

the snail, being air-breathing, always takes a reverse position; and any one who will examine an old wall when snails are hybernating will find them attached most frequently to the roof of a cavity with their shells downwards, sometimes on an upright part distant from the opening in the wall through which they enter; but I have never seen one on the floor of the cavity, or anywhere where water could accumulate: and it is precisely in accordance with this habit and in such shaded situations that these holes are found, and which are bored upwards for the same reasons. The same holes, therefore, would not be suitable for the aquatic and the air-breathing Molluscs: what would be life to the one would be death to the other.

In conclusion, the fair inference to be drawn from the foregoing appears to be that the holes and chambers in question are not the work, even partially, of *Pholades*, or of any other marine Mollusc, and therefore are of no value as a testimony to any movement or elevation of the land. But, all the facts being considered, as well as the distribution of the holes in so many limestone districts where snails abound, at such various altitudes, and so far asunder, the position of the holes and their form agreeing with the habit of the Mollusc, it may reasonably be assumed that Dr. Buckland was correct in the conclusion he drew, in his paper published in 1841, that the holes were made by *Helices*—not, however, as M. Bouchard supposed, by the chemical action of the snail secretion alone, but by the mechanical rasping action of its odontophore, assisted, possibly, by an acid secretion from its mouth.

### III.—BANDED AND BRECCIATED CONCRETIONS.

By JOHN RUSKIN, LL.D., F.G.S.

(PLATE II.)

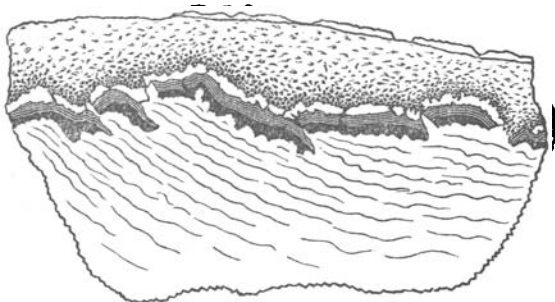
(Continued from the December (1869) Number, page 534.)

WE have now, I think, obtained sufficient evidence that the disposition of differently coloured or composed bands in agate is in most cases the result of crystalline segregation. We shall find, also, that the order of this segregation is constant under given conditions; and that, with fixed proportions of elements and fixed rate of cooling and drying, the agate will necessarily produce itself in a riband of a fixed succession or pattern of stripes: a spectrum of substances, which, if we had observed data enough, we might read like a spectrum of light; inferring, not the nature of the elements from its bars of colour, but the former conditions of solution from the bars of elements.

When the stone has been undisturbed, this riband or chord of its constituent elements will necessarily form quietly round it, either in its nest, or on its nucleus, with phases of level or vertical deposit under peculiar circumstances. But when the congelation has been disturbed, the chord of elements is broken up, and may then be traced here and there about the stone, forming where it may, and as

it can. For instance, Fig. 1 represents rudely a quartzose band formed at a junction of fluor with siliceous sandstone. The dotted space is the grit, the undulating lines stand for a coarse mass of compact fluor spar, vaguely crystalline in that direction.

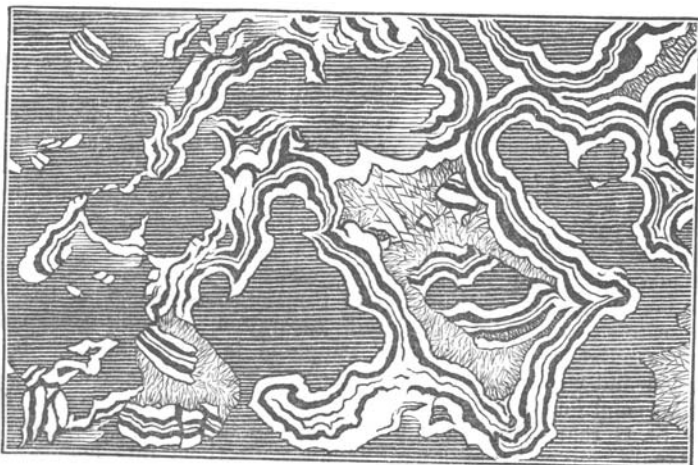
FIG. 1.



The faulting of the band is, I believe, entirely owing to fitfulness in the crystalline action; there is no trace of any kind of flaw or rent, either in the sandstone on one side, or fluor on the other.

The composition of the band here, as in the hornstone (*GEOL. MAG.* 1869, Dec., Fig. 1, p. 529), is of one series of elements only; but very often the chord is composed of a central band, with corresponding opposite series on its sides. Here, in Fig. 2, is a very simple case,

FIG. 2.

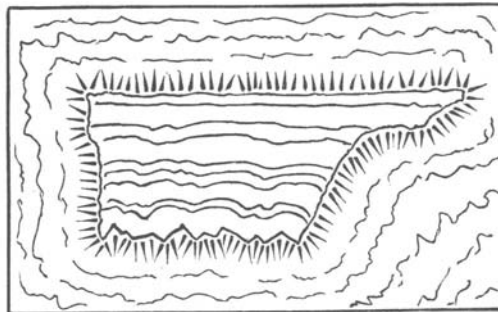


in which the chord has a thin white central line, with first a dark and then a broader white one on each side. The entire chord is flung irregularly about the stone, sometimes in continuity for a few folds, sometimes in broken segments; but the outer white band has the power of detaching itself from the chord occasionally, and of expanding here and there into wider spaces.

And, as in Fig. 1, we have a deceptive semblance of consecutive faults, so here we have an equally deceptive mimicry of brecciation

by violence. But the two apparently broken portions of the band, in the centre of its own loop, are simply detached crystalline formations of it in those places. Here, Fig. 3, is a single example of such

FIG. 3.



an one from another stone, in which the enclosed banded segment is seen at once to be concurrent at its base with every undulation of the surrounding belt, though so trenchantly divided from it at the flanks.

And here we have to note a further separation of our subject

into two branches, or, rather, into two threads of mesh (for its classification, like most true natural ones, is not branched, but reticulated). When the bands form in several fragments in all directions, as in Fig. 2, we are conducted gradually to the most fantastic structures of abruptly brecciated agates. But when they are systematically affected by a consistent action of crystalline power, as in Fig. 1, we are conducted to the group I shall describe in the following paper under the name of involute agates (I carelessly used the word "conchoidal" for involute, in page 534), which seems to me, as far as I have any clue to their mysterious structure, to be chiefly owing to the action, in a partially fluid substance, of the great diagonal—or spiral?—force of silica. This diagonal power of, or in, quartz, is to me one of the most interesting phenomena in mineral nature, both in itself, and as one of a group of powers like it—wholly distinct from the crystalline ones, and acting with them, or dominant over them, at particular times and places, elsewhere and at other times remaining entirely passive.

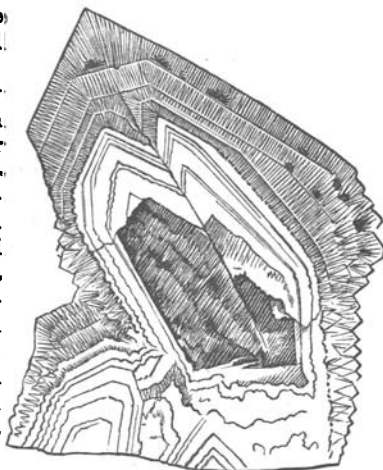
Thus the growth of an ordinary quartz crystal depends on the regular imposition or secretion of parallel coats, which sometimes are capable afterwards of frank separation, forming "capped" quartz. But the flute-beak of Dauphiné is never capped. It is formed and wholly compacted under an oblique energy, which disciplines and guides together the hexagonal forces of the crystal. On the St. Gothard the same force, instead of terminating the crystals obliquely, unites them laterally, and leads them into long walls, warped into curves, sometimes like crowns or towers. Generally, when there is amianthus within crystals, the oblique force carries the filaments across the crystal diagonally; and it is very notable, as regards the time of secretion of these interior deposits, that while the iron oxides always arrange themselves in concurrence with the coats of the crystal, amianthus and rutile never do, but shoot clear through the whole body of it, if themselves long enough, and, if short, root themselves on an external plane, and shoot to the inside;

while the iron oxides root themselves on internal planes and shoot to the outside.

Here (Fig. 4) is an example which will at once illustrate the power of the oblique force, and this relation of the oxides.

It is the section of a singly terminated, and apparently, seen from the outside, an altogether single, crystal, one of a well-formed cluster, showing externally no signs of disturbance. They are all beautifully spotted with black iron oxide under a clear external coat, about one-seventh of an inch deep, which entirely covers them. These concretions of iron are represented in the woodcut accurately in section by the black spots; a minor series, not seen externally, is exposed by the section

FIG. 4.

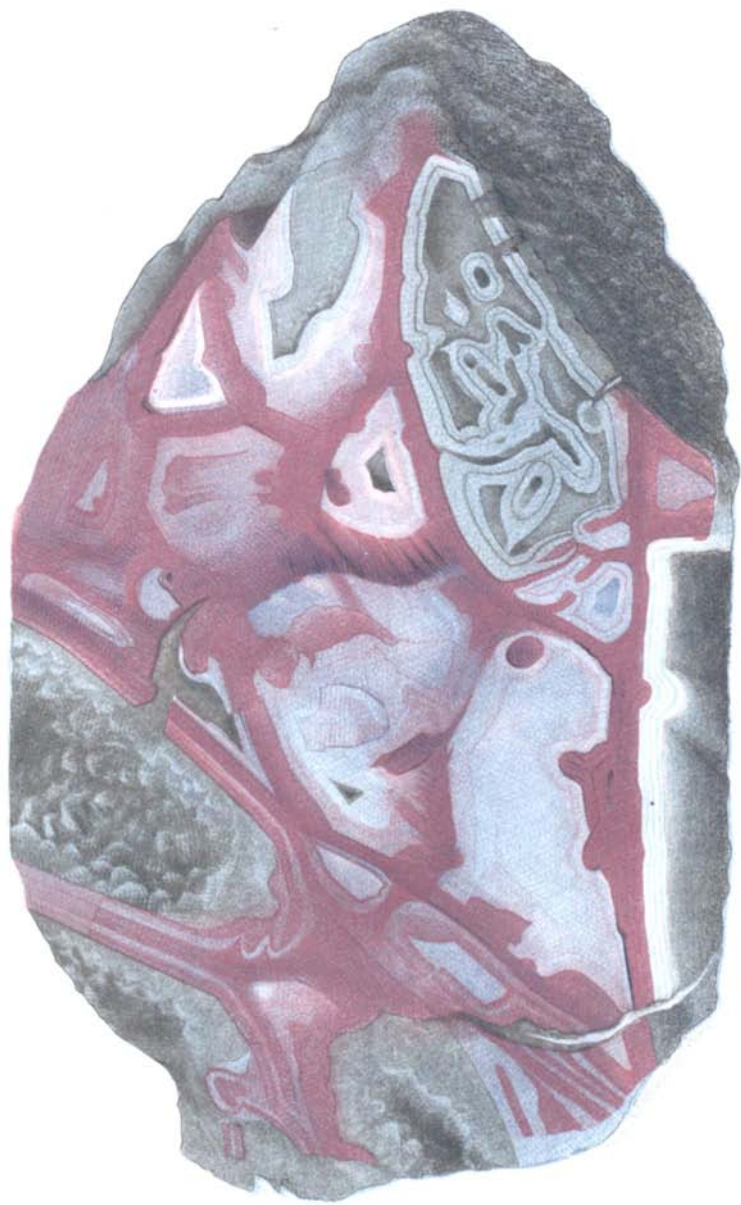


within the crystal, which is also shown by the section to be dual in the interior, separated into two parts by a perfectly straight line in the direction of its length, and nearly into two other parts by a jagged and broken one across it; all the interior beds being faulted by the oblique force, which acts,—in one direction softly, guiding, without breaking, one part of the white beds (opaque white in the stone) into an angle beyond the other,—and in another direction violently, causing jagged flaws across the beds. Within the white beds, and under the great flaw, the quartz becomes again dark-clear.

Now, all these arrangements of substance take place under laws which surely need more investigation than they have yet received,<sup>1</sup> being quite distinct from those which limit crystalline form, and bearing every semblance of a link between molecular and organic structure. For instance, pure crystalline force determines both gold and silver into cubes or octahedrons. So also it determines the diamond. But no force of aggregation supervenes to form branches or coils of diamonds; whereas an unexplained power, dominant over the crystalline one, extends the golden triangles into laminae, and wreaths the cubes of silver into vermicular tracteries. Agencies alike inexplicable twist the crystal of quartz like a piece of red-hot iron, and design the bands of agate into curves like those of a nautilus shell.

The transition from such coated crystals as that shown in Fig. 4,

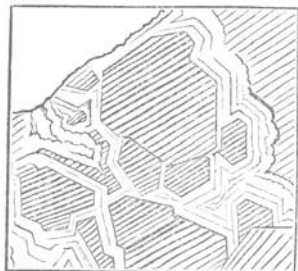
<sup>1</sup> I look with extreme interest to the result of the inquiries which Mr. W. Chandler Roberts has undertaken on the chemistry of silica. I have to thank him already for some most valuable information communicated to me in the course of last year, of which, however, I will venture no statement until he has made public his discoveries in such form as he may think proper.



TRANSITION FROM MURAL TO INVOLUTE AGATE.

to these involute agates, may I think be traced without a break. The base of this stone is formed of smaller and less perfect crystals, which, cut transversely, present themselves in honeycomb-like groups, Fig. 5. Each of these cells is a little mural agate, with no

FIG. 5.



spherical force disturbing it. When quartz disposed to such formation gets mixed with jasper, or with any other uncrystallizable rock, the cells become shapeless, and we get results such as those represented in Plate II. This stone there drawn shows the combination of angular cells with confusedly coiled ones, of which a close-set group is seen on the right, gathered together within broadly curved lines, which I think we shall be able to trace through succeeding examples, as they reduce

themselves to the shell-like contours of true involute agate. On the other hand, in the centre of the stone, the less disciplined series of jasper veins, surrounding crystalline spaces, show the first origin of the groups of agate, which ultimately resemble a pebble breccia. I will endeavour in following papers to trace the two series through their gradual development.

#### IV.—ON THE DENUDATION OF THE LAKE-DISTRICT.

By J. CLIFTON WARD, F.G.S., Associate of the Royal School of Mines, of the Geological Survey of England and Wales.

**A**N interesting Article by my colleague, Mr. C. E. De Rance, in the last number of this Magazine, upon "The Surface-Geology of the Lake-District," induces me to offer a few remarks in connection with the subject.

Being engaged in the Survey of part of this district, I am at present professionally tongue-tied as to details, but there are several *general* points connected with its ancient and present physical geography which have not seldom occurred to me during the short time I have been in the country.

1. The enormous amount of denudation that has taken place over the area in question, almost as much material having been taken away in the formation of the valleys as has been left to form the mountains.

2. The utter incompetency of marine action to form the present contour of the country, its complicated systems of valleys, its numerous lake-hollows.

3. The very great power of the atmosphere as a present working agent; the frequent storms, the deluges of rain, the almost constant wetting of the hill-tops, the sudden changes in temperature, the giant power of frost, the rushing of the wind up or down valleys and round corners.