NOTES ON THE GEOLOGY OF OKEHAMPTON.

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THE leading features of the geology of Okehampton and its neighbourhood are simple enough. The town itself lies in the Culmiferous trough of central Devon, on the verge of the north-western corner of the Dartmoor granite. There is no question that all the stratified rocks of the immediate locality are Carboniferous, by no means rich in fossils, and belonging to the lower portion of that system. They are for the most part slates and shales, though a few grit bands with quartz veins occur, and many of the beds are so massive as to make very excellent local building-stone. Slaty cleavage, in fact, is by no means pronounced in the district. A special feature is the occurrence of Carboniferous limestone at Meldon.

Traversing these Carboniferous rocks, contouring and sweeping round the granite at no great distance, are some bands of "greenstone"—to use, for the moment, the familiar field term—and other rocks of igneous origin; and all participate in the general northerly dip from the granite, which characterises the rocks of this region.

The granite of Dartmoor here rises to its highest point—at Yes Tor and High Willhayes; and there is a wide zone of stratified and associated rocks next the granite, which have been the subject of contact and dynamic alterations. The changes thus induced supply some of the most interesting features of the local geology.

Finally, traversing both granite and Carboniferous rocks, and at points the igneous bands included in the latter, we have a series of metalliferous lodes and cross-courses—at Longstone Hill, Meldon, the Castle, Halstock, Belstone, and South Tawton, more particularly.

Mr. Ussher, F.G.S., places the stratified rocks of the vicinity of Okehampton in the lower division of his grouping of the Devonshire Culm-measures,[1] remarking: "On their northern outcrop, the beds forming this series occupy a very much narrower tract than that to the south. Their northern outcrop is about two to three miles in breadth; their southern outcrop varies very considerably, its breadth from Dartmoor northward through Okehampton being about five miles, whilst on the east of Dartmoor it is about fifteen miles, and about the same on the west of Dartmoor through Lydford."

The general succession given by Mr. Ussher of these Lower Culms, is as follows:

"Dark grey shales, with grit beds, seldom thick, and generally even, slaty, and splintery shales, (type, St. David's Hill, Exeter).

"Even-bedded cherty shales and grits (of Coddon Hill type).

"Limestones and dark grey shales."

These limestones, "from their local development, and very partial occurrence, both in the northern and southern areas," Mr. Ussher regards "as lenticular masses in the shales and grits."

From these data, the Okehampton Culm-measures are not only to be regarded as belonging to the lower group of the series, but as falling into place in the lowest division of that group—the immediate successors in time, as we have them, of the Upper Devonians, which, however, they may or may not, at this particular point, overlie. Evidence on that head is wholly wanting; and I can only express an analogical belief in the affirmative view of the proposition.

These Culm-measures are, in my view, undoubtedly the oldest rocks in the Okehampton district.

An important paper was read on the 5th June last, before the Geological Society, by Dr. Hinde, F.G.S., and Mr. Howard Fox, F.G.S., which is very suggestive in regard to some, at least, of the Carboniferous rocks of this locality. They identify what have been generally known as the Coddon Hill Beds (though not including in the series all the beds referred to it by others) as radiolarian beds, "a series of organic siliceous rocks—some of a very hard, cherty character, others flaky, and yet others of soft incoherent shales." Beds superficially like grits have been found to be radiolarian. These Coddon Hill Beds occur along a comparatively narrow belt of country, a short distance within

[1] See the "Culm-measures of Devonshire," in the *Geological Magazine* for January, 1887.

the northern and southern boundaries between the Carboniferous and Devonian systems. Starting with the northern exposures, they are developed in various localities from the neighbourhood of Barnstaple, past Dulverton, to Ashbrittle in West Somerset. On the south the beds are traceable from Boscastle to the neighbourhood of Tavistock, and on the east side of the Dartmoor granite they are found near Chudleigh and Bovey Tracey. They extend also from Barnstaple to Fremington.

Forms belonging to twenty-three genera of radiolaria have been recognized, included in the orders *Beloidea, Sphæroidea, Prunoidea, Discoidea,* and *Cyrtoidea*; in addition a scanty but significant fauna (twenty-five species) of corals, trilobites, brachiopods, and cephalopods is present in some thin shaly beds near Barnstaple. Nearly all the forms are diminutive.

These fossils are held to tend to confirm the view that the Lower Culm-measures are the deep-water equivalents of the Carboniferous limestone in other parts of the British Isles. There is good work to be done by any local geologist in tracing these radiolarian beds in this area.

Touching the age of the Dartmoor granite, perhaps I need hardly argue that it is more recent than the Carboniferous series through which, so far as Okehampton is concerned, it rises. It is self-evident that a disturbed rock must be older than the disturbing cause; and, as a matter of fact, this was thoroughly well recognised, some fifty years ago, by Sir Henry de la Beche, who says—

"The intrusion of the Dartmoor mass was certainly after the deposit of the carbonaceous series of North Devon, be the age of that series what it may: it thrusts the southern portion of this series northwards to Okehampton, cuts off the ends of trappean bands and of associated beds of grit and shale near Christow and Bridford, and sends veins into it in the valley of the Dart."[2]

The limit on the other side is equally well marked by the finding of Dartmoor fragments, identified as such by myself as the result of systematic inquiry, in the red-rock breccias —once deemed Triassic, now generally accepted as Permian— on the coast from Teignmouth eastwards. The bricks must be older than the house.

The age of the "greenstones" traversing the Carboniferous rocks can be approximated in much the same way. They are later than these rocks, because they are intrusive in

[2] *Rep. Corn. Dev. and W. Som.* 165.

them; but they are older than the granite, because it metamorphoses them. This cannot indeed be seen, as a matter of direct contact, in the vicinity of Okehampton; but the two form junctions near Tavistock, and there the evidence is clear. Nor is there any reason to doubt that the intrusive greenstones of the one area belong to the same series as those of the other. The great distinction recognised between the two localities, in the matter of igneous activity, is that in and about Tavistock and Brent Tor, we get interbedded, and therefore contemporaneous, lavas, ashes, and tuffs, as well as the intrusive dykes, in large variety. Lieut.-Gen. M'Mahon has shown, however, that this distinction is not so complete as it once seemed to be. But of that more anon.

Another noteworthy feature of difference, as connected with the granite of the Okehampton area, is the almost entire absence of the dykes of felsitic rock known as elvans. These are a later phase of the granitic outburst, for they frequently traverse not merely the bordering rocks, but the granite itself. They are quite common on the northern side of the Moor, among the Devonian rocks, and their significant scarcity among the Carboniferous on the northern, points to the more urgent character of the deeper-seated activities on the south, to which I elsewhere allude. On the other hand, the granulite of Meldon is a phase of eruptive granitic material unknown in mass elsewhere in Devon.

The last series of great earth-changes affecting the district was the formation of the mineral lodes—the result, not of one operation, but of a series. What De la Beche had to say thereon can hardly be bettered.[3]

"The lodes upon Dartmoor approximate considerably to east and west courses, and round its borders on the north, east, and south, where mines have been worked, the same directions in the lodes would generally appear. The chief exceptions seem some tin lodes on both sides of Longstone Hill, near Okehampton, which would appear to take courses about W. 30° S., and E. 30° N. Such short parts of these lodes were, however, worked when we visited them, that these exceptions may merely have been some of the minor irregularities common to all lodes. [This, however, is not so.] Some eastern and western lodes between Belstone and Okehampton [Halstock] are cut by a N. and S. cross-course; and a cross-course, in which lead and silver ores have been found, traverses the Okement, near the Castle."

To this it need only be added that the Belstone Consols and South Tawton lodes run east and west.

[3] *Rep. Corn. Dev. and W. Som.* 302.

The minerals enumerated by Mr. Townshend M. Hall, F.G.S., in his *Mineralogist's Directory*, as occurring at and near Okehampton, independently of the mines, are:—Amethyst, andalusite, axinite, chiastolite, hornblende, jasper, opal, rock crystal, and tourmaline. The granite, I need hardly explain, is essentially a mixture of quartz, felspars, and micas—the second chiefly orthoclase, and the third chiefly muscovite, but with biotite largely represented. Calcite occurs with the limestone and elsewhere. The mines add considerably to this total—Argentite, cassiterite, chalcopyrite, chalcocite, bismuthinite, galena, garnets, hematite, limonite, marcasite, malachite, mispickel, pyrrhotite, semi-opal, pyrites. The garnets include both colophonite and grossularia; and the granulite yields fine crystals of pink (rubellite) and green tourmaline. The microscope also shows the existence as constituents of various rocks among other minerals of apatite, apophyllite, indicolite, ilmenite, magnetite, olivine, sphene, and topaz (in the granulite), while beryl is also said to occur.

Among the mines of the locality—none now working—are Belstone Consols, Copper Hill, East Wheal Maria, Forest Hill, Fursdon, Holstock, Ivey Tor, Meldon, Okehampton, Sticklepath, South-Zeal.

Before passing on to a brief review of the leading features of the petrology of the district, it may be well to call attention to the importance of a careful examination of the surface deposits of our moorland valleys, especially at points where, as near the fork of the ravine above Meldon viaduct, we find large accumulations of more or less water-worn stones, which occasionally, as here, suggest the former existence of moraines. Whether ice had any share in the formation of such deposits or not, it will be found that some, at least, of their contents consist of rocks which cannot now be traced *in situ*, and which, therefore, must represent portions of the long-denuded superincumbent mass, the removal of which has produced our present Dartmoor. A careful study of these deposits would be of the highest value in supplying material for a more than hypothetical reconstruction.

The Carboniferous rocks of the district have been touched upon in sufficient detail already, and it is hardly necessary—with the abundance of interesting material elsewhere—to add more concerning them, than to say that they exhibit every mark of great and repeated disturbance. Some very interesting folds and contortions of the slate beds may be

readily seen, as in the quarry near the Castle, and on the right of the road to Brightley.

These slates, as we have already noted, are traversed by bands of igneous rocks, which bear a very definite relation in their course to the contour of the granite *massif*. These rocks are divisible into two great series — one volcanic, formed contemporaneously with the slates and grits; and the other, intrusive, which has broken through them at a later date—the familiarly styled "greenstones." It is these intrusive rocks that yield the curiously fretted honeycombed and seamed masses which it is the wise local custom of the Okehampton folk to employ for the rustic coping of their garden-walls. They vary considerably in texture, but are mostly dark-grey in colour. Some are very fine and even-grained, the only mineral distinguishable by the naked eye being abundant minute specks of pyrites. Others again are coarse; while some show what is called "lustre mottling" very characteristically, and indicate clearly the presence in quantity of pyroxenic constituents. They belong unmistakably to the same group as the so-called "gabbros" of White Tor, Cocks Tor, Smear Down, and other localities near Tavistock, generally classed in the present day as epidiorites.[4]

Lieut.-General M'Mahon, F.G.S., in a paper on "Various Rocks of Igneous Origin on the Western Flank of Dartmoor," published in the *Journal* of the Geological Society for August, 1894, deals largely with the "greenstones" shown on the Geological Survey map as outcropping on Sourton Tors, South Down, and at Meldon. He notes the presence of felsite and trachyte at Sourton Tors; and there and at Meldon "the occurrence of some interesting tuffs, the matrix of which has been converted by contact-metamorphism into what closely resembles the base of a rhyolite, and which, in extreme cases, exhibits fluxion structure, or a structure indistinguishable from it." He adds, that so complete was the resemblance of the matrix to the base of an igneous rock that he was "for long doubtful whether the rock was not a lava full of volcanic *ejectamenta*." The "extreme abundance of the fragments — pieces of six or seven kinds of lava being sometimes visible in a single slice,"—with the extended area over which the deposits were found, convinced him, however, that they were really metamorphosed tuffs.

[4] *Vide* "The Igneous and altered rocks of S. W. Devon"; and "Geological Notes on the South Western line between Lydford and Devonport." *Trans. Dev. Assoc.* xix., xxi.

As to the epidiorites and their relations to the volcanic rocks, General M'Mahon notes that the former are only altered dolerites. He does not think that they need be regarded as of very deep-seated origin; nor did he find any actual evidence in the area embraced in this paper that the epidiorites are intrusive. My own impression is most decidedly that they are; but, as he points out, this need not necessarily divorce them from the volcanic eruptions of the period; and he remarks generally—"the epidiorites of the west of Dartmoor may have been comparatively deep-seated offshoots of the volcanic forces that seem to have opened up numerous volcanoes in this region during the Carboniferous age."

This, of course, is in absolute practical accord with the suggestion made by me several years previously, that these more basic rocks are the result of the earlier stages of the igneous activities that initiated Dartmoor.

The volcanic tuffs and associated rocks of Meldon, which General M'Mahon was the first to investigate and describe, may be found under and near the viaduct, and on the flank of Blackdown, both points being marked on the Survey map as "greenstone." Specimens from the outcrop near the viaduct simulate the appearance generally of lavas, but are really composed "of fragments of trachytic, felsitic, and other lavas of somewhat more basic character, cemented together in what now looks like the base of a felsite"—this base, moreover, containing large quantities of apophyllite. In some cases alteration has proceeded very far to the simulation of rhyolitic characters, the profuse formation of mica in the matrix, and a general appearance of fluxion structure. These are, as General M'Mahon says, very beautiful examples of the effects of powerful contact-metamorphism. The structure of these pyroclastic rocks varies considerably, and "near the railway viaduct some of the agglomerate beds contain quite large blocks of slaty and felspathic rocks."

The Blackdown tuffs, as described, are chiefly made up of fragments of trachyte and altered sedimentary rocks in a very fine-grained micro-crystalline-granular matrix, originally a fine dust, all the slices containing a profusion of mica.

It may seem rather venturesome on my part to question the conclusions of General M'Mahon; but I am bound to say that while I accept the rock at Meldon viaduct as

a tuff, and do not doubt that there are tufaceous outcrops elsewhere in the locality, I think there is equally good evidence of the occurrence of a lava full of volcanic *ejectamenta*, and that if in this particular he and I are dealing with the same exposure, I am clearly of opinion that his original idea was the correct one.

I have nothing to add to his description of the viaduct tuff, since it agrees exactly with my own observation; still it may be worthy of note that on comparing my section with those of several other Devonian tuffs in my collection, I find that it most closely resembles—though at a considerable distance—the highly-altered tuffs and volcanic grit which I obtained several years since from the detritus at Cattedown;[5] and which I have been compelled to connect with some stage of the long-vanished volcanic superstructure of the moorland. Hence these tuffs, which lie higher up in the flanking series of the Dartmoor borders than any others, certainly seem to lend their countenance to the hypothesis.

But I am unable to regard some of these interbedded igneous rocks as other than lavas, charged with volcanic fragments. Macroscopically, some specimens are not only quite rhyolitic in general aspect, but have in parts almost the texture of pitchstone; and although I am only too well aware of the danger of trusting to the naked eye in these matters, still the broader view and the field behaviour do count for something in the interpretation of cases of doubt. That the tuff and the lava are of the same period is clear; but under the microscope their characters seem to me distinctive enough; and all that appears needful to account for these allied phenomena is that at intervals during the formation of the tuffs there were occasional surface-lava flows, which took up such tufaceous material as they found in their way. And since the volcanic agencies of which these rocks are a vestige were active during the earlier part of the Carboniferous era, they may very well have been practically in continuity with those with which we are familiar in the Devonians.

One of the slides that I have examined consists in the main of a doleritic lava, plentifully bestrewn with lath-crystals of plagioclase, and enclosing derived crystals of felspar and quartz, some broken, a number of fragments of doleritic rock of various types, some marked by hornblende, and a few granules of olivine. So well rounded are certain of the smaller inclusions that they at first suggest an amygdaloidal

[5] *Trans. Devonshire Association*, xxi. 77.

character, but others of the same kind are as distinctly irregular and broken, and on further examination it seems clear that these regular outlines are due to attrition of some kind or other. There is a strong resemblance in many of these fragments to the proterobases, epidiorites, and amphibolites of White Tor, Wapsworthy, and Cocks Tor—an important point as bearing upon the age of these interesting rocks. The containing rock has been subjected to great pressure, and there is a very noteworthy development of secondary mica traversing alike matrix and inclusions.

Of course it is quite possible, when an agglomeratic rock consists at times of such large fragments as at Meldon, that a slide may be cut from an inclusion, rather than from the mass, so that we could not depend upon microscopic evidence alone. If so, however, we merely shift the origin one term back, and make this old lava-flow with its inclusions one of the parents of these Meldon agglomerates (hence doubly clastic in their origin)—the father instead of the child. The point is one of no little interest in working out the local geological record.

General M'Mahon also notes the occurrence of a mica diorite on South Down—a "compact igneous rock of purple-grey colour, which has the appearance in the field of being a contemporaneous lava. Under the microscope it is seen to consist of a ground-mass formed of a meshwork of small plagioclase prisms, with a red mica next in abundance. Hornblende is not prominent, but sphene and apatite are abundant, and there is a fair amount of magnetite or ilmenite." I agree with General M'Mahon that this rock is probably contemporaneous. It is well marked and distinctive in character.

The noted Meldon granulite first finds record in the pages of De la Beche, as "white granite." It is essentially a mixture of quartz and felspar, in mass; but fifty years since distinctions were comparatively few.[6] He says:—

"For appearance few granites can exceed the white variety found up the valley of the West Okement, near Okehampton. It occurs as an isolated patch [patches] amid altered carbonaceous rocks, greenstones, and limestones, on the skirts of Dartmoor. It is a beautiful material, and may be obtained in large quantities, but we believe it has not hitherto been employed, except by the Hon. Newton Fellowes, for a chimney-piece, at his seat at Eggesford, near Chulmleigh, in North Devon. At a short distance this granite has the appearance of statuary marble."

[6] *Rep. Corn. Dev. and W. Som.* 501.

The Meldon granulite is likewise referred to at some length by General M'Mahon, and as an unquestionable instance of intrusive character: "It not only cuts obliquely through the bedding of the slates . . . but near its margin it sends numerous veins into the slates, and infolds large slabs of them in its arms. The slates in contact with the dyke are highly altered." That is, they are baked, and the intruding rock generally behaves itself just like an ordinary elvan dyke, only that the contact changes are greater.

Mr. J. H. Teall, F.R.S., who describes this rock in his *British Petrography*, was the first to observe that it contains a considerable quantity of topaz, in addition to quartz, felspar (largely plagioclase), and white mica. Topaz is commonly developed in our griesens. He noted also the beautiful green tourmaline, but does not seem to have observed the pink variety of that mineral, or rubellite.

Gen. M'Mahon notes further, as a striking feature in the Meldon granulite, "that the leaves of mica and the prisms of felspar are sometimes *bent*, and in some cases broken; and that the ground mass consists of a mosaic of quartz and felspar," which is sometimes regarded as a proof of dynamo-metamorphism. He believes, however, these features to be "sufficiently accounted for, by supposing that they were produced either when the granite was forced through the jaws of a fissure in the slates, or by strains when the dyke was solidifying."

That seems to me to meet all the necessities of the case, for the chief effects of alteration here are of a contact character. One of the most interesting examples is that of a slate baked into a grey semi-porcellanous mass, in which spots of more highly vitrified material present themselves—no doubt the precursors, had the process been carried further, of definite crystallization.

And this leads me to consider the metamorphism of the district generally.

In some passing notes on the results of contact-metamorphism on the west side of Dartmoor, read at Barnstaple in 1890, I said I should be inclined to generalise by the statement that the principal change produced in the schistose rocks of the Okement and Lyd valleys was one of texture, by way of induration and banding. In fact, banding is one of the most common characteristics of the altered slates of this region. Next the granite, the Carboniferous shale is frequently converted into a massive black

rock with semi-conchoidal fracture—really a form of hornfels —while within a few feet we may have the lamination fairly preserved in the form of coloured bands.

One of the best spots to study these changes is at Meldon, in connection, not only with the granulite, but the granite. The immediate contact rock is of this massive hornfels type, graduating into a dark- and light-grey banded compact rock of cherty aspect—in short, a schistose hornfels.

At Meldon, too, may be studied the effects of contact-metamorphism on the grit bands interstratified with the slates. These, which in the upper valley of the Lyd at times, become essentially quartzites, may here be found compacted to the frequent obliteration of all traces of original bedding. There is also a tendency to the aggregation of their micaceous constituents, resulting in the most extreme type of change in the production of banded tourmaline quartzites, closely akin to the Continental tourmaline hornfels. The microscopic examination of one such Okehampton example shows that the rock now consists essentially of granular crystalline aggregates of quartz and tourmaline. Here there has been a double change—first the aggregation of the mica, and then the transformation of the mica into the tourmaline—the original rock having been evidently a coarse-grained micaceous grit. The tourmaline is mainly more or less crystalline, in bands, commonly brown in colour in thin section, less frequently the elsewhere more characteristic blue.

The changes, however, in the slates of the altered zone at Okehampton are, with one notable exception, rather in the direction of induration, than the development of new minerals. We find nothing approaching the production of mica schist, still less of pseudo-gneiss, of plentiful andalusite and chiastolite, (with the exception for the latter of one locality) as in the well-marked region from Meavy round to Cornwood and Ivybridge. At first, the slate is merely made more compact and occasionally gritty, without material gain in hardness; then it is porcellanized. Finally, it becomes the massive cherty or flinty rock already described, with well-marked conchoidal fracture, and oftentimes a notable development of pyrites in the mass, and specially on the joint faces, occasionally accompanied by chalcopyrite. The most curious form of metamorphism that I have noticed in this connection, is in a massive, somewhat rough-textured, black rock, evenly dotted with small, dull-shining patches, which looked much like augite. Slicing, however, proved that I was

dealing with a gritty slate highly charged with carbon, in which the schistose texture had been obliterated by pressure, save on the margin next the joint face; and that the polished mottling had been produced by shearing action, in which the varying hardness of the rock had caused its particles to undergo unequal pressure as they slid over each other. Quartz grains, more or less crushed and broken, were thinly scattered throughout.

The most notable feature of the contact-metamorphism of the district is the very remarkable development of garnets. Now garnets occur elsewhere in the contact zone of Dartmoor as a product of metamorphism; but this particlar phase is nowhere so strongly marked as at Belstone Consols and Meldon. The lode at Belstone Consols is, indeed, essentially a course of garnet rock—the common brown garnet, which occurs both massive and crystallized. In like manner, the spoil-heaps of the abandoned mine at Meldon yield the green garnet or grossularia, which, so far as I am aware, is found nowhere else in the West of England. There seems a greater local proneness towards the production of garnet as a result of contact-metamorphism, in Carboniferous than in Devonian rocks; while it has been found elsewhere that the production of garnets by metamorphism is very commonly associated with limestones. Hence the significance, in this connection, of the Carboniferous limestone at Meldon.

Both these points—at Belstone Consols and at Meldon—are within half-a-mile of the granite; and the former was long since selected by the late Sir Warington Smyth, F.R.S., as one of the most typical examples of contact-metamorphism on this side of the Moor. I found a kind of garnet schist, some years since, at Peek Hill, on the Meavy. More recently I have noted veins of granular garnet in a much altered-Carboniferous slate, now massive and of a flinty texture, on the flank of Ugborough Beacon; and garnet (including the form known as melanite) occurs also in connection with "greenstone" at South Brent. Nowhere in Devon, however, do we find this mineral so abundant as in the Okehampton area.

The garnet rock at Belstone is generally more or less crystalline, and contains numerous well-formed crystals, so far as the exterior faces are concerned. It also occurs in a massive form with smooth conchoidal fracture; and again at times puts on an appearance resembling a rough-textured chert, which is frequently associated with friable aggregates

of imperfectly-cohering small irregular crystals. It is chiefly of the common type, and of a brownish hue, but passes into grey-green in places, and thence casually into grossularia. There are a few reddish patches, which indicate a tendency to vary towards the red or almandine variety, but it is nothing more than a tendency. I have also found a few translucent crystals of a fairly pronounced oil-yellow, which may be regarded as colophonite. All that have been noted, therefore, belong to the iron- or lime-alumina, or lime-iron-alumina groups.

From the occurrence of a yellowish-brown rough-textured rock in which garnets are imperfectly and casually developed, and which also shows the well-preserved forms of what were originally crystals of hornblende, there seems good reason to believe that this Belstone garnet rock is the product of contact-alteration on an igneous band of trachytic character, which from other indications was well charged with iron.

The altered sedimentary rocks associated with it are either baked and semi-porcellanized, or else compacted, retaining traces of an original schistose structure—clearly they have not come within the operation of the metamorphic force so fully as the parent of the garnet vein. Copper ore occurs with the garnet rock—chiefly the yellow chalcopyrite, but occasionally the grey chalcocite—pseudomorphous after the garnet crystals. It seems most probable, therefore, that the metamorphosis of the garnet rock and its mineralization were fairly contemporaneous, and that the action on the adjacent sedimentaries was rather of a secondary character.

The fact that the contact-metamorphism of the Okehampton district, while differing in character, is not so pronounced as on the southern borders of the Moor—nor, indeed, as in the valley of the Lyd—implies, of course, that the contact forces—mainly heat and pressure—must have acted with greater vigour in one area than in the other. There are points near Shaugh and Meavy where the slates in immediate contact with the granite have been fused into felstone, to the almost entire extinction of their original character.

Such a contrast, however, is precisely what we might have expected, *à priori*. The Devonian rocks underlying the Carboniferous, the erupting granite in contact with them would be nearer the original source of heat, while the dynamic action would be much greater in consequence of the higher resistile force at such an increased depth. At

Okehampton the molten mass would be much nearer the surface, the rocks underlying the Culm series having been already traversed by it. Hence the lessened influence, both of heat and pressure.

All this has a very important bearing upon the hypothesis which I put forward in 1888, and since then have seen no reason to modify or abandon, only to hold the more firmly: the hypothesis that our modern Dartmoor is but the basal wreck—the mere stump—of a volcano which once towered some 18,000 feet into the air; and which has been gradually wasted and denuded by the forces of Nature, until the scattered vestiges of its higher regions are to be found only in the breccias of the red-rock conglomerates of the east and south-east of the county; or perchance here and there in some ancient detritus, as at Cattedown; or even casually in the valleys of the Moor itself.