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Ruskin's Rocks

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The first rocks are the most common: rolled flint pebbles broken or cut to reveal dimly translucent interiors beneath a sand-coloured crust. Dark siliceous jellies fracture along shell-shaped curves; rust-coloured whorls float across the polished surface of a cloudy purple lagoon; a light grey flint is run through with a black cross-shaped fossil, tapering to a tightly lobed quatrefoil at the other end. Next come banded flints and chalcedonies; a pale silicate like scratched ice over a deep pond prefaces a profusion of delicately layered red, tan, white and grey, each thin line ruching in a minute amplification of the film below it. The rough rinds of chalcedonies are sliced through to reveal glassy nodules of purple and iridescent blue. There are miniature landscapes sugared with crystals; a bubbling carnelian the colour of oxblood and the opacity of cast glass; a series of quartzes flecked and interwoven with gold; chalcedonies stained with fernlike traceries of iron. Next are jaspers: saturated clouds and strings of colour set in mauve-grey stone; an oval slice of creamy white and yellow abuts a pink and white agate like an egg next to streaky bacon. Then quartzes, from veins to detached crystals, clear, opaque and smoky, progressing from the simplest pyramids to perfect tapering prisms. The last rocks are the rarest: roseate, milky and bright blue-green opals, green jaspers and deep purple amethysts.

This is the mineral collection 'especially founded on the forms of flint' that John Ruskin donated to the St David's boys' preparatory school at Reigate, Surrey in 1883. It originally contained 133 specimens and was accompanied by a detailed catalogue. The St David's collection was part of Ruskin's larger effort to incorporate the study of minerals into primary education throughout Britain – a goal he enlarged upon in an introduction to his unfinished textbook, *Institutes of Mineralogy*, where he ascribed particular value to minerals that were familiar, easy to find or affordable to purchase, durable, washable and able to be examined by children 'without danger to themselves, the furniture, or the carpets'. In addition to the St David's donation, Ruskin gave significant collections to St George's Museum at Sheffield, the Kirkcudbright Museum in Scotland, the Coniston Institute and Harrow. He also spent a good deal of his time between 1882 and 1884 arranging and rearranging the siliceous holdings of the newly relocated British Museum. Eventually given charge of a single case in which to illustrate 'the more common forms of native silica', Ruskin supplemented the museum's specimens and wrote an accompanying catalogue. Smaller collections went to Miss Bell's School for Girls at Winnington, Cheshire, the Whitelands Training College at Chelsea, the Cork High School for Girls, and Somerville and Balliol Colleges, Oxford. The St David's collection was one of only three donations for which Ruskin wrote a catalogue, and as Ruskin's editors remarked, that document stands out for being 'carefully written and most instructive'. Unlike many of Ruskin's mineral collections, which have either been dispersed over time or so altered that any original written material cannot be correlated with individual specimens, the St David's collection has changed hands only twice since the school closed in 1903. While some of the more valuable items have gone missing – most noticeably the majority of the (eminently pocketable) examples involving native gold – the rest of the collection is largely intact, and in some cases Ruskin's original labels still exist. With the St David's collection, then, it is uniquely possible to compare Ruskin's words with the original specimen to which they refer.

In Ruskin's view, banded and brecciated silicates, a group of rocks that includes the agates, jaspers and chalcedonies at the heart of the St David's collection, were valuable examples of a self-organising principle at work in the mineral world. Close observation of the striations and chunks of colour which characterise such stones revealed to Ruskin's eye that these had pulled apart from each other via an internally motivated mechanism he called 'tranquil division'. This was a chemical process rather than a physical one, in which the mineral components of each stone assumed compositional agency. Thus Ruskin's verbs in the St David's catalogue tend to treat his silicates as acting entities: flint 'develops' and 'purifies' itself; chalcedony 'throws itself into bands'; in the case of number 43, where 'chalcedony is the active and formative element', jasper 'submits'. A vein of quartz demonstrates 'energetic crystalline power' while a calcite crystal stuck to it has 'got hold of a crystal of iron, and swallowed it up, all to itself'. Ruskin's views ran counter to standard mineralogy, which, then as today, interpreted banded silicates as a sequence of individual deposits laid down in solution, in the same way that stalactites form in a cave, while their brecciated counterparts were seen as banded silicates that had broken into pieces which were then glued back together by subsequent coats of liquefied stone.

> '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.'

Ruskin accused those who held to this explanation of failing to observe or account for contradictory details in the rocks themselves. For instance, the nodules that others treated as tiny stalactites seemed in the case of silicates to form independent of gravity, often pointing in several different directions within a single stone. In the St David's catalogue, Ruskin accordingly chose to call them 'pseudo-stalactites', tetchily remarking in his entry for number 21 (now lost) that half of these formations dropped one way and half the other:

> 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*.

Here Ruskin's theorising ran ahead of his reason, since, as in the case of stalactites forming downward and stalagmites forming upward, gravity alone could account for his first observation: depending on the rate and internal variation of crystallisation, his sideways instance might have been the result of rolling the forming stone rather than upending its parent orb. Yet Ruskin also amassed more persuasive evidence in support of tranquil division. In particular, he noted that in banded silicates 'the basic films never exceed a certain thickness, nor the basic rods a certain diameter'. This, as he explained in a series of papers aimed at the geological profession between 1867 and 1870, seemed at variance with the idea that such coats and rods formed like baby strata, one at a time and in superimposition. Rather, Ruskin believed that examples like those in the St David's collection proved a chemical process was a work: bands and rods were all a uniform thickness because their formation was simultaneous, which meant they were collectively constrained to the same degree, and width, of separation.

This is the basic argument Ruskin's mineral collections were meant to demonstrate in the most persuasive manner possible. In the St David's collection, the rocks have been arranged to showcase silica's full range of formative potential, from the least organised flint flecked with fossilised organic material to the purest quartz arrayed in complete crystalline order. There is also an attention to colour – which surges and ebbs through the collection as if to pull a complex tapestry of molecular kinships through to the surface – and to form: cut and polished rocks are balanced by rougher specimens; the large examples are offset by small ones. The somewhat idiosyncratic inclusion of metals in the middle of the sequence and the segregation of gem-quality stones at its end seem calculated to periodically reinvigorate the observer's flagging attention.

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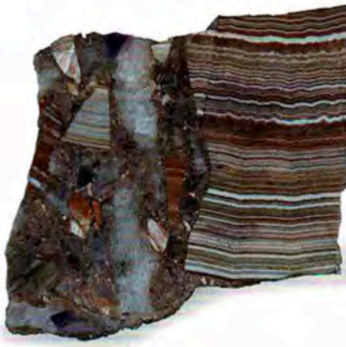

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An argument is being made, in other words, with subtler means than science alone.

Persuasion was important because of what was at stake. Following the Protestant exegetical tradition of typology, in which nature's forms and the processes by which they come into being are seen as 'types' – embodiments of eternal truths and models of correct human behaviour – Ruskin believed that the chemical and the conscious differed from each other only by degree. For him, the 'is' of mineral formation – its infinite chemical reproducibility giving rise to ever-new individual forms – merged into the 'ought' of ethical conduct until the laws of the first domain seemed equally applicable in the second. This was most literally demonstrated in the series of lectures Ruskin delivered along with his minerals to Miss Bell's School for Girls. In his talks, later published as *The Ethics of the Dust, or Ten Lessons to Little Housewives on the Elements of Crystallisation* (1866), Ruskin instructed his female pupils to persist in their own 'unconquerable purity of vital power, and strength of crystal spirit' and develop according to plan, as it were. The girls were to follow the example of mineral atoms, which always 'get into order as soon as may be':

For in the fulfilment, to the best of their power, of their adopted form under given circumstances there are conditions entirely resembling those of human virtue: and indeed expressible under no term so proper as that of the virtue, or courage of crystals.

Ruskin's 'crystal virtues' endowed minerals with a 'limited, though stern code of morals' focused on purity and form; his 'crystal quarrels' included an example he donated to St David's (number 68) in which quartz and iron combined to produce misshapen and imperfect results. Aside from what strikes us today as Ruskin's chauvinism – for his time, his view of female education was considered quite liberal – one of the more surprising aspects of Ruskinian ethics is the ease with which they were transferred from culture to nature – even inorganic nature – and back again.

Silicates were particularly valuable to Ruskin because they seemed to possess a second formative principle in addition to that of crystallisation: something he called 'the great diagonal – or spiral? – force of silica' that aggregated individual crystals into 'branches or coils' and propelled crystallisation along particular lines. Ruskin matched curves and shapes he found in siliceous minerals to components of living things, like birds' wings, and to pleasing aesthetic lines in the creative output of human beings. Ruskin believed these vectors developed independently, and only resembled each other because they obeyed a transcendent set of natural laws. In the St David's catalogue, he was eager to attribute seemingly organic forms to chemical processes alone. Flint's 'conchoidal' fracture thus looks 'exactly like the cast of a shell'; mineral formations are described as 'mimicking a fossil'; various moss-like structures are in reality 'entirely inorganic'. In the case of number 51, Ruskin mocked the 'greatest authority on mucose matter' for having claimed 'the embedded forms were all real mosses. I am myself, nevertheless, still under the somewhat contrary impression that Mr Bowerbank's mosses must all be real minerals!'

A second, and more troubling, dimension to Ruskin's focus on silicates emerges from their capacity to aggregate a variety of individual crystalline impulses into a larger whole. This had direct implications for what Ruskin believed to be the proper relationship between humans and their natural surroundings, in which people and their myriad productions were the final and most intricate outworkings of a self-assembling natural system that began with the simplest atomic configurations. There were thus composite natural-artificial landscape 'orders' akin to those of classical architecture: 'corresponding not only to the several species of rock, but to the particular circumstances of the rock's deposition or after-treatment, and to the incalculable varieties of climate, aspect, and human interference'.

Ideally such 'human interference' would take the form of large-scale environmental cultivation tailored to a particular inorganic context – a possibility Ruskin worked to instil in Britain when he founded The Guild of St George in the 1870s. Along with educational reform, the Guild was to shape and repair the critical physical junction between mineral and social life: averting floods, draining fens, checking sea-erosion, constructing breakwaters – 'dig the moor and dry the marsh', as Ruskin urged, 'to bid the morass give forth instead of engulfing, and to wring the honey and oil out of the rock'.

In the context of an ethical society, a correct alignment between human creativity and geological particulars could produce spectacular results. This is precisely the way Ruskin approached Venice. The underlying geomorphology of the Venetian archipelago, including its shallow seas, the narrow bandwidth and regularity of the tides, and the gradual but immense deposition of fine (siliceous) sediment by the Po and other rivers – all of these inorganic vectors combined in what Ruskin emphasised as 'the only preparation possible' for such a unique cultural achievement. Thus the St David's donation was ultimately part of Ruskin's larger campaign for an obedient nation whose ethics *resembled* the formational patterns of rocks because they were derived from the same divine source, and *responded* to this most basic foundation with an accretive, even 'coralline-like activity'. Distributing carefully arranged and annotated mineral collections to the youth of the nation was an efficient way to disperse granules of natural truth that both embodied right behaviours and inspired emulation.

Within this fundamentally geological system, human activity becomes something like a carboniferous crystallisation atop a siliceous substrate. It occupies the carbon-rich layer that Ruskin called the 'earth veil', stretched over the silica-rich bedrock of the world, and it ideally assembles 'lovely cities, crystallised, not coagulated, into form' from carbonate materials like limestone and marble. Architecture was thus both the calcined shell or deposit of the society from which it emerged and the ultimate index of the relationship between that society and its mineral environment. As such, Ruskin believed, it could be analysed just like any other inorganic product. His resultant transpositions from mineral to architectural form could be startlingly direct. Ruskin dismissed the Greek fret ornament, for example, because the only chemical substance it resembled was a crystal of bismuth, which could only be produced artificially. 'On this ground, then', wrote Ruskin, 'I allege that ornament to be ugly; or, in the literal sense of the word, monstrous; different from anything which it is the nature of man to admire'. Human agency, like silicate force, was best directed wherever it was able to abet the social conditions that permitted more admirable crystallisations.

Follow the threads that connect aphoristic moral statements, motivate arcane mineralogical disputes and intrude in architectural criticism before coalescing in an agate presented to the schoolboy's gaze. The picture of Ruskinian ethics that emerges represents an amalgam of nature and culture which is far more deliberate and thoroughly worked out than the iterations in architectural discourse today. Historically, Ruskin's project coincides with that of Charles Darwin, whose 1859 publication, *On the Origin of Species*, famously demonstrated that there is no organic life without struggle and adaptation. Contra this position, Ruskin's embrace of inorganic fixity is a conservative impulse that attempts to negate precisely the ways in which living beings are *other* than their inorganic environments. Agency there may be – even furious, wilful activity – but change in Ruskin's siliceous ethics is a recursive process: the achievement of an alignment across diverse forces, the decay of that achievement, and the attempt to reinstate it according to the same unalterable pattern. Predicating human behaviour on the self-organisational properties of minerals is ultimately an attempt to strip a critical animal faculty from the human subject: the ability to evolve and change.

'Jasperine agate with beautifully parallel and fine agatescent bands and central quartz. The flammeate, jasperine, red and grey stains are of precision and beauty certainly in their kind, not to be surpassed, and in my own collection unrivalled.'

Rock captions, extracted from John Ruskin's original catalogue, 1883

1

Agatescent chalcedony (ie, chalcedony throwing itself into bands), showing both the straight-levelled and concentric forms. An altogether exquisite example, cut and polished under my own direction.

2

Jasperine agate, in perfect brecciation. A small slice off the best piece I have in my own collection.

3

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 at the top.

4

Submitted for examination to the greatest authority on muscose matter, 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.

5

Yellow and red jasper, thrown into bands by the force of the containing agate, which, however, is so far bothered by the stolidity 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.

6

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 (and can't make anything of 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.

7

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.

8

Flint-chalcedony, making the best it can of itself. It cannot be seen in finer condition, 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). Cut and polished under my own direction.

9

Level Icelandic chalcedony, traversed by pseudo-stalactites, each with its proper rod of nucleus. Cut and polished under my own direction, and extremely instructive, if one could only understand a single word of what it says. Look at it against the light.

10

Slice of 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, are 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.

11

Fine white quartz, partly forming a vein, partly disseminated through black indurated slate. The quartz forms fine sugary crystals at its surface, and is set with small crystals of sulphuret of iron and calcite. One of these calcite crystals, has got hold of a crystal of iron, and swallowed it up, all to itself; while another at the edge of the specimen seems to have taken three or four, like pills.

12

Compact quartz, vexed 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.

13

Native gold in semi-crystalline quartz. I believe this 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, while the gold, in grains and masses of various sizes, falls to the bottom of the stream. This specimen was cut when I bought it, and the section shows the exact lines of contact between the gold and quartz: crystalline in the interior of the stone, where the metal is compact, and effervescing into moss in the cavities.

14

Portion of an imperfectly brecciated flint, coloured by iron oxide. I bought the whole piece in a dealer's back-shop for sixpence; cut it, and have kept the biggest piece, which I would not part with for five pounds. 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, and the grey parts might be called grey chalcedony, if they were a little more clear. But on the whole, it is better called a high-caste flint, traversed by fibres of red jasper.

15

Blue agate, surrounded by a coat of scarlet jasper. It will be seen that the globular concretions of the agate are independent of this exterior coat; while 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 puzzling interest.

16

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. Quartz never allows other minerals to get into the centre of it as a nucleus for its crystals, and, as a rule, keeps even those it is very fond of, either at its surface or just under, but with its closest personal friends it relaxes so far as to allow them to crystallise all through it and do whatever they like, going on meanwhile in perfect tranquillity.

17

Quartz in perfect crystallisation, 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!

18

Quartz crystal showing its mode of growth by the accident of a pause when it had got halfway, during which its then surface was covered with mossy chlorite. It is 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 was originally 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.

19

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. The whole thing is a trifid lump of wonder, and I wouldn't give it away, if it didn't always split my head to look at it.

20

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 marvellous under the microscope.

21

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.

22

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.

23

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.

24

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.