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III. *Some Remarks on Mineral Veins, &c.* By R. W. Fox, Esq.*

IT appears to be a question worthy of investigation, how far the internal structure and temperature of the earth may be connected with electricity and magnetism, and with the meteorological phænomena observable at its surface.

Both the Wernerian and Huttonian hypotheses seem to have a tendency to involve the subject of geology in obscurity, rather than the reverse; especially when applied to the explanation of the origin of veins.

How, for instance, could very *oblique open* fissures in the earth, sometimes many yards wide, and of great but unknown length and width, exist for a moment without being closed by the weight of the superincumbent mass? Besides, I apprehend that in Cornwall, at least, the width of the veins, taken in the aggregate, is not found to diminish in depth; although some of our mines have been worked to the extent of from 230 to 240 fathoms under the surface.

Veins are, however, often found irregular in their thickness at different depths; and when this circumstance and their frequently great inclination from the perpendicular are considered, it may be asked, why, if they were originally rents in the rock, they do not abound with fragments of it?

Proximate veins often unite for a certain distance, either horizontally, or in their descent, and appear to have the characters assigned to contemporaneous veins. If so, it is impossible to imagine them to have been open fissures, as the included rock would have had no support. If we suppose them to have been formed from fissures produced at different periods, it may be questioned, why the old rents, where the adhesion might be presumed to be the weakest, did not re-open? whereas neighbouring veins are sometimes not quite parallel, but often far otherwise in descending into the earth; and the direction seems to be wholly independent of the cleavage or dip of the containing rocks; and in fact they pass through different rocks, such as granite and clay-slate, without suffering any alteration in their course at the place of junction.

But if it should be admitted, for the sake of the argument, that such open fissures as have been alluded to, *could* exist, and that the substances found in veins *could* all be held in solution, and *might* be deposited in the actual forms and combinations in which they are now found,—there is nothing like horizontal stratification to be seen even in the largest veins; and

* Communicated by the Author.

the commonly smooth surfaces of their containing sides, or "walls," and the rarity of stalactitical forms in them, equally forbid the idea of the contents of veins having once flowed down their sides or exuded from them. Nor are there any instances that I am aware of, of even the smallest veins, however great their inclination, exhibiting extensive open fissures, in consequence of the upper part being closed up or choked by depositions from above.

It may be remarked, that the contents of veins are not arranged according to their specific gravity, the metalliferous ores being commonly found in detached masses, sometimes near the surface only, and at other times at considerable depths, or they are dispersed in the veins at various depths. Frequently, ores of different kinds, which would combine immediately if in fusion, are found in contact, but in entirely distinct masses. Many of these combinations would be instantly decomposed by a great degree of heat; and clay, which is so prevalent in veins, cannot be supposed to have an igneous origin.

Thus I think it may be asked, if the theories which have been advanced on this subject be calculated to remove some difficulties, do they not substitute greater in their stead?

The curious arrangement of veins, and the geological structure of the earth, seem to me to afford ample evidence of *design*; and I cannot but believe that the operations of Nature under the surface, as well as above it, are intimately connected, and that they equally derive their origin from Divine wisdom and creative power.

It is a very remarkable fact, that veins are in a considerable degree, either coincident with, or at right angles to the magnetic meridian.

In Cornwall and Devon, copper and tin veins are instances of the latter; and those of clay, quartz, &c. of the former. Lead and silver ores, &c. are usually found in north and south veins, when they occur in the neighbourhood of those of copper and tin. In some parts of Cornwall, however, instances have occurred of lead veins assuming nearly the E. and W. direction, but I am not aware that any copper and tin veins are known to exist in their immediate neighbourhood. I believe the lead veins generally run from about E. to W. in Wales, and in some parts also of the North of England. This is likewise the prevalent direction of the great silver veins in Mexico. The same observation applies to the veins in many mining districts in Europe.

This may be taken as the most common direction of the principal metalliferous veins in different districts, as far as my information

information extends; and I believe the fact of some other metallic ores being arranged at right angles to the former, is not peculiar to Cornwall.

In the latter district the E. and W. veins are usually intersected and broken by the cross veins; and instead of being continued in straight lines, the parts are more or less widely separated. And as the cross veins commonly consist of clay or quartz, or of both together, the insulation seems almost complete as it respects water and *electricity*. The clay being found to dam up the water effectually even in the immediate neighbourhood of deep excavations; and the quartz, which is an imperfect conductor of electricity, appears to me to be rendered more effectually so by its radiated texture,—a formation which I believe is peculiar to quartz found in cross veins. Sometimes the quartz is on one side of the clay, and in others included in the middle of it.

Nor must I omit to allude to veins of another kind (if they may be so termed), which more easily approach an horizontal position, and are usually in an E. and W. direction, and are called “slides” by the miners, from their separating the veins at different depths under the surface. These slides are also mostly impervious to water.

There seems, in fact, to be a remarkable analogy between the arrangement of veins and some electrical combinations. The high temperature of the earth varying as it seems to do at different places, and the salts contained more or less in water, tend to strengthen the resemblance.

The arrangement of ores in the veins also affords evidence, I think, in many ways, of the presence of electricity, either as *cause* or *effect*. I may instance the regular disposition and aggregation of different kinds of ores in the same veins, and the frequent accumulation of metallic ores in parallel veins in places at right angles to their direction*.

The principal mining districts in Cornwall are usually near the places of junction of granite and clay-slate.

It has been observed that nearly parallel E. and W. veins often become more productive when they unite either horizontally or in depth, and the reverse frequently happens when veins descending into the earth at *opposite* inclinations intersect each other.

Instances are occasionally, but very rarely, met with of E.

* My friend R. Tregaskis, of Perran, near this place, who is well acquainted with the practical part of mining, has remarked to me, that veins are usually found most productive of ore near the intersection of cross veins, and I believe this observation to be well founded.

and W. veins intersecting the cross veins without suffering interruption.

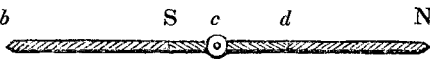
The great veins or dykes of porphyry, or *Elvan courses* as the miners term them, may also be connected with electrical action. They are nearly in an E. and W. direction, and are not affected by the veins which cross them.

I need not say that the above is a very summary and imperfect statement of some of the phænomena of veins; and I cannot but believe, that a more minute investigation and complete classification of facts than has yet been attempted, relative to this important branch of geology, would be interesting to the philosopher, and perhaps valuable to the miner. This object might, I think, be best attained by scientific individuals, or societies, employing a suitable person who would devote his time and attention to the subject. He might also try various experiments, especially with the magnetic needle, near the junction of different rocks, and in the vicinity of veins having different directions, to ascertain if the variation or the magnetic intensity is affected thereby.

With the view of making some experiments hereon, when I can find sufficient leisure for the purpose, I have had some magnetic needles prepared with one polarity only in action; the other being neutralized, or nearly so, by altering the centre of suspension to within the neutralized pole itself, and extending it with brass as a counterpoise to the acting pole*.

If it should prove that veins differently circumstanced have different effects on these needles; may it not tend to explain the cause of the periodical variation of the compass, if we suppose electrical action to vary in its relative intensity at different periods of time? And may not electricity, the intensity of which varies so continually in the atmosphere, affect the oscillation of the pendulum and cause the discrepancies observable, especially when the pendulums are insulated, or only partially so; on agate edges?

* To make the above description more intelligible: Suppose NS to be the magnetic steel; S*b* an addition to the steel, made of brass or some other metal not affected by magnetism, to act as



a counterpoise to the opposite arm; *d* the centre of the steel part of the needle where magnetic neutralization takes place. It is evident that *c*, the centre of suspension, can be so placed that the two arms *cS*, *cd* having south polarity, may counteract each other, and leave the north polarity *dN* to its full action; or the case may be reversed, by substituting the S pole for the N. Would it not be interesting to make experiments with these needles on the magnetic intensity at different places, and in different latitudes?

I may

I may also just remark, that the rotation of the earth on its axis from W. to E. appears somewhat analogous to certain phænomena in electro-magnetism.

Geology has perhaps hitherto been considered too much as an insulated science; whereas, I believe that the phænomena it embraces are only additional links in the chain of creation, so intimately connected in all its parts. Otherwise it must be admitted to present an anomaly when compared with the other works of the Deity, in the minutest portions of which, order, wisdom, and reciprocal dependence become more and more evident in proportion as they are investigated.

ROBERT W. FOX.

IV. *Description of a Parabolic Sounding Board, erected in Attercliffe Church. By the Rev. JOHN BLACKBURN, M.A., late of St. John's College, Cambridge; and Minister of Attercliffe-cum-Darnall*.*

[With a Plate.]

IN the year 1826 a new church was consecrated at Attercliffe, near Sheffield; being built according to a design by the late T. Taylor, Esq., by means of a grant from His Majesty's Commissioners appointed under the Act for the building and promoting the building of additional Churches.

The area of the interior is in the form of a rectangular parallelogram, 95 feet by 72. At the east end is an elliptical recess 32 feet wide and 10 feet deep, making the extreme length of the centre line from east to west 105 feet. The roof is vaulted and groined; the highest point in the ceiling of the nave about 56 feet from the plane of the floor: there are galleries at the sides and at the west end.

In this church the resonance was powerful, but the sound indistinct and confused, whatever was the character of the voice from which it proceeded: no exertions, no pains on the part of the speaker could render him audible. To remedy this most serious inconvenience, various unsuccessful experiments were made. The pulpit was removed to different points; and although its present situation proved the best †, the evil complained of still remained: the common horizontal sounding board was tried, which conferred indeed a benefit on a few seats about the pulpit, (seats which least of all re-

* Communicated by the author.

† The pulpit stands in the middle aisle, 15 feet in advance of the altar rails; its form is octagonal; its floor 9 feet above the floor of the church; the ascent is by a winding staircase, with the door on one side; in front are the reading-desk and clerk's-desk.