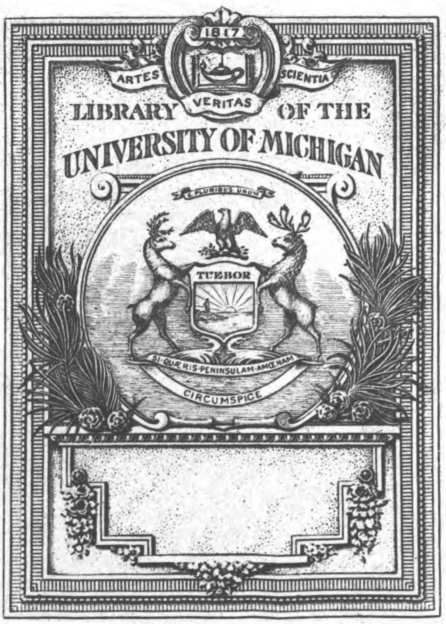
An elementary treatise on quartz and opal, including their varieties

George William Traill



AN

ELEMENTARY TREATISE

ON

QUARTZ AND OPAL.

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ELEMENTARY TREATISE

ON

QUARTZ AND OPAL,

INCLUDING THEIR VARIETIES:

WITH A NOTICE OF THE PRINCIPAL FOREIGN AND BRITISH LOCALITIES IN WHICH THEY OCCUR.

BY

GEORGE WILLIAM TRAILL.

NEW EDITION, GREATLY ENLARGED.

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TO

M. FORSTER HEDDLE, Esq., M.D.,

PROFESSOR OF CHEMISTRY, UNIVERSITY OF ST. ANDREWS,

This Elementary Treatise

IS, BY PERMISSION, RESPECTFULLY INSCRIBED

BY

HIS FAITHFUL AND OBLIGED FRIEND,

THE AUTHOR.

PREFACE TO THE FIRST EDITION.

THE minerals Quartz and Opal, owing to their great variety and beauty, hold a prominent place in most collections, and are well suited to form an independent treatise. A work of the kind must necessarily, to a certain extent, be compiled from general sources, yet a considerable amount of the following Treatise will be found strictly original, the Author having devoted his attention principally to this branch of the science; and care has been taken to assert nothing as fact but what has been well authenticated.

The Author is much indebted to the very complete lists of British localities contained in Greg and Lettsom's "Manual of the Mineralogy of Great Britain and Ireland;" also, personally, to Professor Heddle of St Andrews, for much general information, and for his kindness in affording frequent access to his extensive and valuable collection of minerals.

EDINBURGH, *October* 1866.

PREFACE TO THE SECOND EDITION.

FROM the very favourable reception accorded to the first edition, the Author was induced to continue his researches, with the view of bringing out a new Edition on a considerably extended scale.

The lists of localities have been revised and extended; many new analyses given; and great pains taken in rendering the lists of synonymes as complete as possible, many scarce works having been consulted for the purpose; so that it is confidently expected this edition will be found more worthy of the attention of scientific men, as well as the public generally.

EDINBURGH, *January* 1870.

LIST OF WORKS

CONSULTED IN PREPARING THE FOLLOWING TREATISE.

Allan's Manual of Mineralogy, 1834.

Jameson's System of Mineralogy, 1820.

Beckmann's Hist. of Inventions and Discoveries, by Johnston, 1797.

Hill's History of Fossils, folio, London, N.D.

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Brooke's Crystallography, 1823.

Sir Thomas Browne's Works, folio, London, 1686.

Dana's System of Mineralogy, 1854.

Greg and Lettsom's British Mineralogy, 1858.

Bischof's Elements of Chemical and Physical Geology, translated by Paul, Cavendish Society, 1852–9.

Jackson on Minerals and their uses, 1849.

Kürr's Mineral Kingdom, 1859.

Mantell's Thoughts on a Pebble, 1849.

Mohs' Mineralogy, by Haidinger, 1825.

Moore's Ancient Mineralogy, 1834.

Nicol's Manual of Mineralogy, 1849.

Phillips' Mineralogy, by Allan, 1837.

Pliny's Natural History, by Bostock and Riley, 1855–7.

C. Plinii secundi Historiæ Mundi; cura Dalecampii, 1606.

Poema Orphei de Lapidibus, ex editione Gesneri, 1781.

Traité élémentaire de Minéralogie, par Brochant, Paris, 1800–1.

Le Règne Mineral, par Necker, Paris, 1835.

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Traité élémentaire de Minéralogie, por Beudant, Paris, 1830.

Traité de Minéralogie, par Haüy, Paris, 1822.

Cristallographie, par Romé de l'Isle, Paris, 1783.

Handbuch der Mineralogie von Hausmann, Gottingen, 1847.

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King's Natural History of Gems, 1867.

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AN

ELEMENTARY TREATISE

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QUARTZ AND OPAL.

ELEMENTARY

TREATISE ON QUARTZ AND OPAL.

QUARTZ.

QUARTZ is composed of pure silica, generally combined with minute proportions of metallic oxides, from whence the varied and brilliant colors it frequently exhibits are derived.

It is a most abundant mineral, forming extensive veins and masses in primitive and transition rocks, and, consequently, diffused over almost every quarter of the globe. It is an essential constituent of granite, gneiss, mica-slate, and other allied rocks; and, in the form of sand, forms nearly the whole of the mobile soil of the sterile desert. In South America quartz has been observed by Humboldt in mountain masses or beds many hundred feet in thickness. Its specific gravity varies from 2·5 to 2·8; and is 2·65 in the purer varieties.

Quartz consists of many varieties, differing much in external appearance; all of which readily scratch glass, and equal 7 in Professor Mohs' scale of hardness. It is infusible *per se*, except at the highest temperature of the oxy-hydrogen blowpipe, when it melts to a colorless globule. When heated along with NaO,CO_2 unites with the base, fusing readily with intumescence into a transparent glass. It is insoluble in all acids excepting the hydro-fluoric; but when pulverized is slightly soluble in a solution of caustic potash.

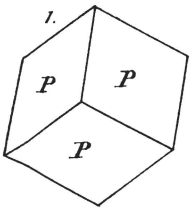
Quartz occurs massive and crystallized; also fibrous, stalactitic, granular, spongiform, pseudomorphous, &c.

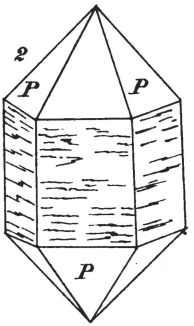
CRYSTALLIZED QUARTZ. ROCK CRYSTAL. Dragonite. Quartz, *Phillips, Brooke and Miller, Hauy,* &c. Quarz, *Naumann, Werner, Haidinger, Hausmann.* Rhombohedral Quartz, *Mohs.* Crystal de Roche, *Sage.* Crystallus Montana, *Cronst.* Crystallus Montana maximè pellucida, *Sibbald.* Crystallus quae glaciem refert montanam, *Boëce de Boot.* Nitrum Crystallus Montana, *Linn.* Whitestone of the jewellers. Berg Crystal.

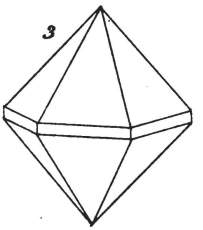
Silica	99·37
Alumina	trace
	99·37 Bucholz.

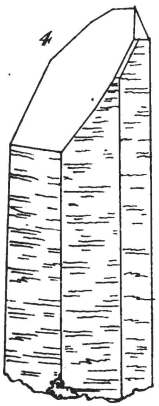
Loses by ignition 0·05 to 0·79 per cent. of water, *Bischof.*
Sp. Gr. 2·653 Beudant.
2·650 Brisson.

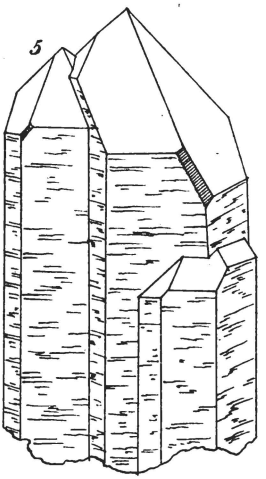
Rock crystal is the name usually given to crystallized quartz when pure and colorless. The primary form of the crystals is a rhomboid, fig. I.; but these are of rare occurrence, and are always small. The usual form is a hexagonal prism terminated by hexagonal pyramids, fig. II.; or, less frequently, the double hexagonal pyramid, fig. III. Crystals, however, are seldom so perfectly regular as figures II. and III. One or more of the pyramidal faces is generally enlarged at the expense of the others; and sometimes one face almost entirely extinguishes the rest, as shown in figure IV.;—this form is common in the fine transparent groups from Dauphiné and elsewhere among the Alps. The primary pyramid P, has the middle edge=103° 34′, and the polar edges=133° 44′. Frequently, however, it appears as a rhombohedron, with polar edges=94° 15′. The faces of the pyra-

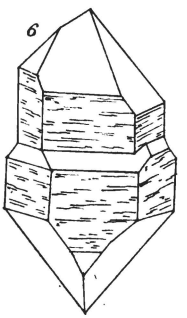


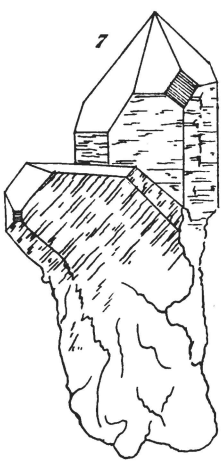


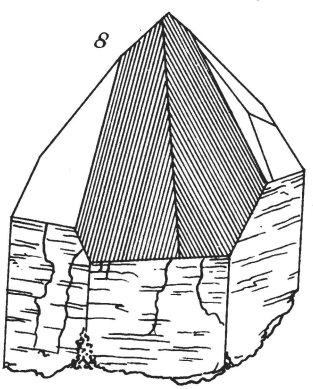


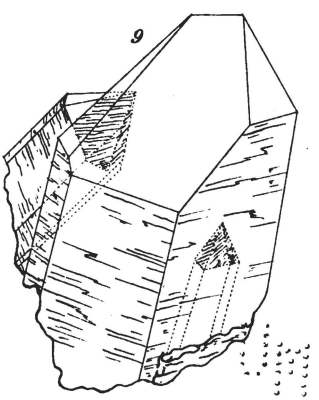












mids are smooth and polished, while the prisms are generally striated horizontally;—these striæ being the result of a frequent alternation between prismatic and pyramidal faces during crystallization.

Crystals of quartz are seldom isolated; most generally they occur in groups, crossing and penetrating each other, and often forming beautiful cabinet specimens. They are sometimes grouped with the axial system of the individuals parallel, fig. V., a beautifully limpid specimen from Hudson's Bay; or occasionally as represented in fig. VI.; less commonly penetrating each other, presenting the appearance of a simple crystal, fig. VII. Figure VIII. represents a twin crystal from Hudson's Bay, exhibiting minute striæ on one of the pyramidal faces. Figure IX. represents a crystal formerly in the author's cabinet, in the interior of which two other crystals of quartz are distinctly visible, without the superposition of chlorite or other foreign substance;—in this instance the pyramids of the enclosed crystals are striated, while the prisms are smooth, with a slightly blistered appearance. Rock crystal has a conchoidal and splintery fracture, and a vitreous to splendent lustre. The fracture, perpendicular to the axis, often presents the lustre of velvet, as first observed by Brewster. Rock crystal exhibits double refraction and circular polarization. Its refractive power is about a third of that of diamond; being as 10·5 to 30. On rubbing two pieces together in the dark a phosphorescent light is produced, and an empyreumatic odor at the same time emitted: this phosphorescence is also seen under water.

Crystals sometimes enclose foreign minerals, and such specimens are occasionally of great beauty, and are highly prized. Among the minerals which have been observed are, capillary crystals of epidote, rutile, limonite, actinolite, tremolite, asbestus, schorl, beryl; crystals of mispickel, adularia, albite, stilbite, chabasite, scheelite, red oxide of silver, kyanite, iron pyrites, antimony glance, cassiterite, magnetite, topaz, calc-spar; thin scales, or filaments of mica, pearl-spar, native

silver, native copper, native gold, silver glance, anthracite, bitumen; and, more rarely, drops of water, naphtha, and a very expansible transparent liquid. Sir D. Brewster mentions a specimen from Quebec, containing a cavity with fluid, in which is a loose group of calc-spar crystals which moves through the fluid on turning the specimen. According to Sir Humphry Davy, the fluid contained in rock crystal generally consists of water, with a minute quantity of saline matter; and the expansible fluid is azote.

It is said that the gold miners in California often come upon huge quartz nodules filled with water, and are occasionally poisoned by drinking it, owing to the quantity of silica it holds in solution. Specimens of this kind are apt to explode with great violence on the application of heat; an instance of which is on record where a person had his palate severely lacerated by placing one in his mouth and its bursting there. The author knew of a valuable specimen having been blown to pieces with great violence in the drawer of a mineral cabinet where it had remained during the continuance of an unusually severe frost. The water had evidently frozen, and the cavity had been too small to admit of its full expansion in passing into the solid state. In another instance a considerable quantity of water enclosed in a chalcedonic druse was lost by gradual exudation through the crystalline pores during the course of years: this was partly restored on the specimen being immersed for a considerable time in water under the exhausted receiver of a powerful air pump: the air was thus exhausted from the interior of the nodule, favoring the gradual admission of the water upon the restoration of the atmospheric pressure. Stones containing water were known to the Ancients under the name *enhygros*.

Quartz crystals are sometimes so thoroughly intermingled with chlorite as to appear wholly composed of this mineral; and their hardness is much reduced in consequence. The capillary crystals of rutile

in rock crystal sometimes occur of a bright red color, and such specimens were formerly known by the name of *Venus-hair-quartz;* and are supposed to be identical with the *Veneris crines* of Pliny; and the *chrysothrix*, or golden hair, of the Orphic Poem.

Crystallos, a name which expresses both ice and crystal, was first given to this mineral by the Greeks.

It was the common opinion of the ancient naturalists, and the belief has, indeed, been prevalent almost to our own time, that rock crystal was nothing else but ice or snow congealed to hardness by long-continued and intense cold. Pliny is positive in this opinion:— "*Crystallus fit gelu vehementius concreto.*" Diodorus Siculus, on the contrary, supposes it was water solidified by the power of solar heat: "*Crystallum esse lapidem ex aqua pura concretum, non tamen frigore sed divini caloris vi.*"

Rock crystal was made into drinking vessels by the ancients, which proves in their lapidaries a high degree of skill.

In the Mineral Department of the British Museum may be seen a sphere of rock crystal about three inches in diameter, which is considered to be the famous "show-stone" of Dr Dee, used in conjuring by Kelly, his assistant.* Butler says of it:—

> "Kelly did all his feats upon
> The Devil's looking-glass, a stone;
> Where, playing with him at bopeep,
> He solved all problems ne'er so deep."

Some crystals attain an immense size. There is one in the Museum at Paris 3 feet in diameter, and weighing nearly 8 cwt. Allan mentions a group of crystals in the University Museum at

* A curiously-shaped specimen of obsidian, now in the Londesborough collection, disputes with the above sphere, the honor of being the instrument used by Kelly. They may, indeed, both be genuine, for it is evident from Meric Casaubon that Kelly had several such stones.

Naples, weighing nearly half-a-ton, and another at Milan, 3¼ feet long, and 5½ in circumference, estimated to weigh 870 lbs. About a century ago, a drusy cavity was opened at Zinken, affording 50 tons weight of rock crystals, which at that early period sold for £60,000. One of the crystals weighed 800 lbs.

Rubasse is the name given to rock crystal, colored red artificially by repeatedly heating the specimen, and plunging it into a solution of cochineal. By this process the stone becomes full of small fissures, which absorb the coloring matter. It is produced of other colors also, by substituting saffron, indigo, or other ingredients, though the same name is applied to all:—the red color is, however, preferred. *Natural rubasse* occurs in the Brazils, but is very rarely met with.

Crystallized quartz is very widely, and often abundantly, distributed on the Continent of Europe. The finest specimens occur in Savoy, Switzerland, Tyrol, Piedmont, Dauphiné, and elsewhere among the Alps, forming drusy cavities in mica-slate; at Baréges, and in several parts of the Pyrenees; at Kongsberg in Norway, along with native silver. In Upper Saxony, along with tinstone. In Silesia, in granite. in Bohemia. In Bavaria, in clayslate. In Carinthia; Carniola; Transylvania; Switzerland, particularly at Mount Blanc, being found amongst the rock fragments which lie sprinkled over the glacier surface; in Siberia; at Mount Caucasus; at Shemnitz in Hungary; and in Ceylon. Very large crystals have been brought from the Brazils, and from Madagascar. Specimens containing fluids are found at Bragonza near Vicenza, whence their popular name, *Goccia d'Aquae di Vicenza.* Beautifully limpid crystals occur imbedded in the primitive marble at Carrara, and in the Keuper marls of Lippe; and brilliant specimens have been brought from various localities in North America, such as, Lake George, Cape Diamond near Quebec, crystals from which latter locality frequently contain fluids, the southern shores of Hudson's Bay, &c. Crystals having the primary form occur

in jasper, near Warwick. Fine dodecahedral crystals are obtained at the beds of specular iron in Fowler, Hermon, and Edwards, St Lawrence Co., New York. Crystals with rounded angles, as if they had been partially fused, occur in limestone at Gouverneur. At Palatine, Montgomery Co., crystals occur having one end terminated with the usual pyramid, while the other is rounded and smooth. Large crystals, often perfect, and weighing several pounds, occur at Minnesota mine. Lake Superior:—metallic copper occasionally envelopes these crystals as if it had been cast around them. Limpid specimens are sometimes brought from China, containing imbedded minerals, or carved with much skill into drinking-cups, idols, &c., and are highly valued.

Good specimens of rock crystal are found in many parts of Great Britain. The following localities may be enumerated:—

Cornwall; at the Tintagel slate quarries, and in the cliffs there, in clear crystals, fit for ornamental purposes. At Dennyval slate quarries, and near Scorrier. In the cliffs at Delabole, near St Teath. At Swanpool. Enclosing schorl at Boscawen cliff, near Penzance. At Mainforth, near Falmouth.

Cumberland; at Brandygill, Tentergill, and Pottsgill, on Carrock Fells. At Caldbeck Fells; and at Falcon Craig, near Keswick. At Alston; and in fine clear crystals on hæmatite at Cleator Moor iron-mines. *Capped quartz* occurs at Carrock Fells.

Devonshire; in fine crystals five or six inches long, containing chlorite, and studded with smaller crystals around the base in the manner of a ruff. At Wheal Friendship, near Tavistock. At North Bovey, in large opaque reddish crystals. *Babel quartz* occurs in Devonshire.

Derbyshire; at Castleton, with blende. At Masson Low, or Heights of Abraham.

Gloucestershire; at Clifton, known as "British Diamonds."

Isle of Wight; at Sandown, and Brixton Bays, in rolled pebbles of great purity, which probably have been washed out of the Wealden deposits at these localities.

Lancashire; at the Ulverston iron-mines with hæmatite.

Northumberland; at Allenheads.

Shropshire; at Snailbeach, with calcite.

Somersetshire; at Cheddar in geodes.

Kent; in the "Caller" flint nodules in chalk-pits near Canterbury. At Tunbridge Wells, in limpid pebbles, fit for ornamental purposes.

Wales.—Carnarvon; at Snowdon, very fine.

Scotland.—Argyleshire; in the primary form in mica slate on the north shore of Holy Loch; in chlorite slate in the primary form on Bishop's Hill; at Ballygroggan, Mull of Cantyre, in fine doubly pyramidal crystals in basalt; in small crystals of a pink color at the "Spindle Rock," near St Andrews, lining cavities of calcite in trap tuff; in the Island of Arran in drusy cavities in granite; in greenstone at Burntisland, Fife; in the neighbourhood of Cairngorm, Banffshire, in fine crystals, usually wine-yellow or brown: sometimes black. These crystals occur in granite, or in clefts in the granite, lying loose in the powder of the decomposed felspar, also in the alluvial soil, along with beryl and topaz, and are much sought after for ornamental purposes.

Ireland.—Antrim; at Knocklayd Mountain, near Ballycastle. Colorless crystals at Divis Hill, near Belfast. Near Carlow. In Donegal, very fine. Downshire; beautifully crystallized with topaz and beryl, generally dark brown, or black, in clefts and cavities of the granite at Mourne Mountains. Dublin Co.; at Howth, in marl. Yellow at Palmerston. Kerry; at Killarney, in yellow detached crystals; in sandstone at Mulloch Veil. Kilkenny; in large crystals at Castle Comer. Londonderry; in the parishes of Upper and Lower Cumber. Very fine at Dungiven, parish of Banagher; also at Finglen

Mountain, close to Dungiven;—at all of which localities it occurs in large detached crystals of a yellow, or smoky color, imbedded in the soil. They are known locally by the name of *Dungiven crystals*, and sometimes are very perfect;—one has been found at Dungiven, weighing nearly 90 lbs. At Rovenach, near Newtown-Limivady. At Blasquet Island, Co. Kerry. Tyrone; in the parishes of Donaghmore and Tullyniskan, in large detached crystals. Yellow at Glen Malur, in Wicklow.

VIOLET QUARTZ.—AMETHYST. Quartz hyalin violet, *Hauy.* Nitrum fluor, *Linn.* Crystal de roche violet, *Sage.* Ametista, *Ital.*

Silica	98·50
Alumina	0·25
Peroxide of iron	0·50
Oxide of manganese	0·25
	99·50 Rose.

Loses by ignition 0·16 to 0·3 per cent. of water, and becomes colorless, *Bischof.*

Sp. Gr. 2·632 Lowry; deep blue.
2·65 Rose.
2·750 Werner; violet from Saxony.
2·781 Karsten; dark violet from Ceylon.

The color of amethyst is by some mineralogists supposed to be derived from a small percentage of oxide of manganese; but it would seem, by the analyses of Heintz and Poggendorff, to be due to the presence of a minute quantity of ferric acid.

The color is often irregularly diffused; and portions of specimens

are sometimes colorless. This is well described by Pliny:—"*Ad viciniam crystalli descendet albicante purpuræ defectu.*"

The fracture presents numerous delicate ripple lines, somewhat resembling those observable in the palm of the hand; and all specimens of rock crystal having this peculiarity, whatever be their color, are now classed as amethyst by mineralogists. This fracture is due, according to Sir David Brewster, to the crystal being composed of layers; and these layers are found to have opposite optical properties.

The amethyst was valued by the ancients, on account of the property their superstition attached to it of preserving from intoxication any person by whom it was worn:—when adorned with figures of the sun or moon, it was worn as a charm against poisons. The name is derived from the Greek, *a*, not, and *methusos*, drunken. There are in collections many finely engraved specimens regarded as antiques, frequently sculptured with the head of Bacchus. Pliny remarks that "the lying Magi hold out that these gems are an antidote to drunkenness, and take their name from this property. Moreover, that if the names of the sun or moon be engraved upon them, and they be thus hung about the neck from the hair of a baboon, or the feathers of a swallow, they are a charm against witchcraft. They are also serviceable to persons having petitions to make to princes: they keep off hailstones and flights of locusts with the assistance of a spell which these doctors teach." This is not, however, the only amethyst of the ancients; the violet-colored sapphire, violet fluor spar, and probably several other minerals, being designated by the same name.

Amethyst, like most other gems, appears less brilliant by gas light; and is seen to best advantage when surrounded with pearls and set in gold.

In last century when the stone was much in repute, ranking next to the sapphire in value, the property of its color being expelled by intense heat, was taken advantage of when it was wished to have sets of

them all of the same tint. The most perfect necklace of well-matched stones ever brought together was that possessed by Queen Charlotte—it was valued at £2000 in last century. At that time fine amethysts sold as high as thirty shillings a carat; but immense quantities having been imported from the Brazils, they gradually became common, and went out of fashion; latterly, however, the taste for them has revived, and finely colored stones the size of a florin are worth from £10 to £15, according to Emanuel.

The best violet amethysts are brought from Ceylon; Silesia; Catharinenburg, Nertschinsk, Mursinska, and other places in Siberia; the Brazils; the kingdom of Murcia in Spain; Persia; and Cambay in India; where they occur in geodes, or hollow balls lined with crystals, and as pebbles. They occur in detached crystals amongst a reddish ferruginous earth in many places on the mountain St. Sigimnont in Catalonia. They occur also, though of less beauty, at Dannemora in Sweden; Clausthal and other places in the Hartz; Bohemia; Porkura and Siebenburg in Transylvania; Oberstein in Germany, in great abundance, where they are cut and polished expeditiously and cheaply by water power, and sent into all parts of Europe to be made up into cheap articles of jewellery; Kapnik in Hungary; at Annaberg; Kunnersdorf in Upper Saxony; Silesia; Bavaria; Stiria; Salzburg; Carniola; Switzerland; France; in the trap rocks of Iceland and Faröe; at Guanaxuato in Mexico; at Lake Superior, Pennsylvania, and elsewhere in North America; and in Great Britain at the following localities:—

Cornwall; at Wheal Buller, and Wheal Tolgus, near Redruth. Wheal Bellon, near St Just. Wheal Cock. Wheal Alfred. St Cleer, near Liskeard. Bosaverne mills. Levant mine, St Just. St Ewe parish, four miles S.W. of St Austell. Nangisel Cove, Sannen, near Land's End, in drusy cavities. Wheal Uny, near Redruth. Wheal Hope, near Truro.

Devon; at Oakhampton. Radiated at Whitchurch Down.

Gloucestershire; at Clifton, very fine, penetrated by lance-like crystals of hydrous oxide of iron, which sometimes project half-an-inch; also at Providence iron-mine, one mile and a-half S.W. of Clifton.

Somersetshire; parish of Cheddar, two miles S.W. of Axbridge, in nodules.

Scotland.—Haddingtonshire, on the coast in trap, opposite the Bass Rock; near Burntisland; in druses in amygdaloid near Montrose, and at Kinnoul Hill. In the cavities of agate in Fife, Perth, and Forfarshire.

Ireland.—County Cork; near Cork, at a quarry on the bank of the Lee, in very fine crystals. Mayo; Achill Island, in fine translucent crystals, occasionally 8 or 10 inches long. Meath; near Navan, of a pale color. Also in Dublin Co.; at Kerry Head; in Leitrim. In the Hebrides; in Lewis, and North Uist.

ROSE QUARTZ.—Quartz hyalin rose, *Hauy.*

Sp. Gr. 2.645, Heddle.

The color of rose quartz is due, according to Fuchs, to the presence of from 1 to 1·5 per cent. of oxide of titanium.* Some mineralogists, however, attribute it to manganese. The color becomes much paler when the stone is long exposed to light. Rose quartz is rarely found crystallized. The fracture has a peculiar fatty lustre. When cut and polished, and of a good color, it forms a handsome ornamental stone, and is sometimes sold for spinel, but the deception may be readily detected by its inferior hardness and specific gravity: speci-

* It contained also traces of an alkali, and of lime and magnesia.

mens, however, are seldom sufficiently free from cracks to admit of being used in jewellery. The larger masses are wrought into vases and other objects of art.

Rose quartz, as it loses its color when ignited, cannot have been formed by fusion. According to Bischof it loses no water by ignition, but becomes milk-white.

Milky Quartz, Quartz hyalin laiteux, *Hauy*, is distinguished from the former by its color only, which, as its name denotes, presents a milky aspect. Some specimens are slightly opalescent. It is only found massive, and is uncommon.

The principal locality of rose quartz is at Rabenstein, near Zwiesel, in Bavaria, where it occurs in a vein of manganese, traversing a coarse-grained granite. Very fine rose-red semi-transparent specimens occur at Kolyvan and in the Tigerezkeschen snow mountains in Siberia, where it is cut into elegant vases. It is also met with, but of less beauty, at Abo, in Finland; at Ekaterinburg; in the Hörlberg in the Forest of Bohemia, and in the Harlachberg, near Bodenmais; in the Palatinate; in South Greenland; at Southbury, Connecticut, Williamsburg, Massachussets, Topsham in Maine, and elsewhere in North America. Pale rose red and milk white varieties occur near Hohenstein in Saxony; rose red at Arendal in Norway, at Chateau-neuf in Auvergne, and Moisin in France; milk white in Spain. Rose quartz occurs also at the following British localities:—In Aberdeenshire, on the hills of Kildrummy, Auchindoir, and Glenbucket; in fine specimens on the shores of Kirkness, in Shetland; opalescent and pink at the Island of Shiant, Hebrides; in the Island of Coll; also near Belfast, in small detached crystals, pale, rose red, and milk white.

BROWN QUARTZ.—Smoky-quartz. Quartz hyalin enfumé, *Hauy.*

Crystallus hexagona obscura, *Wall.* Crystalli fusci coloris, *Sibbald.* Topazio fumoso, *Ital.*

Sp. Gr. 2·605, Karsten.

Loses color when ignited, but experiences a loss of only 0·01 per cent. of water, *Bischof.*

This variety occurs of various shades of brown and greyish-brown, passing into black :—when black it is called *morion.* The color is due to a minute portion of oxide of iron. It is much used in jewellery, and usually called *Cairngorm* by lapidaries, owing to fine specimens being found in the vicinity of Cairngorm in Banffshire. An Edinburgh lapidary cut nearly £400 worth of ornamental stones out of a single crystal from this locality. India, Brazil, Mexico, Bohemia, Olivet, near Orleans, and Pennsylvania, now produce the finest specimens. It is found in Britain at the Carnbrae Mines, Cornwall, in the vicinity of Cairngorm, in Banffshire, and at several of the localities of rock crystal.

Under this head may be noticed *Yellow quartz,* quartz-hyalin-jaune, *Hauy,*—which is generally artificially produced by submitting the dark varieties of brown quartz to a certain treatment with heat : they become nearly transparent; assume several shades of yellow, passing into reddish-brown ; and are extensively employed in jewellery, under the names of *citrine, false-topaz, occidental-topaz, false-hyacinth,* &c., according to color. Some specimens much resemble yellow topaz, but may be distinguished by their inferior specific gravity and hardness. Quartz seldom occurs yellow in the natural state.

Blue Quartz.—Siderite. Saphir d'eau. Leuco-sapphire? *Pliny.* Blue quartz occurs in fine specimens of a Berlin-blue color, at Golling, near Salzburg; in Bohemia, and Silesia; massive at Ped-

nandrea mine, near Redruth, and at North Roskear, in Cornwall; also in Cumberland.

RADIATED QUARTZ occurs in closely aggregated crystals, which radiate from a point. It is found in small fibrous tufts on red Heulandite at Campsie Hills, S. Stirlingshire; at Salisbury Crags, Edinburgh; in the amygdaloid of the Kilpatrick Hills near Dumbarton, (the *Kilpatrick-quartz* of Thomson), in fine specimens, generally of a pale flesh-red color, associated with natrolite and other zeolites, at Holly Park, near Rathfarnham, S. Dublin. Radiated quartz is not uncommon in Cornwall, especially in cross-courses, hence it is sometimes called by the miners *cross-course-spar.*

Sp. Gr., of Kilpatrick quartz, 2·525 Thomson.
2·62 Heddle.

FIBROUS QUARTZ:—

Silica	98·5
Oxide of iron	1·5
	100· from the Vorgeberge,
	—— by Klaproth.

Loses no water by ignition, *Bischof.*

FIBROUS QUARTZ is produced when the composition presents thin columnar particles. It occurs in fine specimens at Bodenmais, in Bavaria; at the Vorgeberge, in North Greenland; and (it is said) in Egypt, a pale green variety occurs with epidote in the Vale of Llanberris, near Carnarvon.

CAT'S-EYE. — Quartz - agathe - chatoyant, *Hauy.* Katzen-auge, *Germ.* The Sunstone of the Turks. Belocchio, and Occhio di Gatto, *Ital.*

	a.	*b.*
Silica	95·00	94·50
Alumina	1·75	2·00
Lime	1·50	1·50
Oxide of iron . .	0·25	0·25
Water	1·50	1·75
	100·00	100·00

a, white cat's-eye, Ceylon; *b*, brown cat's-eye, Malabar, both by Klaproth.

Sp. Gr. of *a*, 2·660
„ of *b*, 2·625

Cat's-eye is a variety of the preceding, interspersed with parallel fibres of amianthus, which produce a peculiar opalescence when the stone is cut *en cabochon*. It is generally translucent; is usually of a yellowish, or greyish-green color; but also brown, of a deep orange, and sometimes even nearly black. It is a gem much valued in the East, the Hindoos esteeming it above all precious stones after the diamond; consequently the finest specimens seldom find their way into Europe where the stone was, until the last few years, in comparatively small request. Its value in this country has increased much of late, and it is now frequently employed in jewellery for rings and pins.

Cat's-eye is supposed to have been known to the ancients, and is probably identical with the *Beli oculus* of Pliny.

Its principal localities are Ceylon and the Malabar coast. It has been brought from Orange River near the Cape of Good Hope; from Treseburg in the Hartz, and Hof in Bavaria.

GLOBULAR QUARTZ occurs at Knockmahon copper-mines near Bunmahon, S. Waterford; and of a black color, in chalk, at Dover.

STALACTITIC QUARTZ occurs at Wheal Alfred, Cornwall. At Clifton, near Bristol. In very fine specimens at Kinnoul Hill, Perthshire. At the Giant's Causeway, Antrim, of a brown color.

FLOAT STONE. — Schwimmkiesel, *Hausmann.* Schwimmstein, *Werner.* Quartz nectique, *Hauy.* Silicé nectique, *Beudant.*

	a.	*b.*	*c.*	*d.*
Silica	86·9	98·0	94·0	91·0
Alumina	0·7	...	...	·25
Carb. of Lime . .	9·1	2·0	...	2·0
Oxide of Iron . .	...	...	0·5	...
Water	3·3	...	5·0	6·0
	100·0	100·0	99·5	99·25

a, by Count Schaffgotsch; *b*, by Vauquelin; *c* and *d*, by Bucholz.

Sp. Gr. 0·448 Karsten.
0·512 Tralles.

This is a light porous variety of quartz of a greyish-white color, which possesses the property of floating on water until the air contained in its numerous cavities is expelled. It consists, according to Ehrenberg, chiefly of the siliceous coverings of infusoria. It occurs at St Ouen, near Paris, in beds of flint in chalk, and on the banks of the Seine; in Cornwall at Wheal Alfred; also in Pary's mine, Anglesey.

CELLULAR QUARTZ, a spongiform variety of the above, of a reddish-brown color, is found in Cornwall at Relistian mine, four miles S.W. of Camborne; at Cardrew mine, and at Pednandrea. Fine specimens have been brought from the Cape of Good Hope. A singular cellular or honey-comb variety of a dark grey color has been met with

at Alston, Cumberland, and Teesdale, Durham; probably the skeletons of decomposed septaria.

FULGURITE.—Astrapyalite. Sand-tubes. Blizsinter. Ceraunian-sinter.

Fulgurites are vitrified tubes formed by the action of lightning on sand. They are of a grey color; and are irregular and rough on the exterior, being incrusted over with grains of sand; but in the interior are smooth and glassy. They are usually three or four inches in length; but occasionally several feet, and divided into branches. The largest known specimen is sixteen feet in length: it was discovered by Dr K. G. Fiedler near Dresden, and is now in the British Museum.

They occur at the Senner and Lüneburg Heaths, North Germany; also occasionally in the sand and sand-hills on the coasts of Cumberland and Lancashire. They have been formed at Paris in tubes an inch long by means of the discharge of a powerful electric battery.

SAND.—The white variety is nearly pure quartz in a granular state: such is the sand at Headon Hill, on the north side of Alum Bay, Isle of Wight, largely used in the manufacture of glass, and occurring in great purity in a bed of from 30 to 50 feet thick. Other localities are at Lynn, on the coast of Norfolk; in the caverns of Reigate, in Surrey; at Ard, near Salt Lough, N. Donegal.

ITACOLUMITE, *Dana*.	*a.*	Articulite, *Wetherill*.	Flexible sandstone. *b.*
Silica	95·89	Silica	96·50
Peroxide of Iron . .	2·78	Alumina	2·50
Lime	0·84	Oxide of Iron . .	0·50
Water	0·17		
	99·68*		99·50

* With traces of KO, Na, O, MnO, Mg.O, but no Al_2O_3, HF_3, or any alkali other than the above.

a, from Saraw Mt. Stokes Co. No. Carolina, by Wetherill; *b*, by Klaproth.

Sp. Gr. 2·61.

Itacolumite, which derives its name from the mountain of Itacolumi, in Minas Geraes, Brazil, is a granular, laminated quartz rock of the talcose series, which has been generally regarded as having been altered by metamorphic action. Its lamination is undoubtedly due to a little mica which it always contains, and to the presence of this mica has also till lately been assigned the most interesting property possessed by the substance, namely its flexibility. A recent (July, 1867) investigation of Prof. Wetherill, however, would seem to prove that the flexibility is quite independent of the presence of mica; that the latter, even when present in considerable quantity, plays no part whatever in determining the motion, which he finds to be due to innumerable ball and socket joints, which exist uniformly throughout the mass of the stone.

The color of this substance is light yellow to reddish brown: its hardness is equal to that of agate, and its structure is so open and loose that both liquids and gases pass rapidly through its pores.

The scales of mica are comparatively few in number: they are thin, uniform in size, and lying in parallel planes as they would settle naturally from a liquid: they determine the cleavage of the rock.

The specimens examined by Wetherill were from North Carolina and Brazil. Heating to redness, with subsequent quenching in water, does not make the stone more friable, nor does it impair its flexibility: while boiling in HCl for five hours, which removed all oxide of iron, had also no effect.

The microscope showed that the ultimate grains of silica were small and sharply fractured: that these were agglutinated in groups of from 20 to 50 by some cement, each group having a cup-shaped cavity at one end, and a rounded projection at the other, respectively

adapted to those of the next or contiguous group. Each of these joints permits a slight movement which is always greater in one direction, and the accumulation of these joints suffers a limited motion which is nearly equal in every direction. The surfaces of the joints are not smooth but rough.

The cement would appear to be hydrated silica, because a piece boiled in a solution of potash became partially disintegrated; and the disintegration is immediate and complete if even weak hydro-fluoric acid is used.

A cylindrical piece of the North Carolina stone, 8 inches in length by $\frac{1}{2}$ inch in diameter, may be bent so as to describe with one end a circle $1\frac{3}{8}$ inch in diameter, and elongated or compressed so as to touch every point in its area: it can also be twisted about its axis, the torsion being 10°.

This substance is also interesting as being the matrix of the diamond.

Itacolumite occurs at Jujjur, about 120 miles N.W. of Delhi; at Minas Geraes in Brazil; in Georgia and North Carolina in America; and, perhaps, in the Urals.

AVANTURINE QUARTZ.—Quartz hyalin avanturine, *Hauy.* Sandaster ?, *Pliny.* Aventurine naturelle, *De Lisle.*

Specific Gravities by Prof. Heddle.

2·644 . . .	red.
2·746 . . .	green micaceous, from India.
2·67 . . .	yellow, Scotland.

This is a variety of massive quartz of a fine granular structure, containing numerous small scales of mica usually of a golden color, which, when polished, presents a shining spangle-like appearance. There is another variety in which an effect somewhat similar is pro-

duced by the reflection of light from an infinity of small fissures disposed throughout the mass. The most common color is a reddish brown; but it also occurs yellow, grey, greyish-blue, and green.

The avanturine most generally known, however, is that manufactured. It greatly surpasses the natural both in beauty and importance, and, indeed, supplied the name. The word arose through a French workman, who, having accidentally dropped brass or copper filings into a vitreous mixture while in a state of fusion, gave the name aventurine to the glittering compound formed, and thus discovered *par aventure.* The Venetian is most highly esteemed, and is largely used in the manufacture of vases and other objects of art.

Avanturine-quartz is supposed to have been known to the ancients, and is probably identical with the *sandaster* of Pliny.

The finest specimens are brought from India. It also occurs at Cape de Gatte, and Arragon, in Spain; red, also white with silvery specks; at Face Bay in Transylvania, black with golden-colored specks; in Lower Brittany, in rolled pebbles; in some parts of the Alps; abundantly in the environs of Nantes; in Siberia; and according to Jamieson in Scotland at Fortwilliam, and the mainland of Shetland. It also occurs in Greenland of a fine green tint; and, according to Dr M'Culloch at Glenfernat in N. Perthshire, of a fine greyish-blue.

PRASE.—Quartz hyalin vert-obscur, *Hauy.* Prasius, *Pliny.*

	a.	*b.*	*c.*
Silica	94·84	95·25	98·5
Alumina	0·47	0·41	0·5
Lime	...	1·0	...
Protoxide of iron .	3·64	2·66	1·0
Magnesia	...	0·67	...
Water	1·05	1·05	...
	100·00	101·04	100·0

a and *b*, by Beudant; *c*, by Bucholz.
Loses by ignition 0·25 per cent., *Bischof.*

Sp. Gr. 2·66 to 2·685, Breithaupt.

This variety is of a dark leek-green color, which it probably derives from an admixture of amphibole. It is generally opaque, and seldom occurs crystallized. The name is derived from the Greek, *prason*, signifying a leek, in allusion to its color.

Prase is spoken of by Pliny as a green stone of inferior rank:—that other kind he mentions as being "*sanguineis punctis obhorret*" was probably heliotrope.

It occurs in the iron mines of Breitenbrunn, near Schwartzenberg, in Saxony; in Tuscany; at Mummelgrund, in Bohemia; at Kupferberg, Silesia; in the Hartz; at Bojanowitz, in Moravia; in the Island of Elba; near Lake Onega; in Finland; Siberia; Maryland; Massachusetts; in fine crystals at the Cedar Mountain in South Africa; also in Cornwall, at North Roskear, and at Wheal Bellon, near St Just; at Falcon Craig, near Keswick; and in quartz veins in the Island of Bute.

FERRUGINOUS QUARTZ.—Hyacinth of Compostella. Sinople ou Zinopel des Allemands, *Sage.* Jaspis martialis, *Cronst.* Ferrum jaspideum. Ironflint, *Jamieson.* Eisenkiesel, *Werner.* Quartz hyalin rubigineux, *Hauy.* Nitrum flour purpureo-fulvum, *Linn.*

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*
Silica	94·93	85·15	88·31	90·00	98·50	76·80	92·00	93·5
Alumina	0·42	0·35	...	trace	...	0·25	...	...
Oxide of iron . . .	3·93	14·14	9·77	3·99	1·50	21·66	5·75	5·0
Oxide of manganese .	...	0·17	trace	5·15	...	...	1·00	...
Water	0·73	...	2·92	...	...	1·00	1·00	1·0
	100·01	99.81	101·00	99·14	100·00	99·71	99·75	99·5

a, from Sundvig near Iserlohn, by Schnabel; *b*, from Schemnitz, by Beudant; *c*, yellow, by Beudant; *d*, red, from Langbanshytta, by Berzelius; *e*, by Klaproth; *f*, red; *g*. brown; *h*, yellow; all by Bucholz.

Loses by ignition 0·73 to 1·0 per cent., *Bischof.*

Sp. Gr. 2·58 to 2·84.

This variety occurs both crystallized and massive; presents several dull shades of yellow, red, and brown; and is generally opaque. It contains usually about 5 per cent. of red or yellow ochre, or Göthite. It forms the transition to jasper. The crystals are always small; the largest rarely exceeding an inch in length. Magnetic properties are, according to Jackson, produced in some specimens by heat.

Ferruginous quartz is found at St Jago de Compostella, Spain, in very perfect distinct crystals imbedded in gypsum; in Bohemia; in ironstone veins at Ilfeldt and Fischbach in the Hartz; at Schemnitz, in Hungary; at Altenburg, Johann-Georgenstadt, Freyberg, and Eibenstock, in Saxony; at Sundvig, Westphalia; at Orpes, Hohenstein, and Sedlitz, in Bohemia; in the Fichtelgebirge, in Franconia; at Oberstein on the Rhine, in Siberia; and at the following British localities: — Botallack and Marazion, in Cornwall; with common quartz and hæmatite at Clifton; in geodes in new red sandstone at Churchill; on Skiddaw, Cumberland; in the neighbourhood of Bristol; at Stockingmoor, near Glasgow; in trap at Dunbar, N.E. of Haddingtonshire; at Leadhills, yellow; and at Kincraig, Elie, Fifeshire, yellow, and of a purplish red in trap tuff: at both of which localities the color is more or less superficial, never penetrating to the centre of the crystals, which are translucent, and have none of the opaque muddiness of true iron flint. In minute crystals of a yellow color, also massive, at Benbradagh Hill, near Dungiven, Londonderry. In trap at Rathlin Island, N. Antrim.

JASPER.

JASPER.—Jaspis, *Werner.* Quartz jaspe, *Hauy.* Silex rupestris, *Linn.* Jaspis purus, *Cronst.* Petro-silex jaspideus, *Wall.* Diaspro, *Ital.* Yashpeh, *Hebrew.* Yashp, *Arabic.*

	a.	*b.*	*c.*	*d.*	*e.*
Silica	93·57	95·76	75·0	80·0	60·75
Alumina . . .	0·31	1·50	20·0	5·0	27·25
Perox. of iron .	3·98	2·74	5·0	13·0	2·50
Lime	1·05	...	...	2·0	...
Magnesia . . .	...	...	...	...	3·00
Potash	...	...	...	...	3·60
Water	1·09	...	...	...	...
	100·00	100·00	100·0	100·0	97·10

a, yellow, by Beudant; *b*, from Kandern, by Walchner; *c*, by Kirwan, having a sp. gr. of 2·70; *d*, by Kirwan; *e*, by Rose.

Sp. Gr. 2·3 to 2·7 Brochant.

This is a ferruginous compact variety of quartz, presenting various shades of red, brown, yellow, and green; in irregular patches, and sometimes in stripes. It has a conchoidal fracture; is dull and opaque,—its fragments being seldom translucent on the edges;—and does not fuse before the blow-pipe. It is a common mineral, distributed in veins and beds both in primitive and secondary mountains.

We are uncertain what particular minerals were denominated iaspis by the ancients; but it is evident to all who are acquainted with the subject that they classed together under that name several totally distinct species. Pliny says it is a green stone, and often translucent. In another place, he speaks of a kind found in Persia resembling in color an autumnal morning sky, and hence called

aërizusa. Beckmann supposes this to have been blue jasper; but as blue jasper, if it can properly be said to occur of this color, is very rarely met with, more probably it has been lapis lazuli, of which the finest specimens have been for long brought from Persia and the East.

Jasper admits of a high polish, and is often manufactured into vases, boxes, knife-handles, and the like. It is found in many parts of the Continent. A variety bearing some resemblance to Egyptian jasper occurs in the pea-ironstone at Auggen and Kandern, Baden, presenting certain shades of yellow and red disposed in patches and annular markings. It occurs blood-red in the Tuscan Apennines, Piedmont, Sicily, &c. Variegated jaspers occur of great beauty at Giuliano, and elsewhere in Sicily. In great abundance in Siberia. A white variety, diversified with crimson veins, is said to occur in Syria.

Among the British localities of common jasper, the following may be enumerated :—

Cornwall ; at Botallack, Cape Cornwall, Wheal Sparnon, Wheal Maudlin, Wheal Unity, and at Tregos, four miles S.E. of St Colomb Major.

Devonshire ; at Ivy Bridge.

Dorset ; Isle of Portland.

Isle of Wight ; at Sandown and Brixton Bays, in rolled pebbles.

Cumberland ; at Falcon Craig.

Yorkshire ; at Scarborough, and near York.

Scotland ; at Dunglass, S. Dumbarton ; Campsie, Kilsyth, and Killearn, Stirlingshire, at the former of which localities it occurs in very fine specimens, usually red and yellow, mottled,—and occasionally of a uniform bright red color ; near Montrose ; Habbie's Howe, Pentlands ; Carlops ; Roxburghshire ; Moorfoot Hills ; Arthur's Seat, Edinburgh ; East Linton, Haddingtonshire, of a bright yellow ; Isles

of Isla and Rum, Argyll; sap-green at Iona; in Shetland; and in several of the Hebrides.

Ireland; abundant in the Cushendell porphyry, Antrim; also in the older conglomerate of Tyrone; at Lough Erne Head, Fermanagh; of a deep red at Slieve Gallion, Londonderry; in Wicklow.

RIBBON JASPER presents various shades of green, red, and yellow, in parallel stripes or layers. These layers, being generally very regular and well defined, enable lapidaries to engrave the stone as a cameo, in the same manner as the onyx. The finest specimens are found at Orsk in the district of Orenburg, Siberia. It also occurs in the Hartz; in Bohemia; at Gnandtstein, in Saxony; at Ivybridge, in Devonshire; at Dressing Green, near Tortworth, Gloucestershire; in Perthshire; at Ballygroggan, Mull of Cantyre.

EGYPTIAN JASPER.—Silex hæmachates, *Linn.* Caillou d'Egypte, *Fr.*

Silica	74·58
Alumina	15·40
Magnesia	5·00
	94·98 from Egypt, by Weiglib.

Sp. Gr. 2·56 to 2·88.

Egyptian jasper occurs in roundish or reniform nodules, externally of a brown color, and rough: internally exhibiting various shades of yellow and brown, arranged in irregular concentric zones, or in patches. It occasionally presents dendritic appearances. The markings in some specimens have a resemblance to natural objects, such as plants or animals. In the mineral department of the British Museum, room 3, case 23, is a small specimen, broken in two, each piece of which bears, it is said, a correct profile of the poet Chaucer:

this specimen was formerly in Sir Hans Sloane's collection. There was another, having a likeness of Voltaire, in the Strawberry Hill collection. The same peculiarity is sometimes observable in flint and other minerals, and such specimens are held in high estimation by the curious. Stones possessing these appearances formerly went by the name of *Gamahées.*

Egyptian jasper is found, according to Dr Clarke, abundantly scattered over the surface of the desert eastward of Grand Cairo. It is found also in Siphanto, and some other islands of the Archipelago. Rolled specimens of jasper, having some resemblance to the Egyptian variety, are met with at Sandown and Brixton Bays, Isle of Wight: these appear to have been washed out of the Wealden strata.

PORCELAIN JASPER:—

Silica	60·75
Alumina	27·25
Magnesia	3·00
Oxide of iron	2·50
Potash	3·66
	97·16, Rose.

Sp. Gr. 2·43 to 2·65.

Porcelain jasper, as it is called, is merely clay-slate indurated by intense heat. It is quite distinct from true jasper, from which it may readily be distinguished by its fusibility on the edges before the blow-pipe. It is compact and opaque; has usually a slaty structure, with an uneven fracture; and has generally either a bluish-grey, or a light fawn color. It is met with chiefly in the vicinity of coal mines which have been in a state of combustion. Occurs at Aussig and Carlsbad, in Bohemia; at Planitz, near Zwickaw, in Saxony; near St Etienne;

at Duttweiler, near Sarrbrück; in Iceland; also in Madeley parish, two miles N.E. of Broseley, E. Salop; near Kinghorn, Fife; near Dudley, Warwickshire.

HORNSTONE, OR CHERT.—Rhomboedrischer Quarz, *Mohs.* Hornstein, *Werner.* Amas siliceux, ou Pierre de corne, *Fr.* Quartz agathe grossier, *Hauy.* Petro-silex, *Cronst.* Pietra-cornia, *Ital.* Haella flinta, *Swed.*

	a.	*b.*
Silica	98·25	90·296
Alumina . . .	0·75	3·100
Oxide of iron . .	0·50	1·733
Magnesia . . .	...	1·285
Lime	...	0·936
Soda and potash .	...	0·700
Water	0.50	1·950
	100·00	100·000

a, by Klaproth; *b*, grey and red, from Marienbad, by Kersten.
Loses by ignition, 0·5 to 2·0, becoming white, *Bischof.*
Sp. Gr. 2·54 to 2·64.

HORNSTONE, or CHERT, occurs massive and compact; has a smooth conchoidal, or splintery and uneven fracture; is dull, or has a glimmering lustre; and is translucent on the edges. It much resembles some felspars. It is infusible *per se* before the blow-pipe; and scarcely so hard as quartz. The colors are usually yellowish-brown, and grey; but sometimes black, and of a purple or bluish tint. Hornstone occurs in large masses and veins, often imbedded in limestone rocks; also pseudomorphous, and forming the petrifying substance of

wood, shells, and madrepore. It is common on the Continent of Europe.

It is found in limestone in the Tyrol; in Cyprus, Hungary, and Sweden, forming veins, and sometimes passing into flinty-slate, or common quartz; in the Erzgeberge, in veins, associated with silver, copper, and other ores; in Kamtschatka, where whole trees with their branches occur as petrified wood; at Zinnwald, in Bohemia; and at Schneeberg, in Saxony, in pseudomorphous crystals after calc-spar, and sometimes mica; in Cornwall and Devon, as at Herodsfoot mine, near Liskeard; and at Beeralston and Beerferris. On Helvellyn. At the Menai Strait. In Arran; Perthshire; Argyllshire; Ross-shire; Inverness-shire; Sutherlandshire; Fifeshire; at the Pentland Hills with clayslate; in Shetland; in the island of Rum, at Scuir Mohr, along with heliotrope, in a seam of a lavender-brown color; at Lough Neagh, as petrified wood; at Milltown, two miles south of Dublin.

Hornstone occurs pseudomorphous at Beeralston, Devonshire, in the form of octahedral fluor, or capping it.

Beckite, a dull reddish-brown mineral occurring in mamillated or botryoidal incrustations at Torquay, and in some of the Devonshire mines, appears closely allied to Hornstone.

FLINTY SLATE—Kiesel schiefer :—

	a.	*b.*
Silica	96·50	61·24
Alumina . . .	0·60	18·75
Magnesia . . .	...	4·91
Lime	0·22	0·05
Protoxide of iron .	0·74	11·70
Soda	...	2·59
Potash	...	1·22
Carbon	0·01	0·49
Water	1·25	...
	99·32	100·95

a, by Du Menil; *b*, from Osterode, in the Hartz, by Schnedermann.

Sp. Gr. 2·41 to 2·88.
„ 2·63 Hoffmann.

This is a compact slaty variety, of a grey, yellowish-brown, dark green, or sometimes black color; containing carbonaceous matter; and forming strata in limestone rocks. In composition it is very various, as will be seen by the above analyses. It sometimes passes by transitions into clay slate, in which it often occurs in beds and imbedded masses.

Occurs in Norway, Saxony, Bohemia, Silesia, France, and other countries. At the Pentland Hills, near Edinburgh; at Marchburn, near Cumnock, Ayrshire, where it seems to have resulted from the action of trap on calm.

LYDIAN STONE, OR BASANITE. Touch-stone.—Kieselschiefer oder Lydit, *Germ.* Quartz Lydien et Pierre de touche, *Fr.*

H. = 7. Sp. Gr. 2·585, Hoffmann.

This is a velvety-black variety of the preceding; indistinctly slaty, with a flat conchoidal fracture.

Lydian stone seems to be identical with the *chrysites* of Pliny, so called from its use in testing gold. It is applied to a similar purpose at the present day; the metal being drawn across the stone, and the trace it leaves either assayed by acid, or simply held to indicate by its color the fineness of the alloy.

Lydian stone occurs at Leadhills; at the Braid and Moorfoot Hills, near Edinburgh; at Carlops, Pentlands, Midlothian, in fine specimens; being the cement of a brecciated vein of pink and white fortification agate; on the coast, three miles east of St Andrews, Fife, in imbedded volcanic bombs in trap tuff, with a specific gravity of

2·6 and 6·9 per cent. of water, *Heddle*; in Pomona, Orkney, in seams in fossiliferous sandstone flag one mile west of Stromness;—and curiously brecciated at Skail; at Glass Drummond, Downshire; at Carlow.

It is common at Hainchen, near Freyberg, in Saxony; in the Hartz; near Prague and Carlsbad, in Bohemia; Silesia; Hungary; and many other countries, frequently occurring along with flinty-slate. At Elfdal it is manufactured into vases and other ornaments.

Between quartz and opal certain siliceous minerals seem to be intermediate, which, according to Fuchs, are an intimate mixture of crystalline and amorphous silica, from which the amorphous, or, in other words, the opalline portion, may be separated by a solution of caustic potash. Among these minerals chalcedony and flint hold a prominent position.

Chalcedony.

Chalcedony.—Kalzedon, *Werner.* Quartz Agathe Calcedonie, *Hauy.* Calcedonie, *Breithaupt.* Silex chalcedonius, *Linn.* Calcedonio, *Ital.*

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*
Silica, ...	84·0	83·0	96·11	91·00	83·3	96·75	86·08	95·15
Alumina, ...	16·0	2·0	...	...	1·6	0·25	4·11	1·95
Oxide of iron, . . .	...	...	0·82	0·03	0·3	0·50	7·63	...
Lime, ...	...	11·0	...	8.97	10·0	...	1·16	2·25
Water, ...	...	...	3·07	...	4·5	2·50	...	1·00
	100·0	96·0	100·00	100·00	99·7	100·00	98·98	100·35

a, and *b*, from Faröe, by Bergmann; *c*, resinoid, by Beudant; *d*, from Chatillon; *e*, by Bindheim; *f*, by Klaproth; *g*, by Guyton; *h*, from Mourne Mountains, by Thomson.

Loses by ignition 0·4 to 2·5 per cent., becoming at the same time milk-white, translucent, and very brittle, *Bischof.*

A compact characteristic specimen from Quivig, in Stromöe, Faröe, gave Heddle a sp. gr. of 2·61, and 0·933 per cent. of water.

Sp. Gr. 2·615 to 2·700, Brochant.
„ of *b*, about 2·66, Bergmann.
„ 2·583, Hoffmann.

Chalcedony occurs botryoidal, reniform, stalactitic, and pseudomorphous; but never crystallized. The color, which is usually uniform, presents various shades of white, grey, yellow, brown, red; more rarely blue, lavender, and green. It is generally semi-transparent; has a subdued waxy lustre; and an even, or flat conchoidal fracture.

It is named from the town Chalcedon, in Upper Asia, where it was collected by the ancients. The rocks near this place, which is not far from the present Scutari, contain chalcedony in considerable abundance. Splendid specimens in stalactitic and aborescent forms were formerly found in Trevascus mine, Cornwall: Iceland, and the Faröe Islands, where it occurs in amygdaloidal rocks, are now, however, its best known localities. Fine specimens of various colors, some of them containing impressions of crystals, have of late years been brought from Uruguay, in South America. It also occurs at Oberstein, in the Palatinate; Siberia, sometimes in fine blue botryoidal specimens; Transylvania; Huttenberg and Loben, in Carinthia; Hungary; Mount Olympus; Tyrol; Bohemia; with bitumen at Pont du Chateau, Auvergne; in several parts of India; in Ceylon; in rolled pieces on the banks of the Nile; in Calmuck, Tartary; in the Altain and Uralian Mountains; on the shores of the Sea of Ochotsk; at Panama; in New Granada; in Greenland; at Aden in Arabia, with fluor; and at the following British localities:—

Cornwall; at Ponsanooth and North Pool mines, in very fine specimens. Smalt-blue at Pednandrea. At Botallack. Formerly at Wheal Alfred. Blue and hydrophanous at Wheal Maudlin, Liskeard. Coraloidal at Redruth.

Devonshire; at Haytor iron-mine, and near Sidmouth. At Blackdown as petrified snails and mussels.

Dorset; at Charmouth.

Cumberland; at Caldbeck Fells, Silvergill, and Roughtengill.

Isle of Wight; at Undercliff, and Sandown, and Brixton Bays.

Yorkshire; at Whitby, and on the beach about three miles south of Scarborough.

Scotland.—Grey, with pitchstone, in the Isle of Rum, Argyllshire. In Walls, Orkney. At Allan Bank, East Berwick. As fossil wood at Craigleith quarry, near Edinburgh. At the Pentland Hills. At Carlops, of a lavender color, in thin veins. On the coast near Kinghorn, Fifeshire; and at Tayport, near Dundee, at both places of a bright red, in trap. In Dumfriesshire, Lanarkshire, Dumbartonshire, Stirlingshire, Ayrshire, Mull, Canna, Eigg, and Skye, &c., in trap. At Burn Aune, near Galston, Ayrshire, of a red color and stalactitic, along with a massive variety of baryto-calcite. In several of the Western Islands.

Ireland.—White and hydrophanous near Giant's Causeway, Antrim. On the shores of Lough Neagh, (also Armagh, Tyrone, and Londonderry.) At Cloghan, Donegal. At Lambay, Dublin Co.; Londonderry; parish of Balteagh. Mammillated, and on pearl spar, at the junction of the trap and chalk, at Smulgedon, near Dungiven; at the White Mountain, and Slieve Gallion.

Many of the antique seals of Assyrian workmanship in the British Museum, and other collections, are of purple chalcedony, from some locality unknown.

MOCHA-STONE. Dendrachates, *Pliny.*

This is translucent white chalcedony, with dark moss-like markings produced by the infiltration of iron or manganese. It is identical with the *dendrachates* of Pliny; and is beautifully described under that name in the Orphic poem. Cambay, in India, is its best known locality:—it is also met with in Wicklow. It was long supposed that this variety was found at Mocha, whence its name, but that was merely the port the stones were conveyed to from other parts in the East for convenience of trade. There is a very fine series of Mocha stones in the British Museum.

CHRYSOPRASE. — Chrysoprase, *Lehmann.* Krisopras, *Werner.* Crysoprasus, *Pliny?* Quartz-agathe prase, *Hauy.* Smaragdo-prasius, *Wall.*

Silica	96·16
Oxide of nickel	1·00
Oxide of iron	0·08
Alumina	0·08
Lime	0·83
Water	1·85
	100·00 Klaproth.

Sp. Gr. 2·6 to 2·714
2·608, Hoffmann.

Chrysoprase* is translucent chalcedony of a bright apple-green color, with an even, or slightly conchoidal fracture. Before the blow-pipe it loses its color, and becomes opaque. The color is derived from oxide of nickel.

* From Gr., *Chrysos*, golden; and *prason*, a leek, in allusion to its color.

Lehmann was the first in modern times who gave to this stone the name chrysoprase: he considers it identical with the mineral described under that name by Pliny, as resembling in color the juice of the leek, but with somewhat of a golden tinge. Its identity, however, is far from certain, none of the few localities in which it at present occurs having been known in the time of Pliny.

When chrysoprase is highly translucent, and of a uniform color, it is much valued as an ornamental stone; unfortunately, however, it sometimes loses its intensity of color, particularly if kept in too warm a place.* Occurs extensively in the neighbourhood of the towns of Kosemütz, Glassendorf, and Grochau in the Principality of Munsterberg, in Lower Silesia; also at New Fane, in Vermont, North America: in both places in serpentine. Very beautiful plates of chrysoprase are to be seen in the Cathedral of Prague.

PLASMA:—

Silica	96·25
Alumina	0·83
Oxide of iron . . .	1·25
Volatile matter . .	1·05
	99·38 Brandes.

Sp. Gr. 2·553, Klaproth.

This is chalcedony of a leek-green, or sometimes grass-green color, sprinkled with whitish or yellowish dots; faintly translucent; and with a vitreous, or glistening lustre. The coloring ingredient has not been satisfactorily ascertained.

This variety is not clearly described in any of the works of the

* It is said that the color can be restored by a solution of nitrate of nickel.

ancient naturalists; although it may be included in Pliny's description of *smaragdus:* there are, however, in collections many engraved specimens regarded as antiques, hence its modern name; *plasma,* in Greek, signifying *engraving.*

Plasma is found of great beauty on Olympus; also in the Sierra de Guadaloupe in Mexico; in Moravia, and Bavaria; in the Schwarzwald, near Baden, and the Hauskopf, near Oppenau. Specimens are occasionally found among the ruins of Rome, from some unknown locality. It occurs also in India and China, whence it is brought to this country in the form of beads and other ornaments.

CARNELIAN.—Karneol, *Werner.* Quartz agathe cornaline, *Hauy.* Silex carneolus, *Linn.* Carniola, *Ital.*

	a.	*b.*
Silica	94·0	94·00
Alumina	3·5	3·50
Lime	1·5	...
Oxide of iron . . .	...	0·75
	99·0	98·25

a, from Siberia, by Bindheim; *b,* by Bindheim.

Loses by ignition 0·391 water, and 0·003 per cent. carbon, *Bischof.*

Sp. Gr. 2·6 to 2·7, Brochant.

Carnelian is properly applied only to the blood-red variety of chalcedony, but popularly to the yellow, brown, and white varieties also, when of uniform color. The name is derived, in allusion to the color, from *caro-carnis,* Latin, signifying *flesh.* The color is often artificially produced:—in the red varieties by exposing them first in the sun for some weeks, then to heat in earthen pots:—in the yellow, by treating them with carbonate of soda at a high temperature.

The ancients designated this stone by different names, according to its shade of color:—the deep-colored specimens the male carnelian, and the paler the female.

A great number of engraved carnelians have come down to us from the ancients, this having been the stone most generally employed for that purpose.

In a specimen from the Gobinskoi Steppe in China, Heintz found in 100 parts, 0·081 alumina, 0·050 peroxide of iron, 0·028 magnesia, 0·004 potash, 0·075 soda, 0·003 carbon, and 0·391 water;—by which it would seem that the color is due to peroxide of iron.

Carnelian is found chiefly in the sandy plains of Asia Minor, Persia, Arabia, Cambay, and Surat in India, Surinam, Ceylon, Java, and Siberia; also in Bohemia, Saxony, Hungary, and the Island of Corsica; in nodules generally of a dark-grey color. These are imported into this country when their colors are artificially altered as stated above. Carnelian occurs fibrous in Hungary.

British localities:—Carrock Fells and Falcon Craig, Cumberland. On the beach about three miles south of Scarborough; similarly at many places on the south coast of England, as, at Chesil Bank, S. Dorset; at Ventnor, Isle of Wight; at Peel Bay, Isle of Man; on the coast of Flintshire. In Perthshire; at Burn Aune, near Galston, Ayrshire; and at several of the localities where agate is met with.

ONYX*.—Quartz-agathe onyx, *Hauy.* Onice, *Ital.*

Onyx consists of chalcedony in alternate parallel layers, usually brown and white; and is that variety generally used in the formation of cameos. Specimens in which some of the layers are black are sometimes sold by lapidaries under the name of Arabian onyx, but this color is artificially produced by boiling the stone, first in oil,

* From ὄνυξ, a nail. It is described by the ancients as having the color of the white part of the nail.

and then in sulphuric acid. The oil imbibed by the porous portions of the stone becomes carbonized by the action of the acid, thereby increasing the contrast of the different layers, and producing an onyx-like appearance.* A blue color is produced by first boiling the stone in a solution of sulphate of iron, then in a solution of prussiate of potash:—a red, by boiling first in oil, then in nitric acid:—a yellow is produced by carbonate of soda.

This stone was much used by the ancients in the formation of cameos; and many finely-executed works of the kind have come down to us, proving in their lapidaries no inconsiderable degree of skill. One of the most celebrated is the Mantuan vase at Brunswick, which is about seven inches high, by two and a-half across, and is one of the largest cameos in existence. The figures, which are admirably executed, represent Ceres and Triptolemus in search of Proserpine. The ancients knew how to imitate onyx, as seen by their engraved pastes.

Those specimens in which one or more of the layers is of a red color, are called *sard-onyx*.

Onyx occurs in abundance, and in large fragments, in the deserts of the Nagaï Khirghiz, where it is collected; also in Yemen, according to Niebuhr; among the ruins of Babylon; in fine specimens in Faröe and Iceland in the cavities of trap; and at many of the localities where the following variety is met with.

The smaller trap druses at the Starr in Skye are sometimes filled totally with chalcedonic substance: sometimes this is so arranged that the lower third or half of the cavity is onyx or band chalcedony, with a dome-shaped layer of the latter arched over a central hollow—which rarely contains zeolites: the onyx more commonly is domed by zeolite.

* Some lapidaries substitute honey for oil, when the same effect is produced.

AGATE.—Achat, *Werner.* Quartz-agathe-à fortifications,—panaché,—dendritique,—&c., *Haüy.* Achates, *Pliny.* Quarzo Agato, *Ital.*

	a.	*b.*
Silica	98·87	98·91
Oxide of iron	0·53	0·72
Carbonate of lime	0·62	0·31
	100·02	99·94

a, grey agate from Hungary; *b*, brown band agate from Kunersdorf; both by Redtenbacher.

Heddle obtained ·702 per cent. of water in Scotch agate.

Sp. Gr. 2·6 to 2·7, Dufrenoy.

This is chalcedony, often mixed with jasper, amethyst, or common quartz, in alternating irregular layers of different colors; also in clouds or spots. It is formed by successive depositions of silica around the interior of the vesicular cavities of amygdaloidal rocks. The layers of which it is composed are sometimes of such extreme thinness that 100 may be counted within the space of a quarter of an inch. These layers are more or less porous: those which are transparent less so than the others. This may be seen in some polished specimens by breathing on them: the moisture disappearing sooner from the opaque than from the transparent layers. Some specimens are found to increase in weight as much as one per cent. after immersion in water, or, in other words, to absorb about 1-40th part of their bulk.

Owing to its beauty, variety, and capability of receiving a high polish, agate is much used as an ornamental stone; and occupies a distinguished position in most collections. It receives different names according to the character of its markings, such as, fortification-agate,

when the parallel lines are so disposed as to resemble the angles in the bastions of a fortification; moss-agate, containing delicate arborescent ramifications of various colors; ruin or breccia-agate, when the agate has evidently been broken up, and the fragments confusedly united by means of calcite, common quartz, or other natural cement; eyed-agate, ribbon agate, and so forth. It sometimes occurs hollow; having the interior lined with crystals of colorless quartz, amethyst, &c.

Bowerbank states, that he has found microscopic organisms in the moss agate of Oberstein, in Egyptian jasper, and in Indian jasper:—and Heddle has recently observed undoubted organic remains of considerable size in agates from Ayrshire and other localities. Many such varieties present indications of having been formed around sponges as a nucleus.

This stone was called *achates* by the Greeks, on account of the river Achates in Sicily being the locality whence specimens were originally brought. The ancient naturalists have distinguished its several varieties by the following appropriate names:—Sardachates was composed, in part, of sard or carnelian; leucachates was, as its name imports, of a white color; coralloachates was so called from some resemblance it bore to coral; haemachates, sprinkled with spots of blood-red chalcedony, was the variety formerly called St Stephen's-stone.

Agates sometimes occur of a very large size:—there is one in the imperial cabinet at Vienna formed into an oval dish twenty-two inches in length. In Germany large agates are made into mortars for chemical purposes; and according to Pliny they were employed for the same purpose by the physicians of his day.

The wonderful invention of a Florentine anatomist may here be mentioned, "(the secret died with him), of petrifying human viscera into real agates. In the Hospital of S. Spirito may be inspected still

by the incredulous, a table top made up of hearts, lungs, livers, &c., thus agatised into one large slab,—meet board for a banquet of vampyres"!*

Large and fine agates are found in the trap rocks of Oberstein and Idal, some thirty or forty miles up the valley of the Nahe, in considerable quantities imbedded in trap; when found they are generally of an ash-grey color, and the fine tints they afterwards exhibit are artificially produced:—some are hollow, and lined with crystals of amethyst. Fine specimens are also found in Saxony, sometimes presenting a brecciated structure. At Kunnersdorff, in Bohemia, Italy, Sicily, Silesia, Sardinia, Arabia, Surinam, and many parts of India; very fine on the N.W. shore of Lake Superior; in Uruguay, South America, in fine specimens of a brownish color, generally combined with onyx.

The following are the principal British localities:—

Cornwall; in quartzose rock on S.E. part of Carnbrae Hill; at Kynance Cove, or the Devil's Bellows, one mile N.W. of Lizard Point.

Cumberland; at Carrock Fells and Falcon Craig.

Gloucestershire; in trap at Mickleton.

Staffordshire; in gravel near Lichfield.

Scotland; at Jedburgh, Roxburghshire. At Carlops, Pentland Hills, Peeblesshire. At Burn Aune, Galston, in fine specimens of a bright lemon-yellow, and mottled; also at Dunure, and along the coast, Ayrshire. Near Habbie's Howe, Edinburgh. In the rocks at St Cyrus and St Cyp, near Montrose, Forfarshire. Very fine, red and mottled, at Dunglass, Haddingtonshire. Near Stonehaven, Kincardineshire. Very fine at Kinnoul Hill, near Perth, accompanied by sardonyx, and in the bed of the Tay thereabouts. Fife, near Kinross.

* King's Natural History of Gems.

Dunnegan Head, Isle of Skye, accompanied by onyx, grey, and sometimes hollow. At Jedburgh, the zoned chalcedony does not occur after the ordinary manner of agates, *i.e.*, filling up by successive layers of deposit, a pre-existent cavity in the rock, but fills, without any skin, layer of Delessite, or other substance, rifts and central cavities of the brown and red jasper of the district.

Hollow agates, containing loose nodules of calcite which rattle when the specimen is shaken, are found loose in the soil in Fifeshire.

In Scotland agates are commonly called "Scotch pebbles;" and though they are of a smaller size than those from some other localities, and often contain flaws; yet, on account of their variety of color and delicate markings, they are probably more beautiful than those found elsewhere.

Ireland; Antrim; on the coast near Ballycastle; also on the shores of Lough Neagh, accompanied by onyx. Donegal; near Malin Head, at the entrance into Lough Swilly, also at Clonca, on the coast. Red agates occur in Wicklow.

There is a fine series of specimens illustrating the formation of agates in the collection of Professor Heddle of St Andrews; and another in the Museum of Economic Geology, Jermyn Street, London.

Jasper-agate, the iaspachates of Pliny, is applied to those varieties in which agate and jasper are so intimately combined as to render it impossible to determine with which they should be classed. Very fine specimens are found at Burn Aune, near Galston, Ayrshire. It also occurs at Dunglass, Haddingtonshire. In amygdaloid in Donegal; at Lambay, Co. Dublin; and Brayhead in Wicklow.

On the Continent occurs largely in Saxony, Deuxponts, Hungary, &c.

HELIOTROPE OR BLOODSTONE.—Jaspe héliotrope ou Sanguin, *De Lisle.* Quartz-agathe vert obscur, *Hauy.* Heliotropium, *Pliny.*

	a.	*b.*	*c.*
Silica	96·25	84·0	96·57
Alumina	0·83	7·5	0·25
Oxide of iron . . .	1·25	5·0	0·50
Volatile matter . .	1·05	...	2·50 water.
	99·38	96·5	99·82

a, by Brandes; *b*, by Tromsdorff, from Bohemia, sp. gr. 2·6; *c*, from Olympus, by Klaproth, sp. gr. 2·55.

Sp. Gr. 2·633, Brochant.

This is chalcedony intimately mixed with green-earth, which imparts to it a deep green color. The blood-red spots specimens often contain are produced by oxide of iron; and the name bloodstone is properly applied only to these specimens. It loses its color by heat. Among lapidaries the stone is in considerable request.

Heliotrope was known to the ancients, and Pliny speaks of it as a stone used in solar observations; whence he derives its name; *helios*, in Greek, signifying the sun, and *trope*, turning.

The finest heliotropes are brought from the southern parts of Asia. They are likewise found in Bohemia, the Fassa Valley, Sicily, Sardinia, Transylvania, Bucharia, Tartary, Siberia, Iceland; in veins in slate at Bloomingrove, Orange Co., New York; also in Scotland, though of inferior beauty, in the Island of Rum, and Mull of Cantyre, Argyllshire.

A beautiful variety is brought from India, consisting of green chalcedony, more or less translucent, diversified with streaks of bright red, and sometimes yellow. It appears to have much the same composition as common heliotrope.

Flint.

Flint.—Feuerstein, *Werner.* Quartz agathe pyromaque, *Hauy.* La Pierre à Feu, *Breithaupt.* Pierre à fusil, *De Lisle.* Silex cretaceus vagus, *Linn.* Silex communis pyromachus, *Cronst.* Silex igniarius, *Wall.* Pietra focaya, *Ital.* The *Lapis vivus* of Pliny.

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*
Silica . .	92·75	92·75	92·50	97·00	89·00	96·75	86·42	98·00	94·00
Alumina .	1·50	1·10	...	1·00	2·00	0·25	...	0·25	1·50
Oxide of iron	1·00	2·00	1·25	1·00	1·75	0·50	1·23	0·25	0·50
Lime . .	2·75	1·25	3·00	0·25	4·15	...	9·88	0·50	1·00
Magnesia .	0·51	...	...	...	...	...	...	...	...
Manganese .	...	...	0·75	...	...	...	...	...	...
Volatile matter	...	...	...	...	...	...	...	1·00	3·00*
	98·51	97·10	97·50	99·25	96·90	97·50	97·53	100·00	100·00

a, from Ochabo, *b,* from Pednigarb, *c,* from Dodromiel, *d,* from Studeno, *e,* from Nudanto,—all by Hacquet; *f* and *g,* by Vauquelin (*g,* the white crust of flint); *h,* by Klaproth, sp. gr. 2·63; *i,* by Gerhard.

Loses by ignition 0·037 to 0·27 per cent. carbonic acid, and 1·1 to 1·3 per cent. water, *Bischof.*

H = 7 to 7·25.

Sp. Gr. 2·633 Brochant.

2·575 to 2·594 Hoffmann.

Flint is translucent; has a resinous, or dull lustre; and a perfect conchoidal fracture. Its colors, which are always dull, are greyish-white, grey, or greyish-black, also yellow, red, and brown; sometimes in clouds or spots; and, rarely, in stripes.

It is infusible *per se* before the blow-pipe, and becomes opaque and white when submitted to heat. Specimens that have been for

* Water and carbon.

some time exposed to the air become less brittle than when first taken from their native bed.

Flint occurs in nodules of an irregular, or globular form, arranged in layers which are distributed in extensive horizontal beds through the upper chalk formation. It sometimes also forms thin veins filling up fissures and interstices of the chalk. The nodules are partly chalcedonic, and frequently contain cavities lined with crystallized quartz. Flint commonly contains specimens of fossil corals, shells, sponges, and remains of extinct animals which can live only in salt water. Many of these are of minute size, and can only be seen by examining thin splinters under the microscope.

The siliceous earth constituting the substance of flint was once, according to Dr Mantell, in a state of complete solution in a sea inhabited by shells, echini, fishes, corals, sponges, and other zoophytes, and was precipitated into the chalk before the latter was consolidated.

Flint was at one time largely made use of in the form of "flints" for fire-arms; but since the introduction of percussion caps its use has been restricted to the manufactures of glass and pottery.

It is common in the chalk formation of northern Europe, including that of England and the north of Ireland; in the Apennine limestone of Italy; in Spain, near Madrid, and the mountains of Jaen; in France; in Palestine. In Scotland imbedded in secondary limestone in the Island of Mull; near Kirkcaldy and Burntisland, Fifeshire, &c.

Plum-pudding stone, consisting of flints imbedded in an indurared siliceous paste, usually of a light yellow color, occurs in some parts of Devonshire, also near St Alban's in Hertfordshire. When polished it often forms handsome cabinet specimens. The stone called by the Swiss *Nagelfluhe* belongs to the class of Plum-pudding stones.

OPAL.

OPAL.—Opal, *Werner.* Quartz résinite, *Hauy.* Silex opalus, *Linn.* Uncleavable quartz, *Mohs.* Silex Opale, *Breithaupt.* Opalus, *Pliny.*

Sp. Gr. 1·9 to 2·4. H = 5·5 to 6·5.

Opal differs from quartz chiefly in containing a larger per-centage of water. This water, however, is thought by Berzelius to be hygrometric, and therefore to vary slightly according to the state of the atmosphere. Opal is amorphous, or occurs in small reniform, botryoidal, and stalactitic forms, and large tuberose concretions; is translucent to opaque, and brittle; with a conchoidal, or even fracture, and a vitreous to resinous lustre. It is colorless, or white, yellow, red, brown, green, grey, and occasionally black. Some varieties exhibit a beautiful play of prismatic colors, which is destroyed by heat;—others have different colors by refracted and reflected light. Before the blow-pipe decripitates and gives out water; but is infusible. Is almost entirely soluble in a cold solution of caustic potash. Opal occurs in short irregular veins in porphyry; in the vesicular cavities of amygdaloidal rocks; in serpentine; and sometimes in metalliferous veins. It also occurs in fissures, showing that it has been deposited from water. The presence of infusoria has been detected in some varieties, showing that these have been formed by organic agency.

Opal is never an essential constituent of rocks, but is, in most cases, in all probability a secondary product, having exfiltrated from the matrix in which it occurs. The only instance in which it has hitherto been observed in sedimentary rocks is in the Taunus slate, near Wiesbaden.

The following varieties have been distinguished :—

PRECIOUS OPAL.—Noble Opal. Edler Opal, *Werner.* Quartz résinite opalin, *Hauy.* Paederos, *Pliny.*

Silica . .	93·90		90	
Water* . .	6·10		10	
	100	from Hungary, by Damour.	100	from Czerwenitza, by Klaproth.

Sp. Gr. 2·25 Beudant.
„ 2·114 Brochant.

This variety of opal, on account of its great beauty, is the one most generally known. It is brittle; has a conchoidal fracture; is translucent or semi-transparent, and has a vitreous to resinous lustre. It is white, bluish, or yellowish-white by reflected light, and generally yellow by transmitted light. It exhibits brilliant and changeable reflections of prismatic colors in flashes; and sometimes the interior of the stone seems filled with colored light. Sir David Brewster, from numerous experiments, supposes this play of colors is owing to the refraction and reflection of light in certain very minute openings or pores in the interior of the mass, which are not cracks or fissures, but possess an uniform shape.

* Kobell got 10·94 per cent. of water by intense ignition, and 7·5 by an ordinary red heat.

Precious opal sometimes loses its play of colors, and even falls in pieces, if kept in too warm a place;—this is attributed to its losing some of the water essential to its composition. It is likewise liable to a loss of splendour, (the Mexican variety more especially), when the minute pores on which the color depends become choked up with dust and grease through wear; but it is said this property may be restored by the careful application of heat.

"They are always much more brilliant on a warm day;—a dealer in precious stones aware of this peculiarity invariably holds an opal in his hand before showing it in order to impart warmth to the gem."—*Emanuel.*

The Hungarian opals of a uniform milkiness of tint combined with good play of colors bear the highest value in the market, as, on account of their density, they resist the effects of wear better than other kinds.

The Mexican variety, of a brilliant green with great transparency, is, by many, thought the most beautiful, but has comparatively little value, as the color is apt to fade away in the course of a few years, unless the stone be very carefully kept:—this variety becomes colorless when immersed in water.

Precious opal, when it possesses vivid colors, is a gem of considerable value, and highly prized by the lapidary. It may be said to be the only gem which defies successful imitation. It is always cut *en cabochon* on both sides, this form being the most suitable for displaying its colors. It is often indifferently imitated in glass, the prismatic changes of color being, in a manner, produced by a small per-centage of oxide of tin, but may be readily distinguished by its inferior specific gravity.

Precious opals of a large size are extremely rare;—it is only after working at the mines for years that one the size of a shilling, and of proportionate thickness, is found. There was at Kaschau a very fine one, of the size of a half-crown piece, which was valued at about

£3000. The largest known mass is that in the Imperial Cabinet of Vienna. It is five inches long, by two and a-half wide, and weighs, according to Beudant, 17 ounces; but it is not entirely disengaged from the matrix, and contains several flaws. This celebrated stone, for which, it is said, the immense sum of £50,000 has been offered and refused, has been known at Vienna for between two and three centuries, but whence originally obtained is uncertain.

The value of precious opals depends so much on their brilliancy and play of colors, that any attempt at pricing them according to their size or weight would be an idle task. Of late years they have been in much request, and their value has risen greatly in consequence.

"The finest opal of modern times was the Empress Josephine's, entitled 'the Burning of Troy,' from the innumerable red flames blazing upon its surface—the reverse being perfectly opaque. The present owner of this unique gem is unknown."—*King.*

In Turkey, where the opal is esteemed as highly as the diamond, £1000 is readily obtained for perfect stones of a large size.

According to Barbot, dealers have an artifice of steeping inferior stones in oil, which forces out their color into a transitory perfection.

Precious opal was known to the ancients, and is that mineral compared in the Orphic poem to the delicate complexion of a lovely youth. It is well described by Pliny, who ranks it, on account of its great value, in the first class of gems. He says the Indians imitated it so well in glass that the counterfeit could hardly be detected. There are very few engraved specimens preserved in collections, consequent on its extreme brittleness preventing the free use of engravers' tools; —that it was sometimes used as a ring stone, however, we learn from Pliny, who tells us of a senator named Nonius, who, possessing an opal which Antony coveted, was proscribed in consequence, and fled, saving of his whole fortune this ring alone. Pliny says this opal was

still to be seen in his time, and, though no larger than a nut, was valued at 2,000,000 sesterces ;—probably equal to nearly £18,000 of our money.

Precious opal occurs in small masses, accompanied by common opal, imbedded in a cellular porphyritic rock at Eperies and Czerwenitza, near Kaschau, in Hungary; at Freyberg, in Saxony; at Frankfort-on-the-Maine; in large and fine specimens at Gracias a Dios, in the province of Honduras, South America; also at Guatemala, Central America.

A semi-transparent variety occurs in Hungary, of a beautiful lavender color, which exhibits pale orange, the complementary color, by transmitted light.

FIRE OPAL.—Girasol. Quartz résinite girasol, *Hauy.* Silex girasol, *Breithaupt.* Asteria, *Pliny.*

	a.	*b.*	*c.*
Silica	92·00	88·729	91·89
Alumina . . .	...	0·994	1·40
Peroxide of iron .	0·25	...	...
Potash and soda .	...	0·338	...
Lime	...	0·491	...
Magnesia . . .	...	1·479	0·02
Water	7·75	7·969	5·84
	100·00	100·000	99·15

a, from Zimapan, Mexico, by Klaproth ; *b*, from Faröe, by Forchhammer ; *c*, from Washington Co., Georgia, by Brush.

Sp. Gr. 2·12.

This is a semi-transparent variety of a dull yellow, or reddish

color, which presents bright hyacinth-red and yellow reflections when turned towards the light.

This is the stone described by Pliny under the name *asteria*. He states that it came from India and Carmania, those from the latter country being preferred; and that it was difficult to engrave:—the difficulty arising, no doubt, from its brittleness, and from the numerous fissures it often contains.

Fire opal occurs at San Miguel and Zimapan, in Mexico; in Washington Co., North America, in good specimens; in Faröe, according to Dr Heddle, on a hill above Quivig, in Stromoe, and at Lambavig in Oësteroe; in the Azores; at Czerwenitza, in Hungary, associated with precious opal; and has been found in Cornwall at Huel Spinster; Huel Gorland; Rosewarne copper mine; and of a light color and semi-transparent near St Just.

MILK OPAL.—

	a.	*b.*	*c.*
Silica	98·75	85·01	93·2
Alumina . . .	0·10	0·83	...
Oxide of iron . .	0·10	6·56	...
Magnesia . . .	...	0·33	0·3
Potash	...	0·25	...
Lime	...	...	0·4
Water	1·04	7·02	6·1
	99·99	100·00	100·0

a, by Klaproth, from Kosemuth, Schlesien; *b*, by Von d. Mark, from Stenzelberg; *c*, by Beudant.

	Water.	
Milk Opal from Hungary . . .	6·1	Damour.
„ from Mexico	8·9	do.
„ from Faröe (Girasol) .	4·26	Heddle.

Sp. Gr. 2·183 Heddle, Faröe.
„ 2·164 do. Giant's Causeway.
„ 2·049

This is a pale bluish-white variety, which, as its name imports, presents a milky aspect. It is generally translucent, but specimens are apt to become partly decomposed on the exterior, and opaque, after having been for some time exposed to the air. A beautiful translucent variety occurs in small quantities in Faröe, which, in thin fragments, presents a brilliant wine-yellow iridescence by refracted light.

Milk opal occurs, among other places, at Czerwenitza, and Eperies, near Kaschau in Hungary, imbedded in porphyry, often associated with precious opal; at Freyberg in Saxony; at Kosemütz in Lower Silesia; at Stenzelberg in Siebengebirge; at Zimapan, Mexico; abundantly in Iceland and Faröe; at several of the Cornish mines; also at the Giant's Causeway in small specimens, and at several places in the trap rocks on the N. E.. coast of Ireland.

HYALITE.—Müller's Glass. Quartz hyaline concretionné, *Hauy.* Gummistein.

	a.	*b.*	*c.*	*d.*	*e.*
Silica . . .	92·00	96·94	95·5	96·99	91·32
Alumina . .	trace	...	...	...	...
Oxide of iron .	...	...	0·8	...	...
Lime	...	...	0·2	...	...
Water . . .	6·33	3·06	3·0	3·01	8·68
	98·33	100·00	99·5	100·00	100·00

a, from Frankfort, by Bucholz; *b*, from Bohemia, by Damour; *c*, from Waltsch in Bohemia, by Schaffgotsch; *d*, from Kaisertuhl, by Damour; *e*, from Hungary, by Beudant.

Hyalite of Waltsch loses 4 per cent. by intense ignition, according to Bischof.

Sp. Gr. 2·4 to 2·9. H=7.

Hyalite occurs in small colorless, or white, botryoidal masses, resembling melted glass. It is brittle; has a highly vitreous lustre; and is infusible *per se* before the blow-pipe. It is found chiefly in the cavities of trap rocks; and occurs in amygdaloid, near Frankfort-on-the-Maine; on the Kaisertuhl, in the Breisgan; at Schemnitz, in Hungary, imbedded in clinkstone; at Waltsch and other places in Bohemia; in Silesia, Moravia, and Mexico; in several parts of the United States; in Co. Down, Ireland, in well-defined specimens at Donald's Hill, forming a mammillated coating of concentric layers in the cavities of a soft claystone amygdaloid, and occasionally studded with small crystals of Arragonite; sometimes coating granite as a thin mammillated crust, white, translucent, and pearly; and also pearly and iridescent at Quarus, south of Newcastle.

COMMON OPAL.—Gemeiner opal, *Werner*. Quartz resinite commun, *Hauy*. Silex resinite, *Breithaupt*.

	a.	*b.*	*c.*	*d.*	*e.*
Silica	91·82	89·54	83·00	93·5	98·75
Alumina . .	0·14	0·27	3·00	...	0·10
Oxide of iron .	2·15	4·94	1·75	1·0	0·10
Magnesia . .	0·18	0·17	...	...	...
			Bituminous oil.		
Potash . . .	0·10	...	0·33	...	...
Water . . .	5·61	5·08	8·00	5·0	1·05
	100·00	100·00	96·08	99·5	100·00

a, and *b*, from Rosenau in Siebengebirge, by Von d. Mark,—sp. gr. of *a*, 2·091, of *b*, 2·063; *c*, from Mahren, by Klaproth, color grey, sp. gr. 2·02; *d*, common opal of a waxy lustre, from Telkobanya, by Klaproth, sp. gr. 1·90; *e*, from Kosemutz, by Klaproth.

NOTE.—Pitch opal from Iceland gave Damour from 7·97 to 8·96 of water:—from Mexico 4·6 of water.—The same variety from Vurla, by Smyrna, gave Brush 5·1 of water: it was grey-green, and had a specific gravity of 2·054.

Sp. Gr. 1·90 to 2·09, Klaproth.

Common opal occurs chiefly in irregular masses, and presents various dull shades of white, bluish-white, yellow, red, brown, and green, without reflecting prismatic colors. It is sometimes stalactitic; also pseudomorphous in the forms of calcite, augite, &c. It has a vitreous to resinous lustre; a conchoidal fracture; and is translucent to opaque. Specimens vary much in chemical composition.

Common opal is found at Telkobanya, Peklin, and elsewhere in Hungary, forming short irregular beds traversing porphyry; of a sap-green color at Climbach, Hesse; at Baldissero, Piedmont; in Faröe, in the cavities of amygdaloidal rocks, where also a translucent green variety, coloured by green-earth, occurs in small quantities; in Iceland; at Guadaloupe, Mexico, sometimes of an olive-green color: at Hrubschitz, Moravia, pseudomorphous after asbestus, fibrous, with a chatoyant lustre; in Cornwall, at Huels Stennach and Spinster near St Day; at Roskear and Huel Rosewarne, in Camborne; at Huels Poligine, Buller, and Damsel; at Botallack, St Just—at several of which mines it occurs in very characteristic specimens. Scotland: in the Isle of Rum, and several of the Hebrides. Ireland: in Antrim, at the Giant's Causeway; in Rathlin Island; at Crossreagh, in the parish of Ballywillin, and at several places along the basaltic range of the N.-E. coast of Ireland, usually white, sometimes yellowish and opaque;

at Sandy Braes, of different colors, in pitchstone porphyry, and sometimes slightly opalescent.

WOOD-OPAL.—Lithoxylite. Holz-opal, *Werner.* Quartz resinite xyloide, *Hauy.*

	a.	*b.*
Silica	93·00	86·00
Alumnia	0·13	0·50
Peroxide of iron	0·38	3·50
Sulphuric acid	...	0·20
Carbon	...	0·03
Water	6·13	9·97
	99·64	100·20

a, from Quegstein in Siebengebirge, *b*, from Oberkassel, near Bonn,—both by Brandes.

Sp. Gr. 2·05 to 2·19.

This variety presents several shades of white, grey, yellow, brown, and black; and different parts of the same specimen have often totally different appearances. It has a conchoidal fracture, with a resinous to waxy lustre; and is translucent to opaque. It is sufficiently distinguished by its ligneous appearance, and in most specimens the form and texture of wood are distinctly visible. The wood-opal of Tokay, in Hungary, still presents in the interior wood which is but little altered. The variety termed *wax-opal* occurs in very characteristic specimens at Libethen in Hungary.

Wood-opal is abundant in Hungary at Kremnitz, Libethen, Jasztraba, Saiba near Neusohl, Tokay, and Telkobanya, sometimes forming large trees in pumice conglomerates; also in Bohemia; in the Sieben Gebirge; in great abundance near Hobart Town in Tasmania;

in trap rocks in Transylvania and the Faröe Islands; in Antigua; and other trap countries.

SEMI-OPAL.—Halb-opal, *Werner.* Quartz resinite hydrophane, *Hauy?*

	a.	*b.*	*c.*	*d.*	*e.*
Silica . . .	82·75	85·00	90·20	83·73	73·45
Alumina . .	3·50	...	1·86	...	...
Perox. of Iron	3·00	1·75	4·11	3·58	9·95
Magnesia . .	...	...	0·86	0·67	2·13
Potash . . .	...	...	0·80	...	...
Soda	...	...	0·90	...	...
Lime . . .	0·25	...	...	1·57	1·21
Carbon . .	...	1·00	...	...	...
Bitumen . .	...	trace	...	...	...
Sulphuric Acid	...	...	0·31	...	...
Water . . .	10·00	8·00	2·73	11·46	12·89
	99·50	95·75	101·77	101·01	99·63

a, from Dolerite at Steinheim, near Hanau, by Stucke; *b*, by Klaproth, from Mahren; *c*, by Wrightson, from Schiffenberg, near Giessen; *d*, by Werthheim, greenish-brown, from Merionitz, in Bohemia (Fettglanzende.)

Sp. Gr. 2·0 to 2·19.

This variety differs from common opal in being dull and opaque; —some specimens, however, are rendered translucent by immersion in water, especially when in thin fragments. The fracture is flat conchoidal, and sometimes splintery. It has most of the colors of common opal, and is associated with it in amygdaloidal rocks in Faröe, Iceland, &c. It also occurs near Frankfort; in Hungary,

traversing porphyry; in Cornwall, near St Ives and St Just; at Huel Buller, near Redruth; and at Oakhampton, near Dartmoor, in Devonshire.

CACHOLONG.—Quartz-agathe cacholong, *Hauy.* Permutter-opal, *Karsten.*

Silica	95·32
Water	3·47
Alumina	0·20
Potash	0·07
Soda	0·06
Lime	0·06
Magnesia	0·40
	99·58 from Faröe by Forchhammer.

Sp. Gr. 2·2 to 2·272.

Cacholong is dull and nearly opaque, with a glimmering or pearly lustre, and of a whitish-yellow, or, rarely, reddish-white color. It occurs in veins often interstratified with chalcedony. The exterior is frequently in a decomposed state, and is then white and opaque, adhering to the tongue from its strong disposition to absorb water. The name is Mongolian, meaning, "beautiful stone," according to Blumenbach.

Occurs in loose masses of great beauty on the banks of the river Cach in Bucharia; also in Faröe, Iceland, and Greenland. Ireland: in Ulster, at Smulgedon; in Tyrone Co. in felspathic porphyry in the parish of Clogher; and similarly at Barrack mountain, parish of Pomeroy.

HYDROPHANE.—Quartz resinite hydrophane, *Hauy.* Weltauge, *Germ.* Oculus mundi. Lapis mutabilis.

	a.	*b.*	*c.*
Silica	93·13	82·9	60·00
Alumina	1·62	5·8	35·77
Oxide of iron . . .	...	0·1	0·25
Lime	...	...	3·50
Water	5·25	5·8	...
	100·00	94·6	99·52

a, from Hubertsburg, Saxony, by Klaproth; *b*, by Weigleb; *c*, from Musinet, by Bonvoisen.

This variety is closely allied to the former; and also adheres to the tongue from its disposition to absorb water. It is opaque; but gradually becomes transparent when immersed in water, emitting at the same time streams of minute air-globules, and becoming considerably heavier. This property is supposed to be owing to the mineral having become porous from long exposure to the atmosphere. Some specimens, after immersion, present the brilliant colors of precious opal. The name is derived from the Greek, *hudor*, water, and *ephane*, it shines.

Hydrophane occurs at Telkobanya in Hungary, Hubertsburg in Saxony, Iceland, Faröe, and Bucharia; at Chatelaudren, in France, and Musinet, near Turin; also in Ireland, near the Giant's Causeway, in small roundish masses of a brownish-white color in amygdaloid; and at Crossreagh, parish of Ballywillin.

FERRUGINOUS OPAL. — Opal ferrugineuse, *Beud.* Eisen-opal, *Hausmann.* Opal-jaspis, *Werner.* Jaspe-opal, *Breithaupt.* Jasper-pal, *Jamieson.*

	a.	*b.*	*c.*
Silica	43·50	88·28	47·81
Alumina	...	0·31	0·93
Peroxide of iron . .	47·00	5·58	38·09
Magnesia	...	0·16	...
Water	7·50	5·67	13·17
	98·00	100·00	100·00

a, from Telkobanya, by Klaproth; *b*, from Stenzelberg in Siebengebirge, by Mark; *c*, from Jasztraba, Hungary, by Beudant.

Sp. Gr. about 2·54.

Ferruginous opal bears the same relation to common opal as jasper does to common quartz. It is opaque; has a flat conchoidal fracture; and occurs of deep shades of yellow, red, and brown. Some specimens bear much resemblance to jasper, but may be distinguished by their inferior hardness.

Ferruginous opal, when it consists largely of iron, is sometimes used as an ore of that metal.

It is found at Telkobanya, and Tokay in Hungary; in the Erz Gebirge; near Almas and Tökörö in Transylvania; and in several of the localities of common opal, often in imbedded masses in the altered pumice of trachyte conglomerates; in Dominica; in St Helena; also in Cornwall, at St Just, and near Camborne; in Antrim at Sandy Braes; and in some parts of the west of Scotland.

MENILITE.—Quartz resinite subluisant braunatre, *Hauy.* Leber opal, *Karsten.*

Silica	85·50	90·20
Alumina	1·00	...
Lime	0·50	...
Oxide of iron	0·50	...
Water and inflammable matter	11·00	Water 9·60
	98·50 Klaproth.	99·80

(White and resinous.)

Sp. Gr. 2·16 to 2·185, brown variety.
" 2·3 to 2·37, grey variety.

Menilite, so named from its locality, Menil-montant, near Paris, occurs in compact reniform, or flattened masses, of a brown or bluish-grey color. It has occasionally a slaty-structure; is opaque, or sometimes translucent; and has little lustre. It is found in beds of adhesive slate at Menil-montant, and from the resemblance of some of its varieties to pitch, is sometimes called the *Pitchstone of Menil-montant.* Menilite is also met with, but of a lighter color, at St Ouen, and in the environs of Mans.

SILICEOUS SINTER.—Kieselsinter, *Werner.* Geyserite, *Damour.* Untheilbarer quarz, *Mohs.* Quarzsinter, *Hausmann.* Quartz agathe concretionnée thermogéne, *Hauy.* Geisersinder. Opale incrustante, *Beudant.* Tuf du Geyser. Kieseltuff, *Karsten.* Kieselguhr.

ANALYSES OF SILICEOUS SINTER.

	a.	*b.*	*c.*	*d.*	*e.*	*f.*	*g.*	*h.*	*i.*	*j.*	*k.*	*l.*	*m.*	*n.*
Silica . . .	98·0	94·01	84·43	93·25	94·0	87·67	88·26	91·56	94·20	63·00	72·0	79·0	87·2	86·48
Alumina . .	1·5	1·70	3·07	2·00	2·0	0·71	0·69	1·04	1·58	trace.	2·5	5·0	2·0	1·41
Peroxide of iron	0·5	...	1·91	1·25	...		3·26	0·18	0·17	trace.	2·5	3·0	...	0·55
Lime . . .	...	...	0·70	...	4·0	0·40	0·29	0·33	...	trace.	...	...	0·8	0·56
Magnesia . .	...	...	1·06	...	...	...	...	0·47	...	...	...	...		...
Potash . . .	...	...	0·92	...	...	...	0·11	0·16	...	...	...	...	...	2·00
Soda . . .	...	...		...	...	0·82	0·11	0·19	0·85	...	...	...	...	
Sulphuric acid .	...	...	...	...	...	...	2·49	0·31	...	...	...	...	...	...
Water . . .	...	4·10	7·88	3·00	...	10·40	4·79	5·76	3·06	34·84	21·0	12·0	10·0	9·00
	100·0	99·81	99·97	99·50	100·0	100·00	100·00	100·00	99·86	97·84	98·0	99·0	100·0	100·00

a, *b*, and *c*, from the Geyser, Iceland, by Klaproth, Kersten, and Forchhammer, respectively; *d*, from Kohren, in Saxony, by Zellner; *e*, the pearl sinter of Santa Fiora, by Santi; *f*, from the Geyser, by Damour; *g*, from Scribla, by Bickell; *h*, from Badhstofa, by Bickell; *i*, from New Zealand, by Mallet; *j*, *water opal*, by Schmitz; *k*, from Mauritius, by Klaproth; *l*, from Santa Fiora, Tuscany, by Klaproth; *m*, from Cessat, by Pontgibaud; Puy de Dome, by Fournot; *n*, from Gegend in Algiers, by Salvétat.

Siliceous sinter, Sp. Gr. about 1·8.

Fiorite, Sp. Gr. 1·917.

Siliceous sinter is an opaque brittle mineral of a greyish-white color, and dull or glimmering lustre, occurring abundantly around, and deposited by, the intermittent boiling fountains called the Geysers, in Iceland, in whose waters it is held in solution. It also occurs in New Zealand, at the hot springs of Roturua, around the crater of the volcanic mountain of Tongariro; in small quantities at the Suanna spring in Florida; and at other hot springs near volcanoes. The solvent power of these fountains and springs is due to their high temperature, and to the presence of a small quantity of alkali. Siliceous sinter is infusible *per se* before the blow-pipe. It is commonly porous. The structure is usually fibrous, although sometimes lamellar, and arborescent. Specimens often enclose the stems and leaves of plants which have been growing around the springs at the time the mineral was deposited.

Fiorite, or *Pearl sinter*, is a variety of the above, occurring in smooth botryoidal, stalactitic, and globular masses of a white, or greyish-white color, and pearly lustre; not so hard as quartz; and infusible *per se* before the blow-pipe. It is found in the cavities of volcanic tufa at Santa Fiora, near Florence, hence the name Fiorite; in volcanic tufa and pumice in the Vicentine, and in other volcanic districts of Italy; also in Auvergne.

TRIPOLI.—Tripel, *Hausmann, Werner, Mohs.* Quartz aluminifere Tripoléene, *Hauy.* Terra Tripolitana.

	a.	*b.*	*c.*	*d.*	*e.*
Silica . . .	90	81·00	87·58	90·86	82·64
Alumina . .	7	1·50	2·04	0·29	9·86
Oxide of iron .	3	8·00		0·23	0·14
Magnesia . .	...	...	0·30	0·09	0·27
Lime . . .	...	trace	1·09	0·16	0·84
Sulphuric acid	...	3·45	...	...	...
Water . . .	...	4·55	8·89	9·01	5·80*
	100	98·50	99·90	100·64	99·55

a, by Haase; *b*, by Bucholz; *c*, from Kritschelberg near Bilin in Bohemia, by Baumann; *d*, from Ebstorff in Hanover, by Kuhlmann; *e*, from Ferndown, Dorsetshire, by Heddle.

Sp. Gr. of *e*, about 2·45, Heddle.

This is a massive, dull, opaque variety, with a slaty fracture; soft, and easily frangible,—sometimes friable. Its principal colors are, grey, sometimes passing into yellowish-white, and ochre-yellow. It consists in great part of the siliceous skeletons of infusorial animalcules. It is used for polishing stones, &c., for moulds for casting medallions, &c., and also in the manufacture of porcelain.

The varieties of this mineral first used in the arts were brought from Tripoli in Barbary; hence the name given to it.

It occurs in the coal-fields of Dresden and Thuringia; at Ebstorff in Hanover; in secondary trap districts in Bohemia; in Auvergne

* Water and organic matter.

associated with volcanic rocks; in good specimens in the Island of Corfu; at Ronneburg and Kerms in Austria; near Burgos in Spain; near Tripoli in Barbary; at Bakewell in Derbyshire; at Ferndown, Dorsetshire.

POLISHING SLATE.—Polirschiefer.

	a.	*b.*	*c.*
Silica	66·50	62·50	58·0
Alumina	7·00	0·50	5·0
Oxide of iron	2·50	4·00	9·0
Magnesia	1·50	8·00	6·5
Lime	1·25	0·25	...
Carbonate of soda	...	...	1·5
Carbon	...	0·75	...
Water	19·00	22·00	19·0
	97·75	98·00	99·0

a, and *b*, by Klaproth, sp. gr. of *a*, 2·080; *c*, by Bucholz.

This variety is closely allied to the preceding; consisting also in great part of the siliceous remains of animals and plants; and is used for similar purposes in the arts. It is white or yellow; of a slaty texture; opaque; brittle; and generally floats on water. Its principal locality is Bilin in Bohemia.

QUINCITE, *Berthier*.—Rose Opal.

Silica	54·0	
Water	17·0	
Protox. of iron	8·0	
Magnesia	19·0	
	98·0	Berthier.

Sp. Gr. 2·19, Heddle.

Quincite occurs in small masses of a light carmine-red, or rose color, disseminated through a limestone deposit, near the village of Quincey, France. The color, which is generally unequally diffused, is supposed to be derived from organic matter. Concentrated acids dissolve the magnesia and iron, leaving the silica in a gelatinous state. It is said also to occur in Mexico.

TABASHEER.—Vegetable opal.

This is a substance formed in the joints of certain kinds of bamboo, in the Birman Empire, many parts of Hindostan, and in South America. It has the same composition as common opal, but is less hard, and more brittle. It is translucent to opaque; is bluish-white by reflected light, and hyacinth-red to wine-yellow by transmitted light. Specimens adhere strongly to the tongue; and when immersed in water become perfectly transparent, emitting at the same time streams of minute air-globules, and a strong siliceous odour. Tabasheer exists originally in the state of a transparent fluid, which acquires by degrees the consistency of mucilage, and is eventually converted by gradual induration into a solid substance.

PSEUDOMORPHS.

Minerals are said to be *pseudomorphous* when they assume forms, or impressions of the forms, peculiar to the crystals of other minerals. The term is derived from the Greek,—Ψευδος, signifying false; and μορφη, form or figure.

Localities of Pseudomorphous quartz:—

It occurs *in the form of lenticular crystals of gypsum* at Montmartre, near Paris.

In the form of calc spar:—in Pennsylvania; at Schemnitz, Hungary; at Fontainbleau, France, in rhombohedrons; at Schneeberg, in Saxony; at Clifton, near Bristol; in Cornwall, at the Gwennap mines; in tabular crystals at Botallack, and lately at the Consolidated mines, near St Ives. Formerly at the Haytor iron-mine, Devonshire.

Cubic and octahedral in the form of flour or pyrites:—in Westhampton, Massachussets; at Eibenstock and Schwarzenberg, in Saxony; in Cornwall at Wheal Alfred; Carnbrae; Balleswidden, St Just; Wheal Spearn, St Ives; Wheal Sparnon, near Redruth; North Roskear; Camborne; in fine specimens, lately, at Trehane, Menheniot; at Great Crinnis; Wheal Herland, near Hayle; at Perranzabuloe. Octahedral at Holmbush mine, Callington; also at S. Caradon, St Cleer. In Devonshire, at Beeralston and Beerferris; also at South Hoo mine. In Gloucestershire, near Bristol, in sandstone, in small cubic crystals. In Cumberland, at Alston and Nenthead, capping flour: similarly at Allenheads and Wheal Allendale, Northumberland, and Weardale, Durham.

In the form of Barytes, probably, in Rutherford Co., North Carolina, often filled with water; at Leadhills, Scotland.

In the form of Iron glance, at Ilfield, Hartz.

In the form of analcime, at Fundy Bay, Nova Scotia.

In the form of dichroite?, at Obergebirge, Saxony.

In the form of scapolite, at Arendal, Norway.

In the form of pearl-spar, at Levant mine, near St Just, Cornwall.

In the form of baryto-calcite, upon the metalliferous lodes at Mies in Bohemia, cellular, and rough on the exterior.

In the form of stilbite, at Kilpatrick, Scotland.

In the form of Anglesite, psilomelane, and galena, at Leadhills.

Hacked Quartz occurred lately very fine at Herodsfoot mine, near Liskeard, Cornwall.

Localities of Pseudomorphous chalcedony:—

Cubic, in the form of flour:—in fine smalt-blue crystals at Tresztyan in Siebenburg; Kapnik, Hungary; and Schneeberg, Saxony.

In the form of calcite:—At Schneeberg, Saxony; in Iceland; in rhomboids and six-sided plates, near Penzance and St Just, Cornwall. Very beautifully at Haytor iron-mine, Devonshire.

In casts of the form of spathic iron?:—at Hoy, Orkney.

In the form of pearl-spar, and also coating it:—at St Just and at North Roskear, Cornwall.

In the form of tabular crystals of barytes:—in fine specimens, at Herodsfoot, near Liskeard, and at Wheal Mary.

In the form of datholite:—Devon, at Haytor iron-mine, a variety known as *Haytorite:*—this variety has also occurred at North Roskear mine in small crystals.

It consists, according to Wohler, of

Silica	98·5
Peroxide of iron	0·2
Water	0·5
	99·2

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[OVER.

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