WISE #253 Ruskin $29.50

CATALOGUE

1884

S. Davids -

OF THE

COLLECTION OF SILICEOUS MINERALS.

GIVEN TO AND ARRANGED FOR

ST. DAVID'S SCHOOL, REIGATE.

BY

JOHN RUSKIN,

HONORARY STUDENT OF CHRIST CHURCH, OXON,
HONORARY FELLOW OF CORPUS-CHRISTI COLLEGE, OXON,
AND
SLADE PROFESSOR OF FINE ART, OXON.

17

[BRANTWOOD]

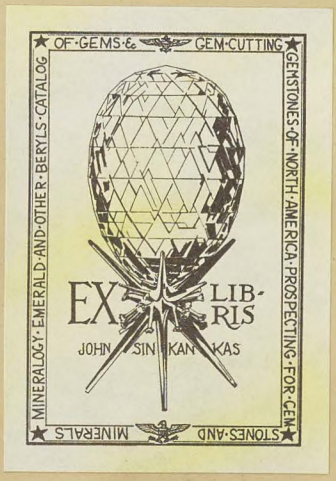
MDCCCLXXXIII.

1883

Ca 26 80
9/75 Wrcden

Sloppy, vague
and displaying a strong
prejudice against
America & Australia
35

Accord. to E.T. Cook & A. Wedderburn,
The Works, V. 26, p. 488, this is
the 1st edit.



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SILICEOUS MINERALS.

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1 Pure black flint with exquisitely characteristic 'conchoidal' fracture, looking exactly like the cast of a shell.

2 Black flint less pure, (with some admixture of chalk or, perhaps, clay), developing agatescent bands in purifying itself. The bands faulted and terminated in the unaccountable way which, with finer material, forms so-called 'Brecciate' Agates, (Compare Nos. **10, 11, 12.**) A small fossil (sponge ?) is imbedded in the angle of this specimen, which is a most finished and comprehensive example of flint-structure. Polished on two sides.

3 Two pieces, *a* and *b*, (2070 of my old collection). A superb example of finely delineated and terminated agatescent structure, in dark grey flint.

4 Rolled pebble of coarse brown flint, with agatescent structure mimicking a fossil. The central division most curiously faulted.

Ground down and polished on one side to show structure.

5 Black flint, full of somebody, I don't know who, gone to pieces. The (weathered or decomposing ?) surface showing the forms projecting.

6 Common grey flint, with very unusual condition of surface. *I believe*, inorganic, and merely mimicking a fossil; but there may be much disguised organism provoking the forms.

7 Grey flint, with many enclosed organisms, one cruciform, going quite through;—the cross on one side diminishing to a quatrefoil round a small cavity on the other.

Ground down and polished on the quatrefoil side.

Extremely rare and fine.

8 Grey flint of like character, with many fossils, totally incomprehensible.

Cut into two pieces, each polished.

9 Agatescent Chalcedony, (*i.e.* chalcedony throwing itself into bands,) showing both the straight-levelled and concentric forms.

An altogether exquisite example.

Cut into four pieces, and polished under my own direction.

10 Dark flinty agate, developing brecciation.

A rectangular slice, polished.

11 Jasperine agate, in developed brecciation.

12 Jasperine agate, in perfect brecciation.

A small slice off the best piece I have in my own collection.

13 Fawn-coloured flint, becoming chalcedonic on the inner surface. The outer surface, to me, inscrutable; the smaller and porous parts showing every state of incipient chalcedony.

14 Finer grey flint passing into finer chalcedony. The flint almost entirely made up of organisms.

Two pieces, A and B, cut and polished under my own direction.

15 Still finer flint, with finer chalcedony. The latter, however, broken on the surface, showing delicate varieties of conchoidal fracture.

Look with lens at those on the smallest piece above my old ticket, where the new number **15** should be put for indication. These fractures are, however, partly, where so finely rippled,

indicative of the interior structure of the stone. See especially the sharp apex to the left hand of the ticket. The structure of the opaque part is mostly inorganic, founded on effaced shells. See near the red arrow.

Two pieces, A and B, cut and polished under my own direction.

16 Common mossy flint of the south coast, passing into pure chalcedony, in one part showing black arborescences of oxide of iron (rare). No one has yet given any account of the nature of the mossy matrix, which is extremely common, but extremely curious. Where the chalcedony is white, it begins to throw itself into sausage-like forms, which might be mistaken for stalactites, but are nothing of the sort.

Their decomposition at the edge into coats (see the shortest polished side) is extremely notable.

This piece was originally twice as large, and broken; the other half is in my own collection.

17 Flint chalcedony, making the best it can of itself. It cannot be seen in finer condition, cut and polished under my own direction, showing the jasperine, spongy interior, edged with extremely minute sparkling quartz. Examine carefully with

lens. I do not know how far these red parts are organic. It is very rare to find chalcedony of the two sides of the wall, as here; and still more rare to find it as on the blue side with superimposed pseudo-stalactites, (to my great regret, broken short off.)

Reference number in my old collection, 1591.

18 Flint chalcedony, perfectly pure, enclosing sponge changed into yellow jasper; frequent on the south coast, but this a very beautiful specimen. It is part of a rolled pebble; see next number.

19 Slice of black and grey flint, enclosing sponges saturated with blue chalcedony. The pebble No. **18** is a rolled fragment out of such a space. This specimen, though, like No. **18**, of a kind frequently occurring, is extremely beautiful as an example; and especially interesting because the black and grey matrix is itself full of all kinds of organisms.

20 Highest quality of purple chalcedony, forming agatescent bands, but I do not think this has been formed on flint; it introduces us to the group of agates properly so-called.

21 Chalcedony on amethyst-quartz. Extremely interesting, both because the points of its pseudo-

stalactites are nearly all perfect, and it is extremely difficult to obtain specimens in which the points have not been knocked off; but also because they show their peculiar difference from real stalactites in dropping, half of them down, and half of them up. Modern geology would, of course, not scruple to explain this phenomenon by the theory that the world had been turned upside down in the interval. I prefer, myself, to direct attention simply to the circumstance, and to the farther interesting fact, that one stalactite in the middle dropped sideways.

Quite seriously, there are forms of chalcedony, like those deposited by the Iceland Geysers, which do really drop and flow; but no mineralogist has yet explained the intermediate incrustations, of which this is a notable example, whose forms seem to be totally independent of the action of gravity.

22 Chalcedony in agatescent deposit, partly stalactitic on central films and rods; a structure extremely frequent, but hitherto unexplained, and, I believe, for the present inexplicable. It is to be noticed especially that the basic films never exceed a certain thickness, nor the basic rods a certain diameter. All through the stone, whatever the

thickness of imposed chalcedony, the walls are always composed of one greenish-brown line, with two external white ones, and the rods are of the diameter of extremely small pins. This specimen is an extremely fine one, cut and polished under my own direction. It is often thought that the interior substance in chalcedonies of this kind has been originally moss, but I believe it is entirely inorganic, and, in this case, as in the next example, chiefly chloritic earth.

23 Moss agate, so-called, being irregular chalcedony, traversed by a network of chloritic earth, and forming itself into level lines in the larger spaces. An extremely curious example, inexplicable as No. **22**. Part of the cellular mass is more or less calcareous (white), and yields easily to the knife.

24 The same kind of chalcedony in bolder development, probably Icelandic, showing connection with some kind of floor and roof, and inconceivably peppered over the surface,—with what, I don't believe any mortal can find out.

25 Icelandic chalcedony, showing the levelled or lake structure in an open space, and a more

closely sprinkled external surface, of nameless ugliness, with two mysterious little pits in it, which are part of the chalcedonic structure. The whole, one petrified enigma.

Cut and polished under my own direction. The other half, one of the choicest pieces in my own cabinet.

26 Level Icelandic chalcedony, traversed by pseudo-stalactites, each with its proper rod of nucleus. Two pieces, A and B, cut and polished under my own direction, and extremely instructive if one could only understand what they say. Look at it against the light, and take care to keep the two pieces together.

27 Icelandic chalcedony, passing into quartz, which traverses a level lake, in the hollow of the interior, and crystallizes, not in the usual form of quartz, but in triangular pyramids. This, like No. **26**, is an extremely rare specimen.

28 Grey chalcedony, forming an agatescent ball, showing a perfectly conchoidal fracture on the broken surfaces, distinguished from that of flint by its comparative dulness and absence of ribbed divisions, which show the greater elasticity both of flint and glass.

29 Brownish-red chalcedony (carnelian), coating oxide of iron. The finest carnelian is rose-colour or crimson, but it is almost impossible now to find a piece that has not been dyed. The colour of this is very good by transmitted light.

30 Chrysoprace. A condition of silica, intermediate between flint and chalcedony, but varying in colour from white to green; dull in fracture, as the broken piece will show, better than the old surface; and never throwing itself into globular or stalactitic forms. It is found, I believe, only at one place in Europe, and is extremely respected by me because it is found nowhere in America.

It is the most valuable form of silica except opal; but it is properly connected with flint and chalcedony, opal forming an entirely distinct family of minerals. These thirty specimens, therefore, contain complete illustrations of the materials of which the transparent or translucent portions of agates are composed. We next enter on a series illustrating the opaque material of jasper, but which, like the chalcedonies, must be traced back to their origin in entirely common flint.

31 Before, however, going on to study the jaspers,

although it is out of scientific order, I think it will be well, and certainly it will be refreshing, to observe the conditions under which pure quartz is associated with native metals; of which it must be observed in the outset, that the native metals are scarcely ever—I do not myself recollect a single instance of finding them—associated with pure and clear crystals, either of quartz, or any other mineral. Both quartz and calcite, when they contain gold, silver, or copper, are opaque, and only semi-crystalline. This generalization is bold, and must, of course, be taken only as the expression of my personal experience, not of a scientific fact; but it may be certainly stated positively, that in the countries hitherto known as mining districts, this law of the opacity of gold-vein-stone holds with rare exception. This specimen, No. **31**, is entirely characteristic of the kind of quartz in which gold is usually found, whether in America or Australia, and it is also entirely characteristic of the mode in which the greatest *quantity* of gold occurs in those countries; dispersed in plates of varying thickness, but still generally describable as laminæ, through what are apparently fissures in the imperfectly crystalline and feebly translucent quartz. This is a very rich and pretty specimen from

Nova Scotia, of which, as of every other specimen of the kind I ever saw, I can tell you, absolutely nothing worth knowing, except that the gold is pure, and the quartz very nearly so; and that I have not the slightest idea how the gold got into it, or where it was before it got into it, unless perhaps in a place which I do not care to mention!

32 Native gold, in the same kind of quartz, but itself more massive, and partially crystalline—I believe Australian; but it represents the kind of gold, all over the world, which forms the nuggets in alluvial deposit. That is to say, the flawed and more or less brittle quartz gets knocked away by attrition, while the gold, in grains and masses of various sizes, falls to the bottom of the stream. This specimen has itself been a little rolled and battered on the outside, but shows the fibrous crystalline character of the gold, beautifully, in its cavities. It was cut when I bought it, and in the section obtained shows the exact lines of contact between the gold and quartz, in the interior of the stone where the metal is compact, while it effervesces in the cavities into moss.

33 Slice of quartz-rock from New Zealand, with native

gold dispersed through the body of it, in extremely fine particles. This form is peculiar to New Zealand, and as I never use a microscope, I cannot say how far the gold is crystalline. I have added, therefore, the extremely rich smaller piece, for experimenting upon at leisure, merely cutting slices off the edges of it, as thin as it is possible now to cut quartz,—and there is scarcely any limit to the fineness obtained by Mr. Sorby and other microscopic observers. A great deal might, however, be found out by the schoolboys of St. David's, very interesting to older people as well as themselves. In the large specimen, No. **33**, the gold is in somewhat finer grains and fibres, but my impression is that in both it is in a state very closely corresponding to that of the chlorite in moss agate.

34 Native gold from Transylvania, in a vein of rather finely crystallized quartz, traversing a grey rock, which is, I believe, called 'Psammite.' This form of gold is entirely peculiar to Transylvania, which, it is well to observe in passing, is a country (you will know where it is, but I don't) which has always taken the greatest pains to crystallize its minerals prettily and delicately, so that whenever you see an extremely charming

and peculiar specimen of anything, you may almost guess it Transylvanian, or if it be quartz only, from Schemnitz in Hungary, which, I believe, is somewhere thereabouts. This Transylvanian gold is beautiful in itself, and exceptional, as compared with American or Australian specimens, in being set on definitely crystalline, though minute quartz.

35 I am very sorry to part with this specimen, of which I have no duplicate, and shall not easily find one; but it is so instructive and beautiful, that I can't keep it any more idle in my cabinet. It is perfectly crystalline arborescent native gold, associated with perfectly formed, though minute crystals of carbonate of lime, and if it is not Transylvanian, I can only say I am very glad there is any other country that can do it, but at least it is not American, nor Australian.

36 Crystalline gold in a cavity in quartz, more or less stained with oxide of iron. I do not know the locality of this specimen; it might be Australian, South American, or perhaps African; the form both of gold and quartz being the general one common to all; but it is comparatively rare to find the gold thus crystallized in the cavities only, and not dispersed through the body of

the stone. Compact oxide of iron is also mixed among the stained quartz, the surface of which is very curiously crystallized round the cave, though not quite in Transylvanian style; and one could fancy rather a pretty fairy tale told about the cave.

37 Part of the wall of a large vein of quartz, I should guess from California, traversed by another small vein of whiter quartz, and having its porous cavities feebly crystalline, and in some places curiously cellular; filled with dispersed moss of finely crystalline gold, every particle of which becomes interesting under a powerful lens. Entirely wonderful and beautiful, though showing the always rude and feeble crystallization of gold-bearing quartz, everywhere except in Transylvania. The wall of solid quartz will be seen to be partially divided by a flaw passing into a fissure, which, with others parallel to it, seems to indicate the further rending asunder of the original vein as the mountain mass consolidated itself. This specimen is unique in my experience, both in beauty and illustrative phenomena, respecting the occurrence of gold in quartz.

38 Detached examples of crystalline gold, chiefly, I

believe, African, broken away from the quartz by the miners, but each in itself interesting.

39 Crystalline gold, I have no doubt Transylvanian, showing in one piece all the principal forms which the metal takes. It belongs to what mineralogists call the cubic system, and in any orthodox mineralogy, various pictures will be found of cubes, octohedrons, dodecahedrons, and other charmingly symmetrical figures, as representative of those in which it is scientifically required to crystallize. But it never *does* crystallize in any one of them. I have one small octohedron (kept in a separate bottle), which I don't believe is genuine, and I had two cubes which certainly weren't. These are all I have been able to find in forty years' experience. The real crystals of gold, of which you may see plenty on one side of this specimen, are entirely indescribable by any human language, and I leave you to make what you can of them. It is impossible to see sharper or better examples, for gold has a curious way of never crystallizing brightly or neatly, but always as if it had been a little beaten about. The ground of the solid crystals, beautifully seen on the opposite side, is a flattish plate, in most places

apparently made up of triangular small ones, which project in little triangular pyramids. In other places, the plate will be seen to be woven out of fine fibres, and here and there apparently to be spun into wires. The laminated form of plate composed of triangles is the most frequent condition; the fibrous and arborescent lace, next commonest; massive crystals as fine as those in this example are extremely rare, and I think couldn't be done anywhere but in Transylvania, to this bewildering extent. The pale colour of the specimen is owing to a mixture of five per cent. of silver, which, however, as silver also belongs to the cubic system, rather helps than hinders the gold in its crystallization.

40 Massive gold, more or less fibrous, with interspersed quartz, but in several parts quite solid gold; I believe Californian, and representative of what is meant by a nugget, when it has not been much rolled. Even the richest nuggets are seldom wholly free from quartz. There is nothing particularly characteristic about this one, but it is nice to feel the weight of it in the hand, and the gold is extremely pure.

As representative of native gold in commerce,

the little pinch of gold dust in the glass vial is enough to show what people carry about their waists and sell their lives for in various countries: but this little shake of it is, I believe, Scotch, and obtainable only in very small quantities. Seen with a lens it will be found composed of more or less flattened fragments, which are obtained by washing the sand of streams,—an extremely wicked waste of time. I do not give this gold-dust a separate number, as it should be kept with No. **40**, to show how gold is commonly found. We will not at present go on to silver, because I have allowed the gold to come into this place in the catalogue, chiefly for the illustration of quartz; and native silver differs from native gold in this particular (one of many), that, as a rule, silver likes limestone, and won't crystallize in quartz; while, as a rule, gold loves quartz, and hates limestone. The single specimen of the above ten, in which it is associated with calcite, was also unique in my collection. Looking back over the other nine specimens, they will all be found to exhibit the same character of quartz, more or less compact and opaque, irregular in fracture, not like glass, nor yet like common stone: like, in fact, nothing but

itself; one can only say of the fracture that it is 'quartzose.'

This kind of quartz forms an immense mass of the rocks of the world, but in no place of all the world does it form globular concretions like those of chalcedony. The two minerals, though the same in material, are everywhere and always distinct, though you will find it stated in mineralogical books (I quote Miller as most authoritative), that "chalcedony appears to be an intimate mechanical mixture of crystalline and amorphous quartz, botryoidal, reniform, stalactitic. It is called carnelian when of a red, yellow, or brown colour; plasma when dark-green; chrysoprase when of an apple-green colour, produced by the admixture of one per cent. of oxide of nickel." This is all that science can make of the matter, but common observation will show you these further interesting particulars, that though chalcedony may be produced either with flint or quartz, it is a substance totally distinct from both, and belongs generally to a later period of the world's history, that of our own chalk, or of still more recent volcanic mountains. Further observe, that no particle of gold, or of any other native metal, has yet, so far as I know, been found in chalcedony, but the oxides of iron and

manganese, and the sulphuret of iron, are frequently and beautifully associated with it. It will therefore be perhaps best to show, in connection with the quartz containing gold, the finest states of chalcedony containing iron, before we go back to the jaspers. I have arranged therefore, by themselves, a series of twelve examples of cut chalcedony, chosen of the finest kinds, which form a pretty ornamental cross. The stones in this group containing brown and tree-like formations, are usually called Mocha stones, being first got where we get our coffee; and I believe the Arabian ones are still the finest ones found. Those with apparently green seaweed are called moss-agates; but I believe there is not a fibre of moss in them, but only the green mineral called chlorite, of which we shall afterwards see tangible examples. The delicate brown fibres, I can state positively, have nothing whatever to do with vegetables. They may be imitated, sometimes very prettily, by dropping any dark colour into Chinese white, and they are certainly produced in these stones by the partially crystalline ramifications through them, while they were still in a gelatinous state, of the oxide of iron or manganese. The substance of the stone, throughout, is pure chalce-

dony: the two little pieces cut into the shape of hearts are also finely agatescent, and show small white globular concretions on one of the stones, which we shall see better examples of afterwards.

It may be as well to number this group of stones C. 1 to 12, C. standing for cross.

C. 1 Mocha stone of the finest possible structure, arborescence radiating from points; and in clusters of two kinds, black and brown.

C. 2 The same, but with the black branches better defined at one part of the stone.

C. 3 Moss-agate, fine, but of the usual structure.

C. 4 Moss-agate, of less usual, and finer, delineation. The chorite half washed away into it like weed.

C. 5 and 7 White agates, before described.

C. 6 A little Mocha stone, merely put for a centre.

C. 8 A moss, or it might better be called a weed,—agate of highest possible quality.

C. 9 Moss-agate, nearly as fine, but richer and darker.

C. 10 An extremely unusual form, the chlorite seeming much mixed with iron.

C. 11 Mocha stone of the very highest quality, but less valuable to the public and the jeweller, because it can't be seen without a lens. If it hadn't been one of the cross stones, I wouldn't have given it away.

C. 12 Mocha stone, in which the arborescence itself is of common character, but of great mineralogical interest, because formed in one of the zones of a well-banded agate, and bent under the point of the white zone at the top to right and left, like the branches of trees in a high wind.

With these twelve mossy chalcedonies, we had better number at once, as **C. 13** to **15**, three illustrative stones, which will make the system of arborization entirely intelligible.

C. 13 Fine chalcedonic agate, with arborescences and spots, of oxide of iron, running between its zones, the spots being entirely independent of the arborescence. An extremely rare example (for the sake of getting which, and one or two others, I bought a whole collection). I should like the reference to it in my old collection, 1292, preserved in this catalogue.

C. 14 White chalcedony, obscurely agatescent, formed on what I believe to be oxide of manganese (I

think it is not heavy enough for iron), with arborescences, which, in that case, would be of manganese, not of iron, and producing themselves, not between its bands, but on the exterior surface. A rare condition.

C. 15 The best piece I ever saw of the shaly limestone of the hills near the Bagni di Lucca, with arborescences of oxide of iron on both sides, originally, of course, formed in the fissures of the rock.

These fifteen examples, being first carefully examined, we shall now be able more or less to understand the similar structures which take place in the finest jasper. It must be noted, in beginning to study these, that jasper is an opaque and compact stone, which owes its preciousness only to its colour, its easy susceptibility of fine polish, and the mossy or flame-like delineations which sometimes traverse its mass. The scientific people only tell one that it is a variously-coloured mixture of quartz with alumina, lime, carbon, oxides of iron, manganese, etc.; which somewhat vague statement I will venture partly to contradict, and partly to narrow. Jasper is no more a mixture of quartz with anything else, than it is of carbon with

anything else. *Quartz* is properly the *crystalline* state of siliceous earth; chalcedony, the *semi-crystalline*; jasper, the compact *non-crystalline*, more or less mixed with either clay or lime, and if the mineralogists were worth as much of either as would bury them or burn them, they would have told us long ago with which. But this, at least, you may depend upon, that jasper never crystallizes into any definite form whatever, and is only found in extremely rare cases in globular concretions, like chalcedony. The coarse forms of it, of a dull yellow, and only taking an imperfect polish, are extremely common. The finer qualities are either of a more glowing yellow or brick red, passing in the finest stones into scarlet, and even crimson. These colours are, I believe, without exception, given it by the red and yellow oxides of iron; but it is well worth notice, that the red oxide, although in a separate state, often pronounced enough in colour to have given occasion to its usual scientific name, Hematite, or blood-stone, *never by any chance reaches its purest hues until it is mixed with jasper or agate.* I begin with an example which, though it carries us back to our old friends the flints, yet shows the colouring element of jaspers in perfection.

41 Portion of an imperfectly brecciated flint, coloured by red oxide of iron. I bought the whole piece out of a heap of flints, in a dealer's back-shop, catching sight of its red edge, for six-pence ; cut it, and have kept the biggest piece, which I would not part with for five pounds. It is the finest example of pure red jasperine colour I have ever seen in silica. The white portions might be called white jasper, if they were a little less brittle. The grey parts might be called grey chalcedony, if they were a little more clear. On the whole, it is better to call it a high-caste flint, traversed by fibres of red jasper.

42 A. and **B.** Blue agates, surrounded by a coat of scarlet jasper. It will be seen that the globular concretions of the agate are independent of this exterior coat, but yet the jasper is itself partly agatescent, and both are bent about by a brown concretion at the edge of the stone. The specimen is full of all kinds of puzzle and interest.

43 A. and **B.** An extremely beautiful fortification agate, formed of dark chalcedony, with zones of white and red jasper. In all such cases the chalcedony is the active and formative element, and the jasper submissive to it.

44. Spherical agate in zones of chalcedony, with fillings of quartz, the chalcedony traversed by mossy flakes of fine crimson jasper. On the fracture the stone looks almost like a compact jasper, extremely fine.

45 A., B., and C. Three portions of a deeply interesting agate, formed as a ball in the hollow of a volcanic rock, and traversed, from its centre to the rock, by opposite tubular veins. The quartz crystals, in which the exterior band terminates, are coated with orange jasper. Their own sparkling cleavages seem like a diamond sand on the smaller surface of the middle slice. The whole thing is a mere lump of wonder, and I wouldn't give it away if it didn't always split my head into three slices to look at it. It is only half of the original stone after all, but I never had the other half, and found I had quite enough when I cut this into three.

46 Acicular agate passing into jasper. What I mean by acicular agate, you will see by looking at it with a lens, but I don't in the least know how it came to be like that. I was always afraid of breaking the specimen, but think that a thin slice might be taken off the flat surface, which,

though broken, would be very wonderful under the microscope.

47 Blue and purple agate, partly acicular, partly zoned, partly anyhow, with a jasperine coat; but these examples are all given for types of colour, and for illustration of the connection of jasper with agate, rather than for specimens of jasper itself. We shall now pass on into the more compact forms of it.

48 A. and **B.** Violet agate, enclosing bands of jasper, with earthy walls in the centre of them. It is generally to be observed, that all the films, walls, and rods in the middle of bands or stalactites of agate, are of some substance less pure than the agate, which seems to throw everything that it doesn't like, and has got mixed up with, into the smallest compass that it can, and then to form itself round, or on the surface of, these rods or films. It will thus throw into its centre, and cover with its own pure substance, either the green earth called 'greeny'—'chlorite' or black oxide of iron, or sulphate of iron, or even the rough substance of the surrounding rock; but the surface is almost always pure, and the sprinkling of dust upon it, which takes place in one of the

specimens above catalogued in this collection, is a phenomenon of extremely rare occurrence.

Now, herein is a specific, and I really think I have experience enough to justify me in saying, exceptionless, distinction between chalcedony and quartz in the process of their formation. *I have never in my life seen a crystal of quartz with a central rod, either of earth or iron.* They may be mixed with, or suspended in its substance in variously confused positions, but they are never thrown systematically to the centre, and, in very greatly the plurality of cases, they are consistently and steadily thrown to the surface. All the oxides of iron are either placed in spots upon the superficial bands of the crystal, or radiate from them towards the interior. Amianthus often plants itself on the interior surface, and shoots towards the inside; and mixed impurities encrust, or disturb the surfaces, leaving the centre of the crystal as far as possible pure. It is impossible to have a more positive proof of the distinct nature of the two minerals.

The particular specimen we are examining throws the rejected earth into curved lines, more or less resembling broken shells. I believe I was the first mineralogist who described this species of agate, and though I have never been careful

about precedence, intend in future quietly to state the things that I have myself discovered, leaving future investigators to point out, with any satisfaction it may give them, that they had been discovered before me, if they can.

There is one point of curious interest connected with this form of siliceous concretion,—phenomena exactly resembling it occur in agates which *have* really been formed on broken shells; and it is matter of extreme difficulty to determine, in many instances, whether the structure was not first organic. It has only been the attentive study of brecciated jasper which enabled me to establish the distinction. See the next following specimens.

49 Brecciated jasper, in variously interrupted bands, apparently floating in grey chalcedony. An example of extreme interest connected with the shell-like jaspers on the one side, and with brecciated agates on the other.

50 Egyptian jasper, properly moss-jasper, casually stained red or yellow, by iron, yet with this distinction, that the red portions are finer in grain, and less ridiculous in wriggle, than the rest; while the yellow bits form a kind of soup of frantic vermicelli, unaccountable for on any

principles of motion or construction hitherto exhibited on the face of the earth. I don't think the agatescent vegetarians will venture to claim any part of this stone as really botanic, but the name moss-jasper is the most conveniently descriptive that can be given. I am bound, however, to place beside it a specimen,—

51 Which I submitted for examination to the greatest authority on muscose subjects, Mr. Bowerbank, who sent me word back that it was a charming specimen; and that the embedded forms were all real mosses. I am myself, nevertheless, still under the somewhat contrary impression, that Mr. Bowerbank's mosses must be all real minerals. At all events, the specimen is a superb though a small one, and two or three film-slices might be cut for the microscope from its roughest end, without the least injury; and the question finally settled at St. David's.

52 Yellow and red jasper, thrown into bands by the force of the containing agate, which, however, is so far bothered by the apathy of the jasper that it can't form its own orbs and angles properly, but wriggles and loops itself about, partly in the style of the jasperine vermicelli. Small, but extremely valuable and interesting.

53 Perfect example of what, for distinction's sake, I have called conchoidal jaspers, exhibiting all the previously described phenomena in perfection, yet with one added circumstance, which must be carefully noted. In all ordinary cases of the formation of rods and bands with earthy centres, the successive deposits or crystallizations on each side of the central film are alike, but in certain cases, not otherwise distinct from these, the deposit on one side of the central film is different in number, or in depth, of bands, from that on the other. This little agate, though not so grotesque as many others, is really more curiously unreasonable, in the apparently motiveless effort to make one side of its white promontories always deeper in bands than the other ; though the red encircling jasper is practically of the same thickness throughout, except where it clogs up in the bay. The pear-shaped or kite-shaped section of this agate is also extremely unusual, and, as far as my knowledge goes, unaccountable, all the more that the irregular white promontories would seem the result of forces which must also have produced an irregular surface.

54 Red jasper, in rough grey quartz, with inlets of

chalcedony—two of them in perfectly straight lines, with central films, and very definitely unequal in the thickness of external deposit, while the material of the jasper seems to flow in between them, like a tide filling a harbour through a flood-gate. All these appearances of flux, as well as of fracture, in agates, are, I believe, pure and wilful imposture on the part of those unprincipled stones. But as I have never seen one of them making itself, I withhold at present any final expression of opinion.

55 Red jasper in bands, some straight, some bent, and some apparently not merely broken, but chopped up; the whole mixed with sandy quartz and gritty earth, in a manner, I believe, which no one could explain but Lord Dundreary.

56 Red and yellow jasper variously coiled and squeezed, with veins of imperfect quartz,—a rare kind, which the traveller who gave it me told me he had ridden three days in a savage country to get. As I don't care about savage countries, nor whether a jasper, which one must ride three days to get a bit of, (and can't understand when one has got it,) is to be found in New Guinea or Old Guinea (this is, I believe, from New), I have no reluctance in parting with

this specimen: but I believe it could not be easily matched.

57 We return to the regions of propriety and common sense, in a slice of pebble of the ordinary kind, known as Egyptian jasper. These pebbles are, I believe, found loose in the sand, and I do not find the mineralogists give us any account of where they come from; perhaps, however, the first question ought to be, where the *sand* they are found in comes from, since we get too easily into the habit of thinking that two-thirds of Arabia and Africa were originally manufactured of sand. The pebble itself is very characteristic in its substance,—jasper properly so-called, without any admixture of chalcedony. Though so thin, it is perfectly opaque, and though apparently containing a considerable proportion of clay or lime, takes a quite lustrous polish. Its bands appear to be the result of the same process which takes place in banded flints.

58 The three last examples of the jasperine group sum its peculiarities, and exhibit them in the finest materials. This specimen, jasperine agate, with central quartz, is beautifully parallel and fine in the agatescent bands, which, please notice

in passing, are also remarkable for the bastion-like points of their angles, to which the term 'fortification,' as descriptive of agate, is properly limited. These angles are, in this example, only the re-entering ones of large arches, but we shall see them in others, formed by straight crystalline planes. The flammeate, jasperine, red and grey stains, the latter especially, where they cross the white band, on the broadest polished side, are of precision and beauty certainly in their kind, not to be surpassed, and in my own collection unrivalled.

59 Slice off a jasperine agate of the finest quality, showing agatescent formation, inside as well as outside its quartz. The external bands, variously arbitrary, and unmanaged, or unmanageable, but chiefly notable, because, on the interior of the narrow and consistent band of red jasper, which falls away at one end like the loose thread of a skein, there will be found a series of little circular domes, built into the quartz; white on the surfaces, and cut through into pretty violet sections, which perfectly illustrate the white spots in the two small agates cut into heart-shape, Nos. **5** and **7**, of the 'Cross' series.

60 Pure scarlet jasper, with lateral yellow zones,

entirely representative of the stone in its finest condition, and ordinary flammeate structure. Its scarlet colour under these conditions has through many ages maintained its position as the real representative of that colour among gems, connected always in the minds of the ancients with the more translucent types of the same colour in chalcedony, which we now call carnelian, but they Sardius; whence in the Apocalypse, with the intention of describing the most beautiful colour of the immortal body, "He that sat was to look upon like a jasper and a sardine stone."

61 We now enter upon the study of the entirely separate and most perfect state of silica, which has permanently retained the German miner's name of 'quartz.' As the first essential component part of granite and gneiss, it forms at least a third of the mass of the non-volcanic mountain chains of the world, and the threads or veins of it passing through softer rocks, are the repositories, principally, as we have seen, of gold, and in non-auriferous districts of the greater number of the most interesting metallic minerals. It is to be noticed in passing, that although veins of quartz occur in granite itself, they are usually

non-metallic; and that the rich mining districts are all in comparatively softer, and in most cases apparently sedimentary rock.

The condition of quartz in an ordinary vein is mostly that with which we have been made familiar in studying gold; that is to say, solid, and opaque, with occasional cavities towards the centre of the vein, in which it takes more or less crystalline form. The piece of the rock on which the house of Brantwood is built, No. 61, is a perfectly characteristic example of this general structure. The quartz is secreted out of a grey sandstone passing into slate, and is itself somewhat coarse and impure, so that in its cavities the forms of the crystals are still obscure, but extremely illustrative of the first development of crystalline force.

62 Part of a vein of quartz, a little finer than the last example, or at least with more energetic crystalline power. The reduction of the six-sided prisms into gradually tapering pyramids is a somewhat unusual circumstance, usually regarded by mineralogists as an accident, but in my own catalogues I always class these tapering quartzes as a peculiar variety.

63 Fine white quartz, partly forming a vein, partly

disseminated through a black rock, I believe an indurated slate,—the quartz forming fine sugary crystals at its surface, and set with small crystals of sulphuret of iron; and carbonate of lime, which, in future, I shall call by the shorter name of 'calcite.' One of these calcite crystals (all of which are excellent examples of the most characteristic form of calcite, an hexagonal prism terminated by trigonal pyramids, which are set the opposite way at each end), is farther interesting from having got hold of a crystal of iron, and swallowed it up all to itself. Another at the edge of the specimen seems to have taken three or four, like pills.

64 Detached wall of solid quartz, passing into small sugary crystals on one side, and well-formed larger crystals on the other: sprinkled on the larger side with pearl spar (carbonate of lime and iron), which itself is sprinkled or peppered with sulphuret of iron, and tiny calcite confused among the quartz, a single cube of pretty green fluor spar setting off the whole very daintily.

65 Fine compact quartz, developing into crystalline quartz, which is coated with more divided crystalline quartz, which is coated with sugary crystalline quartz, which is dropped over by chalcedonic

crystalline quartz. Entirely dainty, puzzling, and charming. Cornish, and it may be noted in passing, that as Transylvania does the neatest things in gold, Cornwall does the neatest things in chalcedony.

66 Well developed, full-sized crystals of quartz, coated with sugary quartz, which seems at first to have rather bothered them: together with impertinent sulphuret of iron, which, I think, has been the cause of general discomfiture and distraction in the early life of the crystals. The natural bridge, or lateral viaduct, from the smaller to the larger crystal, is extremely curious, but on the whole I am rather glad to get rid of the specimen, which always bothers me too much to find out what has been the matter with it. The full-sized crystals are extremely good specimens of quartz form, bringing all their sides neatly to the point, which they are very apt to fail of doing, and to look like an ill-cut pencil.

67 Fine quartz, which has meant to crystallize with great precision, but has been nearly bothered out of its life—all, seemingly, because of some nasty earthy sulphuret of iron. The forms of the crystals at last achieved are of extreme interest, just because they are only half built.

This form of quartz showing external layers is, however, peculiar to some localities. I think the best unbothered ones are found in Schemnitz, in Hungary, before mentioned.

68 Compact quartz, bothered quite out of its moral character by sulphuret of iron, with, I think, a little zinc, (the black glittering part at the bottom,) and nasty carbonate of iron all over. This specimen is described in the 'Ethics of the Dust,' as illustrative of the temper of minerals that don't get on together. We will now take up a series of examples showing how quartz gets on with minerals whose company it likes.

69 Pure white agatescent quartz, terminated in crystalline surfaces, sustaining beautiful cubes of golden green fluor spar, which the quartz sugars all over to finish, paying partly the same attention to a large and well-behaved cube of galena (sulphuret of lead), the tiny fragment of sulphuret of iron not having been able to cause any dissension between the parties. The quartzose base of this grand specimen is of extreme beauty and interest, and the whole fine in its kind.

70 Part of a quartz vein, with a bit of the surrounding slate, the central cavity, lined by fine

crystals, sprinkled with black oxide of iron. These two minerals—quartz and the oxide of iron—are great friends, and there is no end to the pretty things they will do with and for each other. In this instance, the quartz crystals take the oxide just within their outer surface, and then crystallize over it, as if to take care of it; the iron being always allowed to take its own proper flaky crystalline forms, with perfect precision. A piece of sulphuret of iron, apparently impressed by the good example, behaves itself very prettily in the corner.

71 I observed, some time since, that quartz never allowed other minerals to get into the centre of it as a nucleus for its crystals, and, as a rule, kept all extraneous minerals, even those it was very fond of, either at its surface, or just under the surface, as in the last specimen: but with its closest personal friends it relaxes so far as to allow them to crystallize all through it, though, in most cases, they may still have to shoot from the surface inwards. Often, however, it seems to let favourite friends do whatever they like, going on with its own crystals meanwhile, exactly as if they did not exist, though they may amuse themselves by shooting

through it in all directions. This piece is a fragment of a large crystal, traversed, I believe, by black Tourmaline. We won't stop just now to ask what Tourmaline is, especially as I am not sure that this *is* Tourmaline: being only concerned with the fact that it is one of the intimate friends of quartz, and although crowded mostly at the surface, is allowed to shoot as far as it has a fancy to do into the interior. Polished on one side, fractured on the other, and the longest edge,—but extremely pretty. I cannot make out the granular black nests on the rough edge.

72 Slice of a quartz crystal, portions of the sides of which are seen at the edges, traversed by sheaves, of, I believe, actynolite, (another friend admitted to much familiarity,) too complex to be describable.

73 Group of three quartz-crystals, one nearly perfect, traversed by straight silky Amianthus, which runs straight through the crystals without in the least disturbing them, and seems very nearly coming out on the other side.

74 Part of a quartz crystal traversed by white amianthus, which begins all of a sudden, before

one knows that it has got in, and takes a delicate little curve at its own fancy, wholly careless about the intentions of the crystal. Polished one side, fractured on two, the rest crystalline.

75 Section of a quartz crystal containing white amianthus, which can be seen only in one light. Hold the piece with its rough side to the window, the figures on the ticket upright, and look with a magnifying glass through the polished plane. The threads of amianthus will then be seen on the internal surface, though only one or two are visible on looking through from the outside. Extremely mysterious, and seemingly all Maskelyne-and-Cookery.

76 Quartz in perfect crystallization, with a friend whom it respects, but nevertheless keeps outside, —Topaz. This mineral is found continually embedded in quartz, at the surface, in this manner, *but I have never seen a single instance of its getting inside it!*

77 Pure quartz crystal, with cavities, left, I believe, by titanium, but I have not the least notion how that mineral either got in or out, only quartz is always ready to let it do whatever it likes.

78 Crystal of the purest quartz, a little interrupted by calcareous earth, and showing structural flaws, therefore, of extreme interest and beauty. There is no end to the things that may be found out, and to the others past finding out, gradually traceable in it.

79 Perfect quartz crystal, showing its mode of growth, by the accident of a pause when it had got half way, during which the surface of the then existent crystal was covered with mossy chlorite; all the planes in this specimen are genuine, none polished, and the example is extremely rare and good.

It is most singular that no mineralogist of any country on earth has ever brought up a school of miners, to take care of a good crystal when they had got it! This example has originally been as perfect as anything could be, and has been only spoiled, as single crystals always are, by the miner's throwing it into his bag with other stones, and banging them about at his leisure.

80 Perfect quartz crystal of Dauphiné, as good as well can be, and in the inside of it, fit for spectacles or telescopes or what not;—of course a little spoiled at the point in the manner above de-

scribed, but I have not above four bits in my whole collection that are better, and can't spare any of them.

81 This example begins a short series of twelve specimens, representing the conditions of silica, which have taken an established position, as gems, or precious stones, for engraving. The principal of these, both for its frequency of occurrence and ancient classic reputation, is the amethyst; it is also extremely beautiful, and stands alone as a purple gem; for although between the sapphire and the ruby there are gradations of violet colour of extreme loveliness, these stones of intermediate tint are never dark; you may find a dark red ruby, or a dark blue sapphire, but never a dark purple intermediate stone. The amethyst, on the contrary, is characteristically dark purple, and when coloured uniformly, of extreme beauty. In material it is only quartz, coloured, by—the mineralogists don't exactly know what, but it is so far specifically different from common quartz, that when the two, which very frequently happens, are found together, the white quartz is always inside, and the amethyst outside. I have seen exceptional cases, but they are very rare. This No. **81** is a very notable crystal of white quartz

coated with amethystine quartz, in which, however, the purple colour only developes itself at the extremities of crystals: this however it does, whether they are directed up or down!

82 Pale amethyst, on slaty sandstone, very pretty, and geologically interesting. I am afraid, however carefully packed, some of it may break on the way, but I think the remnant will always be pretty.

83 Detached crystal of dark amethyst, very fine, though the amethystine layer is not above a quarter of an inch deep, over brown quartz. Had it been otherwise, no jeweller would ever have let it come into a mineralogical collection.

84 The next seven specimens are examples of the rarest and most beautiful form of silica, the opal, —a stone, however, belonging more to modern romance than to classic history. The most precious forms of it are found somewhere in Hungary, I suppose under the influence of our old acquaintance, Transylvania. I can't spell the name of the place where they are found, and nobody could pronounce it if I did, and it doesn't matter. The other varieties of opal, some only discovered recently, are Brazilian and

Australian. This No. 84 is rather a specimen of the Hungarian rock than of the opal, which, however, is seen beginning to develop itself in colour, out of the pale bluish white substance which forms the vein. All of it properly called opal, and known by its peculiar gelatinous fracture; the colour comes where its structure is perfectly developed, being dependent, like that of mother-of-pearl, on structure only.

85 Hungarian precious opal, of finer quality, in a thicker vein. I broke away two bits of it on speculation, thinking to come at better colour, but I never have any luck in speculation, and pasted the bits in again. If they come loose they may be reattached better than I have done it, this specimen being one of considerable interest.

86 Brazilian opal in a narrow vein, which shows straight longitudinal banding. It is one of the principal distinctions between agate and opal, that when the latter is banded, the bands are always straight, never chalcedonic, nor is it ever thrown into chalcedonic globules. This quite simple, though singular distinction, was, so far as I know, first observed and stated by myself.

87 Brazilian opal, of the kind called hydrophane, which absorbs water on being dipped into it, and only then shows its perfect colour; it can't be too often dipped into water, but neither it nor any kind of precious opal should be exposed to strong heat of fire or sunshine.

88 Precious opal, Hungarian, the best kind, *diffused through the stone*, not forming veins in it. The opals used in jewellery are pieces cut, as large as possible, out of this kind of rock, and afterwards rounded and polished. I never heard of a rolled opal being found in any stream, or a round pebble of it found in any rock.

89 Australian opal, in veins, but very lovely. It is more prismatic than the Hungarian, and would form lovely gems, but that its colours are usually confined to narrow bands. It also shows well by candle-light, by which most Hungarian opals are spoiled.

90 Australian opal, diffused through coarse brown jasper, and itself extremely beautiful and full of colour in the blue tones. It is sometimes, though more rarely, found with lights of vivid green, but not with red, which is the colour most prized by jewellers. This quality of blue

opal, however, is gradually establishing itself in commercial esteem, having been only known about five years.

91 and **92** are two examples of a stone difficult to place. It belongs properly to the jaspers, but while the red jaspers are of universal occurrence, this green variety is found only in India, and is highly esteemed in commerce, under the name of blood-stone, very truly descriptive of its character, showing, in fine specimens, spots of deep crimson on a green ground. It is much used for seals, vases, and other such ornamental work, forming a beautiful contrast in its deep green with chalcedony, gold, or any of the brighter gems. Exquisite 15th century vases of it may be seen in the Louvre.

93 Purple Cornish chalcedony, of the finest kind. This, with the remaining seven large specimens, which complete the collection to the number of a hundred, are examples of the larger and grander forms assumed by siliceous minerals, and all exhibit structural phenomena too complex for description. **No. 97** is remarkable for the extreme delicacy of its agate banding, enclosed within a double rank of quartz crystals. **No. 98** is an extremely interesting example of earthy

stalactites in massive chalcedony; and **No. 100,** as complete and striking a piece of agate concretion as could be found in any national collection.

To this series of agates, a few flint-fossils of which I really know nothing worth telling, except that the two in chalk, marked **F. 12** and **F. 13,** were greatly esteemed by my old collector;—that the dainty little scallop Stylites, **F. 14,** has been a great pet of my own, together with **F. 15,** which is so delicate as to look more like a fracture than a shell;—and that the pretty little hinge of the Terebratula is very charming in its present form as a loop of chalcedony. Don't mistake for fossils the two remnants on the other side of the brown card on which Mr. Simon had pasted it for its glorification. I used also to value the little sponges, **F. 4, 5, and 6;** but the big one, **F. 1,** reminds me disagreeably of cold mornings. **F. 3** is in three pieces, which fit into each other like weights, and contain about three thousand nondescript beasts, a nebula of siliceous vermin. The beast in the form of a figure of 8, **No. 9,** is, I believe, some acquaintance of the beast composed of a pentagon with two legs, **No. 10,** and the broken flat thing, **No. 19,** is a piece of somebody's shell,

who was called an Inoceramus. I cut the little Echinus, **F. 20**, through the middle to see into his mind, but made nothing of it, and only lost the other half of him. Finally, the shattered conical one, **22**, and cast of a spine, **23**, will join on properly to the finer examples which I sent originally.

JOHN RUSKIN.

BRANTWOOD,
27th February, 1883.