite in melting glass.

Q. What is *Rock Crystal* ?

A. Rock Crystal is a very beautiful kind of

Quartz, sometimes perfectly transparent, and sometimes shaded with grey, yellow, green, brown, or red. It is chiefly found in the hollow veins of rocks, and it is said that the Alps, and some parts of Mont Blanc, contain it in great abundance.

Q. What are its uses ?

A. It is cut into vases, lustres, snuff-boxes, and many kinds of beautiful toys. When it is quite pure and transparent, opticians use it in those spectacle glasses called pebbles. Crystal was held by the ancients in great estimation, but they were unacquainted with its nature, for they imagined that it was produced from a congelation of water.

Q. Is it found in this country ?

A. Small common Crystals are frequently found, and are called *Diamonds*, taking their names from the places they are found in ; viz. *Cornish*, *Bristol*, and *Snowdon* diamonds.

Q. Are there not a variety of coloured Crystals, known by other names ?

A. Yes ; namely, *Common Amethyst*, which is a violet-coloured Crystal ; *False Ruby*, which is red ; *Water Sapphire*, blue ; *False Emerald*, green ; *Topazine*, yellow ; and *Cairn Gorum Crystals*, which derive their name from a mountain in the county of Aberdeen, in Scotland ; and are much

used in seals, rings, necklaces, brooches, and various other trinkets. When found they are generally of a smoky yellow, but are rendered transparent by means of heat.

Q. Is not *Common Sand* a granulated kind of Quartz?

A. Yes; it consists of rounded grains, which have a vitreous or glassy appearance. In the torrid regions of Africa and Asia, there are immense deserts covered with sand, so light and dry as to be moveable before the wind, and to be formed into vast hills and boundless plains, incessantly changing their places, and overwhelming and destroying those travellers, whose necessities require them to enter those dreary realms.

Q. For what is Sand useful?

A. Its uses are numerous. When mixed with lime, it forms that hard cement, called mortar; when melted with Soda and Potash, it is made into Glass, the white Sand being used for the fine kinds, and the coarser sort for bottle glass. Its uses for scouring are also well known.

Q. What is *Flint*?

A. Flint is a very compact and hard kind of stone, which when broken will split into pieces in every direction, each having a smooth surface. It is

very common in most parts of England, arranged in a kind of strata, or beds, among chalk.

Q. What are its properties and uses ?

A. It yields sparks of fire when struck against steel, and is therefore indispensable in the modern system of warfare. To the sportsman it is also of the greatest use in obtaining his game. It is also employed in the manufacture of porcelain and glass; for which purpose it is heated red hot, thrown into cold water, and then pulverized.

CHAPTER IX.

Gems and Hard Stones continued.

Q. WHAT are *Agates* ?

A. *Agates* are stones which are capable of receiving a high polish, but are not transparent. They are nearly of all colours, and when broken their surface appears smooth and shining. They are found in many parts of Europe, particularly Iceland, Tuscany, and Saxony.

Q. Of what use are they?

A. They are frequently used for necklaces and seals. Sometimes they are made into cups, handles of knives, hilts of swords, &c. The most beautiful Agates Great Britain produces are found on the sea-shore, near Dunbar, in Scotland, and are called *Scotch Pebbles*.

Q. What is a *Cornelian*?

A. A *Cornelian* is a kind of Agate, generally of a red or flesh-colour, though sometimes white, orange, or yellow. The most beautiful *Cornelians* come from the East Indies, and some are imported which measure nearly three inches in diameter.

Q. What are they used for?

A. *Cornelians* are in great request for seals; they are likewise cut into beads for necklaces, and stones for ear-rings; also into crosses, bracelets, and other trinkets, which in India form a considerable branch of traffic.

Q. What is an *Onyx*?

A. An *Onyx* is also a kind of agate, marked alternately with white and black, or white and brown. It is brought from the East Indies, Siberia, Germany, and Portugal. The *Onyx* is highly esteemed for the formation of vases, snuff-boxes, and trinkets of various kinds.

Q. What are *Opals*?

A. Opals are of a milky hue, and when held between the eye and the light, exhibit a changeable appearance of colour. About four centuries ago Opals were obtained in such abundance from some quarries in Hungary, that upwards of three hundred persons were employed in them. Few precious stones are more beautiful than Opals; but they are too soft to be of much use as an article of jewellery.

Q. What is the *Chrysopras*?

A. The Chrysopras is a very hard stone, of an apple green colour, which however is likely to fade if kept either in a very warm or moist situation.

CHAPTER X.

Jems and Hard Stones concluded.

Q. WHAT is *Jasper*?

A. Jasper is one of the hardest of all stones; it varies much in colour, being red, green, blue, yellow, black, or variegated. It is principally found in Spain, Germany, Hungary, and Sicily, in large masses. It is so extremely hard, that the savages

of Canada (where it is also found) make the heads of javelins with it.

Q. What is *Bloodstone*, or *Heliotrope*?

A. It is an opaque stone, of a dark green colour, and is brought from Persia, Bucharìa, Siberia, and Iceland. It is better calculated for engraving on than even Cornelian, and is in great request.

Q. What is *Lapis Lazuli*?

A. *Lapis Lazuli* is a mineral of azure blue colour, accompanied with white or clouded spots, and also with pyrites, which have the appearance of golden veins or spots. It was formerly much in fashion for various ornamental parts of dress. When burnt, or calcined, it is applied in the manufacture of that beautifully brilliant blue colour, called *ultra-marine*.

Q. What is *Common Felspar*?

A. *Felspar* is a hard kind of stone, varying much in colour, and is sometimes opaque, sometimes transparent. It is very common, and constitutes a principal part of many of the highest mountains.

Q. What is its use?

A. It is of great use in manufacturing the finest kind of earthenware; and the two substances which chiefly compose the porcelain of China very nearly resemble the common *Felspar* in its decomposed state.

Q. What is *Labrador Felspar*?

A. It is a very beautiful stone, exhibiting a brilliant display of colours, according to the position with respect to the light in which the stone is held. It was originally discovered on the island of St. Paul's, near the coast of Labrador.

Q. What is *Moonstone*, or *Adularia*?

A. Moonstone is the purest kind of Felspar that is known. It is of a white colour, sometimes shaded with yellow, red, or green, and contains bluish white spots, which when held up to the light have a pearly or silvery colour, not unlike that of the moon, whence it obtains its name.

CHAPTER XI.

2. SOFT STONES, or those which will not scratch
Glass.

Q. WHAT is common, or *Potters' Clay*?

A. Common Clay, which is found in nearly every country in the world, is sometimes white, or has a blue, red, brown, or yellow tinge, and is too well known to require much description.

Q. What are its properties and uses?

A. The peculiar quality of this substance is to become so hard by heat, that it will even strike fire with steel; and its ductility has rendered it an indispensable article of utility to mankind. Common Clay is formed into plates, dishes, cups, basins, &c. and bricks and tiles are also made of it. When earthen vessels are required to be made very hard and strong, sand is mixed with it.

Q. What is *Porcelain Clay*?

A. Porcelain Clay is generally of a white or reddish-white colour. The quantity produced in China must have been immense formerly, as every

part of the world was supplied with it. In a single province it is said that nearly a million of persons were at one time employed in this manufacture. Though there are several manufactures of Porcelain in different parts of Europe, none are superior to our own, in Worcestershire and Staffordshire.

Q. What kind of clay is *Pipe Clay* ?

A. Pipe Clay is of a very plastic nature, and when hardened by heat is perfectly white. It is used in cleaning woollen cloths, and for various other purposes. Tobacco pipes are made by the simple process of casting them in moulds, forming a hole through the stems by means of a wire.

CHAPTER XII.

Q. WHAT is *Clay Slate* or *Roofing Slate* ?

A. It is a kind of stone of foliated texture, and greyish, black, brown, or bluish colour; it breaks into splinters, and does not adhere to the tongue. Vast beds of slate occur in different parts of the world. In our own country we find it in West-

moreland, Yorkshire, and North Wales ; and it is chiefly used for the covering of houses.

Q. What is *Black Chalk* ?

A. Black Chalk, or drawing Slate, is an Earthy substance of Slaty texture ; and is used by crayon painters and other artists.

Q. What is *Hone* or *Whet Slate* ?

A. It is a well-known kind of smooth slaty stone, which, when properly cut and smoothed, is of indispensable utility to carpenters, cutlers, surgeons, &c. to sharpen their instruments with.

Q. What is *Mica* ?

A. Mica, Glimmer, or Muscovy Glass, is a mineral substance capable of being divided into elastic leaves so thin as to be quite transparent. It is used in Siberia and Muscovy to supply the place of windows.

Q. What is *Basalt* ?

A. Basalt is a coarse-grained blackish stone, generally found in groups of large columns. The *Giant's Causeway*, on the coast of Antrim, in Ireland, and the *Cave of Fingal*, in one of the Western islands of Scotland, are the most remarkable assemblages of Basaltic columns that are known.

Q. What is *Bole* ?

A. Bole is an earthy mineral, soft and unctuous, and of a yellowish or reddish-brown colour. When put into water it immediately absorbs it, and breaks into pieces with a crackling noise. The ancients considered it so valuable a medicine as to hold it sacred. It is used at present as a chief composition in tooth-powder, and is imported from the Levant.

CHAPTER XIII.

Q. WHAT is *Fullers' Earth*?

A. Fullers' Earth is a soft mineral substance, valuable for its property of taking grease out of woollen and other cloths, which, on a large scale, is effected by a kind of water-mill, called a *fulling-mill*. There are extensive beds of this Earth in many counties of England, and no country in the world produces such excellent Fullers' Earth as our own.

Q. What is *Soap Earth*?

A. Soap Earth is a soft oily earth, very much resembling soap. It possesses many of the proper-

ties of Fullers' Earth, and is used for the same purposes.

Q. What is *Jade*, or *Nephrite*?

A. Jade is a very hard and tough stone, of an olive colour, and rather oily. It is found in China, India, and on the banks of the river Amazon, in America; and it is said that several of the tribes of American Indians make their battle-axes of it.

Q. What is *Serpentine*, or *Mona Marble*?

A. It is a stone which when polished bears a near resemblance to marble; is of a dark green colour, variously streaked. It is found in large masses in several parts of this country, and is very valuable in ornamental architecture, both for beauty and durability.

Q. What is *Venetian Talc*?

A. Venetian Talc, which is very abundant in the Tyrol, is an Earthy Stone, easily divided into plates or leaves, soft and unctuous, of a silvery white colour, and rather transparent. When the powder of Talc is added to Carmine, it forms the cosmetic called *Rouge*.

Q. What is *Asbestos*?

A. Asbestos, which derives its name from a Greek word, signifying unconsumable, is found in the isle of Anglesea and in Scotland, and is a

silvery white mineral, of fibrous texture. A variety of this mineral, called *Amianthus*, was well known to the ancients, and as it contained long silky fibres, they manufactured it into an incombustible kind of cloth, used for burning the bodies of the dead in.

CHAPTER XIV.

Saline Stones.

Q. WHAT is *Limestone*?

A. Common Limestone is harder and heavier than chalk, of a greyish colour, and is found in most countries. It forms nearly the whole mountainous districts of Derbyshire and Shropshire, and in it are found numerous veins of lead ore and other minerals.

Q. What is *Chalk*?

A. Chalk, which is so well known to us, is a soft white stone, which has various important uses. When ground or pounded, and freed from gritty particles, it is called *whiting*; and when burnt, and made into lime, it becomes excellent mortar.

Q. What is *Marble*?

A. Marble is a compact close-grained stone, capable of receiving a high polish. The most valuable Marble is imported from Italy; but our own country furnishes us with many varieties of it, particularly the counties of Devon and Derby.

Q. What is *Portland Stone*?

A. Portland Stone, Bath Stone, and Ketton Stone, are different varieties of carbonat of lime, and are so hard as to be used in building. They take their names from the places in which they are found. Most of the bridges and many of the public buildings in London are built of Portland Stone.

Q. What is *Tufa*?

A. Tufa, or incrusting carbonat of lime, is a calcareous substance deposited by such water as is impregnated with lime. Most of the substances denominated *petrifications* belong to this kind of lime; but they are by no means converted into stone, only covered with it.

Q. Have we not some beautiful specimens of this substance in our own country?

A. Yes; at Knaresborough, in Yorkshire, is a *dropping well*, which is particularly celebrated for them; at Matlock, in Derbyshire, and some other places, are springs possessing this extraordinary quality, and the people who have the care

of them constantly keep these petrified articles for sale. In the British Museum there is a human skull completely incrustated with stone, which was found in the river Tiber.

Q. What is *Sulphat of Lime*?

A. *Alabaster*, or *Gypsum*, is sulphat of lime, combined with sulphuric acid, and is of a white colour, tinged with grey or red, and sometimes striped, veined, or spotted. Being much softer than marble, it is very easily manufactured into chimney-pieces, vases, &c. When heated it falls into powder, which when mixed with water, is called *Plaster of Paris*.

Q. What is *Fluat of Lime*?

A. That mineral known by the name of *Derbyshire spar* is Fluat of Lime, from which several kinds of ornamental vases and toys are made; they are extremely varied in their colours and appearance, and being capable of receiving a high polish, are very beautiful.

CHAPTER XV.

SALTS.

Q. WHAT is *Potash*?

A. Potash is an alkaline substance, and exists under the form of a Salt in vegetable substances, which is obtained by burning them. It is used in many arts and manufactures, as scouring, washing, bleaching, dying, glass-making, &c. After Potash has been made red hot, it is rendered whiter and more pure, and is then called pearl-ash. In a mineral state, Potash is found combined with nitric acid.

Q. What is *Nitre*?

A. Nitre, or Saltpetre, is found in a state of incrustation on the surface of the earth, in some parts of India, Africa, and Spain; and in such abundance as to admit of being swept off, at certain seasons of the year, twice or thrice a week. Many plants also contain Nitre.

Q. Of what use is it?

A. Since the invention of gunpowder, which is chiefly composed of Nitre, immense quantities

are annually consumed; and artificial modes of procuring it have been found necessary, chiefly from the putrefaction of animal substances mixed with calcareous earths, the salt being separated from them by boiling. It is also useful in medicine.

Q. What is *Soda*?

A. Soda very much resembles Potash, and is used for the same purposes. It is obtained from sea-water, and from the ashes of plants growing on the sea-shore, particularly from that called *Salsola Soda*, from which it receives its name. In conjunction with oil and lime, it is used in making soap.

Q. What is *Carbonat of Soda*?

A. This salt consists of Soda combined with carbonic acid, and is found in Egypt, on the surface of the earth, near certain lakes, called Natron lakes, from which it is sometimes called *Natron*. It is employed in the manufacture of soap and glass.

Q. What is *Common Salt*?

A. Common Salt, or Muriat of Soda, is found in most countries in a solid state, though by far the greatest part is obtained from sea-water. When dug out of the earth it is called *rock salt*, and when obtained from sea-water, which is effected by the

simple process of exposing it to the sun in shallow reservoirs of earth, called salt-pans, it is known by the name of *sea-salt*.

Q. Are there not some very wonderful salt mines in different countries ?

A. There certainly are ; the most considerable are those near Cracow, in Poland, and it is supposed that they alone contain more salt than would supply the wants of the whole world for several thousand years. At Northwich and Nantwich, in Cheshire, there are also salt mines of great extent.

Q. What is *Borax* ?

A. Borax is a salt composed of boracic acid and soda, and is imported from the East Indies. Its chief use is to jewellers and goldsmiths, to facilitate the soldering of gold and silver, and is particularly useful in the manufacturing the glass pastes in imitation of gems. Borax is also valuable in medicine.

Q. What is *Alum* ?

A. Alum is an artificial production from the different kinds of stones that contain it, and is useful to dyers, tanners, engravers, &c.

CHAPTER XVI.

COMBUSTIBLES.

Q. WHAT is *Sulphur* ?

A. Common Sulphur, or Brimstone, is a yellow, dry, and brittle substance. In burning it yields a suffocating smell, well known under the denomination of *sulphureous*. In all volcanic countries it is found in a pure state; and it exists abundantly in a state of combination with several metallic substances.

Q. What are its uses ?

A. In the composition of gunpowder it is used, to render the mixture of charcoal and nitre more inflammable. It is employed to give a blue colour to artificial fire-works, and its readiness to take fire caused it to be used in making matches. It is also occasionally used in medicine, as an internal and external remedy. Many mineral waters are impregnated with it.

Q. What is *Plumbago* ?

A. Plumbago, or Black Lead, in an inflammable mineral, of a dark iron grey colour, with a strong metallic lustre, which, when handled, is soft and greasy.

Q. Of what service is it?

A. It is of great use to artists, who, if deprived of black lead, would find great difficulty in making their sketches. Many hundred thousand pencils are annually made of it in this country, though an inferior sort may be had, which are made by mixing powdered black lead with sulphur.

Q. What is *Naphtha*?

A. *Naphtha*, or rock oil, is a yellowish or bituminous fluid, of strong odour. Its peculiar property is to burn with great readiness, and on the shores of the Caspian sea, the inhabitants burn it instead of oil in their lamps.

Q. What is *Petroleum*?

A. *Petroleum* is a bitumen, of greater consistency than *Naphtha*; of black, brown, or greenish colour, which, when exposed to the air, assumes the appearance of tar, and is called *mineral tar*. This substance is found in almost all countries, and exudes spontaneously from the earth, or from clefts of rocks. In Pegu it is very abundant, and at Colebrook Dale, in Shropshire, is a considerable spring

of this mineral, which is boiled till it assumes the consistency of pitch.

Q. Are there any other Bitumens ?

A. Yes ; *Mineral* or *Barbados Tar* ; *Elastic Bitumen*, which bears a strong resemblance to India rubber ; and *Asphalt*, or *solid Bitumen*. This latter is found in great quantities on the surface of volcanic productions, and on the Asphaltic lake, or Dead sea, in Syria. It is supposed that the mortar so celebrated among the ancients, and with which the walls of Babylon and the temple of Solomon were cemented, was nothing more than a preparation of Asphalt.

CHAPTER XVII.

Combustibles continued.

Q. WHAT is *Coal* ?

A. This truly valuable mineral is found in beds, or strata, and chiefly occurs in those countries which lie nearly in the same latitudes with Great Britain ; in Siberia, Germany, Sweden, France, Canada, Newfoundland, and some of the northern

parts of China. There are many different kinds of Coals, but the best are those which are brought from Newcastle.

Q. What are the chief uses of Coal?

A. Its uses as fuel are too well known to require any observations; but it has lately been applied in producing *gas*, which, as a new invention of the highest importance, is deserving our attention. An *inflammable gas* is produced from Coal, which is used for lighting the streets and shops of the metropolis. This gas is conveyed to great distances by pipes from the reservoirs in which it is collected; and the beautifully brilliant light which it yields, supplies the want of oil and candles, and affords at the same time considerable heat.

Q. What is *Jet*?

A. It is a solid black mineral, somewhat resembling coal, but much harder; it is found in detached pieces, having a grain resembling wood. If set on fire, Jet burns with a green flame, exhaling a strong bituminous smell.

Q. What is *Amber*?

A. Amber is a substance of a golden yellow colour, having a shining lustre. The only mines of Amber at present known are in Prussia; but

it is usually found in detached pieces on the Baltic and British shores. Before the discovery of the numerous precious stones in India, Amber was very valuable. It is easily burned, and emits a white smoke, and rather an agreeable odour.

CHAPTER XVIII.

METALS.

Q. WHAT are *Metals*?

A. Metals, when found combined with other mineral substances, have the name of *ores*. They are found deposited in veins, at various depths, in the earth, more generally in mountainous than in plain or level districts. They are easily distinguished from other minerals by their peculiar brilliance, and their great weight.

Q. How are they obtained?

A. When a vein of any ore is discovered, the surface of the earth is penetrated to it, and the vein is followed in whatever direction it may lie. The hollow places thus formed are called *mines*, and those who work in them are denominated *miners*.

After the metallic ores are drawn from the mine, they have to undergo several processes before they are fit for use, and are generally first washed in a running water to clean them of earthy particles.

Q. How many metals are there?

A. Twenty-three; these are divided into ten *Malleable*, and thirteen *Brittle* metals; the Malleable metals are Platina, Gold, Silver, Copper, Iron, Tin, Lead, Mercury, Nickel, and Zinc; the Brittle metals are Arsenic, Bismuth, Cobalt, Antimony, Tungsten, Tellurium, Uranium, Molybdena, Chrome, Manganese, Titanium, Columbium, and Tantalium.

CHAPTER XIX.

Malleable Metals.

Q. WHAT are *Malleable* metals?

A. Malleable metals are such as are capable of being flattened or lengthened with the hammer, without tearing or breaking.

Q. What is *Platina*?

A. Platina is the heaviest and one of the hardest

and most difficult to be melted of all metals. Its colour is white, but darker than silver, and is found in small angular grains in the sands of some rivers in South America. Platina is not fusible by the heat of a forge; and is, therefore, admirably adapted for the uses of the philosophical chemist, when made into crucibles and other vessels, which are exposed to the heat of intense fires. Its ductility is such that it may be rolled into plates, or drawn into wire as easily as gold. This metal was not known in Europe till the year 1735.

Q. What is *Gold*?

A. Gold, the most precious of all metals, is distinguished by its yellow colour, by its being softer than silver, harder than tin, more easily melted than copper, and next in weight to platina. It is found chiefly in hot countries, principally in grains, which are mixed with the sand of many rivers in Africa, India, and South America.

Q. For what is Gold serviceable?

A. Its uses are most important to us. From the earliest ages, Gold has been known and highly prized; and, by the common consent of civilized nations, owing to its weight, scarcity, and imperishable nature, it has become the circulating

medium for the purchase of commodities, and the representative of wealth, when coined into money. Its uses also for goldsmiths' work, in jewellery, and for gilding, are numerous and well known.

Q. What are the peculiar properties of Gold?

A. Its remarkable ductility, particularly when alloyed with copper. An ounce of gold upon a silver wire is capable of being extended 1300 miles in length; and leaves of gold may be beaten so thin, that a single grain will cover more than fifty-six square inches.

Q. Is gold found in Europe?

A. Yes, several Gold mines have at different times been discovered in various parts of Europe. In Hungary, Spain, Sweden, Norway, and Ireland, Gold has been found; but the mines of Lima and Peru have furnished this valuable metal in too great abundance to make the European mines worth attending to, the expence of working them being very great, and their produce comparatively trifling.

Q. What is *Silver*?

A. Silver is a white, brilliant, and ductile metal, and is found either in its *native* state, that is nearly in a state of purity, uncombined with any other

mineral, or combined with lead, antimony, sulphur, and a variety of other substances.

Q. Where is the pure, or native Silver, brought from ?

A. The wonderful mines of Potosi, in South America, contain the purest silver that is known. These astonishing mountains, which are about twenty miles in circumference, are said to produce upwards of 30,000 dollars-worth of ore per week, and have 300 shafts or openings where the miners descend.

Q. When it is extracted from other ores, how is it performed ?

A. The mode of extracting either Silver or Gold from the ores with which they are combined, is by reducing them into a fine powder, and mixing this powder with Quicksilver ; the latter having the curious quality of uniting with itself every particle of these precious metals, but being incapable of union with any other substances. It is afterwards easily separated by means of heat, as the Quicksilver readily evaporates. Great quantities of Silver are extracted from lead, and native Silver has been frequently found in the copper mines of Cornwall.

Q. What are the uses and qualities of Silver?

A. It is coined into money, and is manufactured into various kinds of elegant utensils, such as goblets, vases, cups, spoons, dishes, &c. which are called *Silver plate*. Next to Gold and Platina, it is considered the most unchangeable of any metal. It is almost as ductile as Gold, and may be beaten into leaves nearly as thin.

CHAPTER XX.

Malleable Metals continued.

Q. WHAT is *Copper*, and where found?

A. Copper is an orange-coloured metal, more sonorous than any other, and the most elastic of any except iron. It is sometimes found in a pure state, but more generally combined with other substances. The most valuable Copper mines are in Cornwall, and the isle of Anglesea:

but it is found also in several parts of the European Continent, and in China, Japan, and Africa.

Q. What are its chief uses?

A. Copper is employed in the manufacture of various kinds of cooking utensils, but unless the inside is covered with a thin coat of tin, it is likely to give it an injurious, and even poisonous quality. It is also used for sheathing the bottoms of ships, sometimes for covering houses, &c.

Q. Are there not some alloys of copper which are extremely serviceable?

A. Certainly; that well-known yellow metal, called *brass*, is an alloy of copper, with about a fourth part of zinc, which is both useful and beautiful; and not so apt to tarnish and rust as copper. Brass wire is used for the strings of musical instruments, and the finest sieves are woven with it; also the wheels of clock-work, mathematical instruments, &c. are made of brass.

Q. Are there not some other well-known alloys of Copper?

A. Yes; *Prince's Metal*, or *Pinchbeck*, *Bronze*,

and *Bell-metal*, are each composed of copper, variously mixed either with zinc, tin, or iron.

Q. What is *Iron* ?

A. Iron is a well-known hard metal, of a darkish grey colour, and very elastic. It is seldom found in a pure state, but generally combined with sulphuric or carbonic acids.

Q. What are its uses ?

A. Its uses are far more important than any other metal : without it the earth itself could not be well cultivated, nor could the arts be practised with success. When iron ore is dug from the mine, it is broken into small pieces, and when washed from the particles of earth which are mixed with it, is melted in a furnace, and is known by the name of *cast Iron*.

Q. How is *wrought Iron* produced ?

A. By cast iron being thrown into a furnace, and melted by the flame of combustibles, where it continues for about two hours, and is kept constantly stirred, till it acquires consistency, and congeals. It is then worked into bars by being beaten, while hot, with heavy hammers.

Q. Is not *Steel* formed from Iron ?

A. Yes ; Steel is made by bars of Iron being

kept several hours in contact with powdered charcoal in a burning state. By heating steel to different degrees, it acquires different degrees of hardness, when cooled in water. All kinds of edge tools, where excellence is required, must be made of Steel.

Q. Do not *meteoric Stones* resemble Iron ?

A. They more resemble Iron than any other metal. Notwithstanding it has been asserted at different times by people of almost all countries, that meteoric stones, or thunderbolts, have fallen from the atmosphere, yet philosophers have generally regarded it as a vulgar error. It has, however, been too clearly ascertained of late years to admit of any doubt of their reality, and they are found to differ completely from any other stone or mineral, but to resemble each other exactly in the ingredients with which they are composed.

Q. Is not *Load-stone* a kind of Iron ?

A. Yes ; it is sometimes called *Magnetic iron-stone*, and has the power of attracting iron and steel. It is found in most Iron mines, but we are quite ignorant what is the cause of its extraordinary powers, for it not only attracts Iron,

but when a needle is rubbed with it, it will point towards the north pole.

Q. What are *Pyrites*?

A. Pyrites, which in the Greek signifies *fire-stone*, is a mineral substance formed by a combination of iron and sulphur, and occurs in most mines. The hot temperature of almost all the mineral waters may be ascribed to the springs running through Pyrites.

CHAPTER XXI.

Malleable Metals continued.

Q. WHAT is *Tin*?

A. Tin is a white metal, in appearance very much like silver, but considerably lighter. It is always found in combination with sulphur and copper.

Q. Where is it obtained?

A. It is chiefly obtained from Cornwall and Devonshire; there are also tin mines in Germany, India, and America. The Cornish mines

were worked before the birth of Christ, and are still very productive.

Q. Of what use is *Tin*?

A. It is made into saucepans, boilers, and other vessels used for domestic purposes; and iron and copper vessels are lined with a liquid made from tin.

Q. What kind of metal is *Lead*?

A. Lead is a soft but very heavy metal, of a greyish colour. It is commonly found combined with sulphur, and a small portion of silver.

Q. What are its uses?

A. Great quantities of lead are used in casting musket balls and shot; it is made into pipes, cisterns, and reservoirs for water; and is used for covering churches, &c. The different oxides of lead are of great use to painters, viz. white lead, red lead, &c.

Q. What is *Mercury*?

A. Mercury, which, in its native state, is called *Quicksilver*, is found in small globules, of a shining silvery appearance, among ores, stones, and clay. The principal mines are in Bohemia, Germany, and Spain. It is also found in India and Peru.

Q. To what uses is it applied ?

A. Mercury is used for making barometers and thermometers, in the columns of which it ascends and descends according to the temperature of the air. It is also used for various medical purposes, and in gilding ; and when combined with tin, for silvering over looking-glasses.

Q. What is *Nickel* ?

A. Nickel is a fine white metal, resembling silver in appearance ; but is always found mixed with iron and arsenic. It has the property of attracting iron, and is attracted by the loadstone. It is found in Cornwall, and some other counties of England ; also in Germany, Sweden, France, and Spain. It is used combined with iron, brass, or copper, to which it gives a certain degree of whiteness.

Q. What is *Zinc* ?

A. Zinc is a bluish white metal, harder than silver, and is the least malleable of any of the metals so denominated. It is never found in a pure state, but combined with carbonic or sulphuric acids.

Q. Is it applied to any useful purposes ?

A. Many. It is used, combined with copper,

in the manufacture of brass, pinchbeck, bronze, and tutenag, and is employed in forming the galvanic apparatus. When filings of zinc are mixed with gunpowder, it produces those brilliant stars and spangles so much admired in artificial fireworks.

CHAPTER XXII.

Brittle Metals.

Q. WHAT are Brittle Metals?

A. Brittle Metals are such as are *not* capable of being flattened or lengthened by the hammer, without tearing or breaking.

Q. What is *Arsenic*?

A. Arsenic is a bluish white metal, remarkably brittle, and softer than any other metal; usually occurring in masses of various shapes, and in combination with small quantities of iron, gold, or silver.

Q. What are its properties and uses?

A. The oxide of arsenic is so deadly a poison, that if only a few grains of it be taken into the stomach, it proves fatal; yet, notwithstanding

its deleterious effects, it is occasionally used in medicine, though in extremely small doses.

Q. What is *Bismuth*?

A. Bismuth is a hard whitish semi-metal, extremely brittle, and is known to the workmen in our manufactories by the name of *tin glass*. It is used, combined with various other metals, to give them hardness.

Q. What is *Cobalt*?

A. It is a brittle greyish-coloured semi-metal, rather harder than silver, seldom found in its pure state, but generally combined with arsenic or sulphuric acids. Cobalt is not of much use in a metallic state, but its oxide is found extremely valuable in painting porcelain, enamelling, &c. as it forms a beautiful blue colour.

Q. What is *Antimony*?

A. Antimony is a close metallic substance, of a brilliant bluish white colour, harder than silver, and extremely brittle. *Printers' types* are formed by a portion of antimony mixed with lead. After undergoing chemical processes, it is highly serviceable in medicine.

Q. Have the other brittle metals any peculiarly serviceable qualities, when uncombined with other substances?

A. For the most part they are combined with various other metallic substances, or exist only as oxides, and do not possess any very remarkable properties.

CHAPTER XXIII.

Of Rocks.

Q. ARE there not large masses of minerals in a state of combination, called rocks ?

A. Yes ; and for the sake of indicating the substances which compose them, they are divided into four classes, viz. 1. Primitive rocks ; 2. Secondary rocks ; 3. Alluvial depositions ; and, 4. Volcanic rocks.

Q. What is meant by *Primitive Rocks* ?

A. Primitive rocks are considered to belong to the first-formed parts of the earth, as they contain no vestiges of animal or vegetable creation. They are extremely hard and crystallized ; they never rest upon those rocks which enclose organic remains, but are very frequently covered by such.

Q. Is not the *common granite* one of the principal of the primitive rocks ?

A. Certainly ; it is one of the most common and widely-extended rocks that are known, and is considered the foundation on which the secondary rocks are deposited. It is a compound substance, composed of felspar, mica, and quartz ; and is of various colours.

Q. What are its uses ?

A. So numerous and important that it has not its equal. The streets of London are paved with it, and its hardness and durability render it very fit for this use. When applied to architectural purposes it is found equally serviceable, as the weather has little effect upon it ; and in some countries, particularly Russia, the imperial palaces and other public buildings are constructed with it.

Q. What are *Secondary Rocks* ?

A. Secondary rocks are such as contain, or are composed of, the mineralized remains of animal or vegetable substances, and must have been formed after the organized remains which they enclose, which is supposed to have been effected by the deposition of water.

Q. What are *Alluvial Depositions* ?

A. Those substances that have been formed

from rocks, which, by long exposure to the action of water and air, have been worn down, and afterwards deposited in beds on the surface of the land.

Q. What are *Volcanic Rocks*?

A. Volcanic rocks are composed of such substances as have been thrown out of volcanoes, or have undergone certain changes from the action of subterraneous fires.

Q. Can you give an example of the kind of substances that compose them?

A. Yes; pumice-stone, which is so light and porous a mineral, that if placed in water it will float. It is very useful to mechanics in smoothing and cleansing the surface of leather, wood, metals, &c.

CHAPTER XXIV.

Of Water.

Q. IN what way is water connected with minerals?

A. If we only taste the various kinds of water which we commonly use in drinking, we shall

perceive a sensible difference in them, which is chiefly occasioned by the foreign matters with which they are impregnated. In some cases it is hardly distinguishable, while in others it alters its properties altogether.

Q. How are we to discover what mineral substances are held in solution in the water which we drink?

A. To ascertain the exact proportion of the ingredients which water contains, is one of the most difficult operations in chemistry, and could not be related here; but this is certain, that no water can be obtained in a state of *perfect* purity without undergoing the process of distillation.

Q. Into how many *orders* are the different sorts of water divided?

A. Into three; Common Water, Sea Water, and Mineral Waters.

Q. Which do you call *Common Water*?

A. *Rain Water* is the first I shall mention, because it is the purest, but that differs according to the place where it falls; for instance, when it passes through the atmosphere of a smoky town, it imbibes a certain portion of the sulphat of lime. Rain water is always soft, and is highly serviceable for many domestic purposes.

Q. Which is the next in purity ?

A. *Ice and Snow Water* may be said to be equally pure as rain water. The inhabitants of the most northern parts of the world use thawed snow for their constant beverage during winter; and though it has been commonly asserted, that it occasions swellings in the neck, we have no positive proof of that being the case.

Q. What is *Spring Water* ?

A. Spring water comprehends all waters that springing from beneath the soil, are used at the fountain head. It is nothing more than rain water, which, gradually filtering through the earth, again makes its way to the surface. It partakes more or less of the different substances through which it flows, and is generally hard.

Q. What is *River Water* composed of ?

A. It is a mixture of rain and spring water, which from great exposure to the air, and constant running, becomes tolerably soft, and free from earthy particles, which it deposits in its course. Even those rivers, such as the Thames for instance, which are impregnated with putrid remains, are very soft and good, and after filtration and rest, contain little that is either noxious or unpleasant.

Q. Is not *Stagnant Water* more impure than any other?

A. Yes; particularly in ponds and marshes, where vegetable and animal substances are gradually undergoing decomposition. In marshy countries the effluvia arising from stagnant water has a pernicious effect on the health of the inhabitants.

CHAPTER XXV.

Sea Water.

Q. WHAT are the peculiar properties of *Sea Water*?

A. *Sea Water* is compounded not only of a considerable portion of saline substances, but of numerous vegetable and animal productions, which are gradually putrifying, and these give it that unpleasant bitter taste, which is particularly observable in water taken from the surface of the sea. It likewise contains a portion of sulphur and many other minerals.

Q. Is not *Sea Water* recommended to patients suffering from debility?

A. Yes; in all cases where cold bathing is useful, sea-bathing is peculiarly so, and in some complaints it is taken internally with advantage. Besides common salt, we obtain from sea water those medicinal salts called Glauber's and Epsom salts.

CHAPTER XXVI.

Mineral Waters.

Q. ARE there not a great variety of Mineral Waters?

A. Yes; some partake of one mineral substance, and some of another; some cold and pellucid, others hot, saline, and carbonated; but all possessing virtues, which in various complaints have been found highly serviceable to mankind.

Q. Describe the *Bath Water*.


A. It is a hot carbonated chalybeate. The temperature of that drawn from the King's bath is 116° of Fahrenheit's thermometer. It contains a small portion of sulphat of lime, chalk, Glauber's salts, common salt, and oxide of iron, and is very hard.

Q. Have we any other mineral waters equally hot?

A. No; though we have other waters called hot, none of them are equal to the heat of the animal temperature. The city of Bath has been celebrated for its waters from the time of the Romans.

Q. What are *Chalybeate Waters*?

A. Those which contain a portion of iron, such as the *Tunbridge Water*. Its foreign contents are oxide of iron, a small portion of common salt, muriat of magnesia, sulphat of lime, and carbonic gas or fixed air. There are many springs in this country which differ but little in their properties from this.



Having thus described every metallic ore of real importance, as well as the principal minerals belonging to the other classes, I shall here conclude by observing, that whether we survey the boundless expanse of the heavens, descend into the depths of the ocean, or explore the hidden treasures of the earth, we find that the Omnipotent Architect who formed the whole, neglected no part of the vast machine, but exerted his wondrous power in contributing to the happiness and supplying the necessities of his creatures.

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