

lie the islands of Herm and Jethou. The rock of Herm has always been considered white granite. That of Jethou has a marked structure in vertical planes, but otherwise closely resembles this. These vertical planes run north and south, and therefore parallel to the most frequent strike of the foliation and folding in Guernsey. Shall we not here also find a case of a granite in which structure has been developed? Writers have talked of gneiss metamorphosed into granite. May not the process in some cases have been the very reverse, and some gneisses be mere alterations of granite? Most certainly, however, this island of Guernsey must not for the future be quoted as affording undoubted instances of syenites metamorphosed out of sedimentary rocks.

I am fully conscious of the deficiencies of this paper. Additional study would have removed some, but would certainly have suggested many more problems in their turn demanding solution. I have thought it best to publish the results already attained, and not to delay indefinitely. Besides, work such as would be necessary for the complete elucidation of the geology of Guernsey can hardly be done except by a resident; and perhaps this paper may be the means of inducing some resident to take up this most interesting inquiry.

APPENDIX.

NOTES *on the* MICROSCOPIC STRUCTURE *of some* ROCKS *from* GUERNSEY.

By Prof. T. G. BONNEY, D.Sc., F.R.S., Pres. G.S.

GNEISS.

IN describing the specimens which Mr. Hill has selected and forwarded to me for microscopic examination, it will be convenient to group them lithologically rather than geographically. We will take first a series illustrating the gneiss, which occupies three fourths of the whole area of the island. These slides indicate that this region is occupied by a series of coarsely crystalline, rather granitoid gneisses, which have a general lithological resemblance to the more typical varieties of the Hebridean group of Scotland. It cannot, I think, be doubted that we have exposed here in the Channel Islands a fragment of the foundation stones of the earth, of rocks roughly corresponding in age with those that on the continent of America have been named Laurentian. A lengthy description is needless, as so many accounts have now been published of rocks of this character; enough to say of these, as a whole, that while indubitably not igneous, they do not generally exhibit a very marked foliation. Quartz and felspar are always present, and the third predominant mineral is usually a brown mica; the quartz, as seems to be commonly the case in these old gneissic rocks, is rather full of enclosures, many of which are certainly cavities. These vary much in form, some being very irregular, others rounded in outline.

Bubbles are not seldom present, but a good many cavities appear to be empty. The felspar is usually somewhat decomposed and occasionally so much so as to make it difficult to conjecture the species. Four specimens contain rather abundantly very characteristic microcline; there is always a considerable quantity of a closely twinned plagioclase, which generally, so far as one can infer from its extinction-angles, appears to be oligoclase; but it is very probable that albite is also present. Orthoclase is no doubt present, but the characteristic Carlsbad twinning does not appear to be frequent.

1 (*Fermain Bay*).—Contains a considerable quantity of microcline. The third mineral in this specimen is a brown mica, generally in aggregates of rather small crystals, though now and then larger occur, one being about 0·12 inch long. Occasionally a little of this is replaced by the pale green mineral which frequently appears as an alteration-product of the magnesian micas, but most of it is in excellent preservation. The slide contains a considerable number of crystals of apatite, generally associated with the mica. Near to the largest mica crystal is a group of three (besides some smaller ones) cut almost transversely to the principal axis, the largest of which is rather more than 0·01 inch in diameter. The rock appears to have been a little crushed and recemented.

2 (*Bec du Nez*).—Consists chiefly of quartz and felspar (rather decomposed), with which are small films and clusters of a green mineral, associated with a little opacite and ferrite, and a few scales of a white mica, giving bright colours with polarized light. This is probably a hydrous soda or potash mica, but the green mineral is probably a hydrous magnesian mineral replacing biotite.

42 (*Petit Bot Bay*).—The felspar is rather decomposed, but a closely twinned plagioclase evidently predominates. There are aggregated patches of a scaly green mineral of the chlorite group, strongly dichroic and probably uniaxial, associated with apatite, opacite, and very little white mica, as in the last.

13 (*Petit Bot*; pink band, possibly a dyke (E. H.)).—Felspar rather decomposed, but plagioclase as above, with a little microcline and orthoclase recognizable. Some grains of iron peroxide, hæmatite, and perhaps a little magnetite; except one or two very minute scales of a brown mica, no other mineral present. The figure in Fouqué and Levy (plate vii. 2), granulite from Grape Creek, Colorado, will give an excellent idea of this rock. Many would unhesitatingly claim this rock as igneous, in which case it would best be called a pegmatite, but I feel doubtful on the point. It may be a vein granite, but I should not be surprised if field evidence showed it to be a metamorphic rock (*gneiss granulitique*). The difficulty has been enhanced by the rock having been crushed *in situ*.

11 (*Lerée*).—Rather akin to 42, but the replacement product of the mica is less abundant and characteristic. One crystal, about 0·07 inch long, resembling a mica in form, is almost wholly taken up by opacite. The rock appears to have been crushed.

9 (*Vazon Bay, Southend*).—Rather poor in quartz, rich in plagioclase. A fair amount of very characteristic hornblende, as well as

brown mica, the latter mostly in aggregated small scales. Apatite not conspicuous.

8 (*Vazon Bay, middle*).—Felspar, rather decomposed microcline and plagioclase recognizable, a fair amount of aggregated chlorite or some similar replacement-product of brown mica, with some scales, rather larger than usual, of a hydrous white mica, and a few micro-liths of apatite.

15 (*Castle Cornet*).—A considerable quantity of microcline among the felspar, several clusters of altered biotite, with a few scales of white mica and some granules of hæmatite and opacite.

48 (*Brickfield near Les Talbotts Road*).—A gneiss with fairly marked foliation, consisting of quartz, felspar, and a dark brown mica. The quartz is rather clear, and occurs generally in rather small clotted granules; the felspar is in part orthoclase, but there is a considerable quantity of closely twinned plagioclase, extinguishing at small angles with the vibration-planes of the nicol, and probably albite or oligoclase. The mica occurs in small plates, generally aggregated; there is some opacite, and a little apatite.

GRANITE.

24, 26 (*Around Lancreesse Bay, N.W. part of island*).—These specimens only differ in that one is rather more coarsely crystalline than the other. They consist of quartz, felspar, and black mica. The quartz contains a fair number of cavities, in many of which are small bubbles, often moving, but some are empty; others are rather dark, as if stained, and there are occasionally microlithic enclosures. Felspar is the most abundant mineral, usually in well-defined prismatic crystals, rather decomposed. Plagioclase predominates, frequently in closely twinned crystals, and sometimes with external zonal banding. By measurement of the extinction-angles I infer that much of it is oligoclase. I think, however, that some may be albite, and occasionally recognize orthoclase. The mica, not very abundant, is rather dark brown, containing evidently a considerable amount of iron. It is occasionally replaced by the usual green mineral. There is also a very little pyrite, apatite, &c. (38) does not materially differ, except that it has a little more apatite and a crystal of sphene. (27) contains much the same minerals, though it is rich in quartz; but it differs in structure, having a ground-mass which is almost microcrystalline, in which larger crystals of quartz and felspar, rather irregular in outline, are thickly scattered; it is, in fact, an example of the granite porphyry of some authors. The cavities in the quartz are smaller, and bubbles seem to be less frequent. (5) A granite of similar type to those named above, but seems to be a little crushed; fluid-cavities abundant. (25) Part of the slide exhibits a similar granite, the rest a rock consisting of hornblende, felspar, and a little quartz. At first sight one would suppose it an intrusive junction; but closer examination leads me to think it more probably a node of some kind. There appears to be a transition, though very rapid, rather than a break between the two rocks. There is no very marked

difference between their felspars, and the cavities in the quartzes, as far as they can be compared, appear similar.

28 (*Cobo*).—This rock is a little abnormal in character, but I think I am right in classifying it as a granite. The mineral character does not materially differ from that above described. The felspar is a good deal decomposed, but a plagioclastic species is abundant; sometimes one of the latter is enclosed in a larger crystal of (?) orthoclase.

20 (*Dyke, Grande Maison Road Quarry*).—This rock consists of quartz and felspar intercrystallized, exhibiting, in parts, a micrographic structure, with occasional felspar grains rather larger than the rest. The outlines of these are irregular, and they appear to be frequently surrounded by an area exhibiting the micrographic structure. There is also a little brown mica, an iron peroxide, and possibly a small quantity of tourmaline. A considerable number of very small cavities; most of these seem to be empty, but in others I detected minute moving bubbles. The rock is a vein granite.

4 (*Between Forts Doyle and Le Marchant*).—This rock consists of quartz, felspar (orthoclase, plagioclase?, and a very little microcline), together with a little brown mica and iron-oxide. The rock has evidently been much crushed, some of its constituents, both of the quartz and of the mica, being of secondary formation. It is a little difficult to give the rock a name, as in more than one respect it is slightly abnormal; but perhaps it would be best to call it a granite*.

16 (*Dyke, Casile Cornet*).—It consists of quartz, felspar (decomposed, but apparently in great part orthoclase), and a little of a greenish mineral, probably replacing a black mica:—a vein-granite.

21, 22 (*Dyke, Delancy Quarry; thin seam, probably dyke, Grande Maison Road Quarry*).—These rocks have a general similarity, but the latter is the coarser and rather more definitely crystalline. The minerals are quartz, felspar, mainly orthoclase and microcline, and a very little brown mica and iron-peroxide. The rock from Grape Creek, already referred to, gives a fair idea of the structure, except that the felspars in the Guernsey rock are rather more rectilinear in outline. With some hesitation I refer it to vein-granite.

46 (*Castle Cornet*).—Is a quartz-felsite. The ground-mass is crypto-crystalline, in places imperfectly spherulitic, and in it are scattered numerous small scales of a filmy olive-brown mineral, probably a mica. Of the first order of consolidation are quartz, rather clear, showing crystalline angles, felspar, orthoclase with some plagioclase, and a little brown mica. The rock, though rather more micaceous than they, reminds me of the oldest quartz-felsites in Britain.

HORNBLENDIC ROCKS (DIORITES &c.).

3 (*Near Vale Castle*).—This rock consists of a plagioclastic felspar, often rather decomposed, with hornblende, a rather fibrous greenish

* [I have convinced myself that this is a form of the Lancrese granite.—E. H.]

mineral resembling an alteration-product after biotite, grains of iron-oxide, and a fair amount of quartz. The felspar agrees best with oligoclase or albite. The rock has evidently been much crushed and recemented, and much of the quartz has the aspect of a secondary constituent. It is a quartz-diorite.

23 (*Dyke, near Fort Doyle*).—In all probability this rock has once been a basalt, but the felspar has been replaced by secondary microliths of more than one kind, until the original structure is practically obliterated; and the other constituent is a green, rather filmy, irregularly crystallized mineral, which is, in part at least, hornblende. There are some scattered granules of iron-oxide.

37 (*Between Forts Doyle and Le Marchant*), and 39 (*Houmets, near Cobo, $\frac{3}{4}$ mile east of Cobo Bay*).—It is a little difficult to say whether this rock should be called a quartz-syenite or a quartz-diorite, for the felspar is so much altered and replaced by secondary microliths. From the small portions which remain unaltered I should infer that plagioclase predominated, and class the rock with the latter. There is a considerable quantity of hornblende and biotite, both rather altered. The quartz, of which there is a moderate amount, contains numerous cavities, in which are generally small moving bubbles.

43 (*Portinfer*).—Has a general resemblance to the above, but is perhaps rather more distinct; a quartz-diorite.

30 (*Fermain Bay*).—Also a quartz-diorite with mica; some apatite is present, and probably a little sphene.

14 (*Castle Cornet, at boundary of Gneiss*).—A rather coarsely crystalline rock, consisting mainly of green hornblende, a very decomposed felspar, probably plagioclastic, with some altered biotite. There is also a fair quantity of apatite and sphene, with, of course, some iron-peroxide. The rock is a diorite.

7 (*Near Fort Le Marchant*).—The hornblende and felspar are yet more highly altered, but the rock is probably a true diorite; there is a fair amount of a white mica, probably hydrous.

41 (*Bon Repos Bay*).—Consists mainly of well-crystallized hornblende, some brown mica, iron-peroxide, a plagioclastic felspar (not abundant), probably oligoclase, and a little apatite. The slide is not a very good one for examination; but field-evidence, I am told, proves it to be a true diorite.

6 (*South of Fort Doyle*).—Consists mainly of hornblende, with probably a little altered biotite and some decomposed felspar. Some, at least, of the hornblende has the look of a secondary product. At present the rock may be regarded as an abnormal diorite or a hornblende diabase; but I should think that very probably it was once a gabbro, rich in the pyroxenic constituent.

35 (*Fort Doyle*).—A diorite, with a little free quartz and apatite, somewhat crushed and decomposed.

36 (*Fort Doyle*).—The constituent minerals are quartz, felspar, very much decomposed, and a filmy, green, chloritic or micaceous mineral. I cannot give the rock a name, for it appears to me that the slide has been cut from a specimen which has been exposed to great local crushing, and subsequently recemented. (See 35 and 45 E. H.)

31 (*Quarry west of St. John's Church*).—A diorite, the felspar decomposed, the hornblende as in 6, looking in some cases like a secondary product, a little apatite, ilmenite, and (?) sphene.

HORNBLENDIC ROCKS (GABBRO-LIKE).

The group of hornblendic rocks on the eastern side of the island, which are enclosed by the last-described dioritic group, agree with it in having hornblende as an abundant mineral, but present some marked differences.

17 (*Hougue à la Perre*).—Has, macroscopically, a considerable resemblance to a gabbro; microscopically, it consists of fairly well-preserved crystals of labrador felspar and hornblende, with some grains of iron-peroxide and a pyroxenic mineral presently to be described. The last two appear to have crystallized first. The felspar seems then to have commenced consolidation; for some small crystals of it are enveloped in the hornblende, which mineral also appears to have adapted itself to the outlines of the larger crystals. Thus the larger hornblende crystals are interrupted by small crystalline grains of felspar, as augite not seldom is by olivine; a few flakes of biotite are also included in the hornblende, which is very fresh-looking, strongly dichroic, with a characteristic cleavage. The pyroxenic mineral is difficult to identify with certainty; it is sometimes traversed by cracks containing a serpentinous mineral, and the smaller grains are almost wholly replaced by this. The cleavage and general appearance, as well as the optical properties, correspond fairly well with augite; so that we may, I think, refer it to this mineral. The rock must be classed with the labrador diorites, and is evidently closely related to the gabbros.

32 (*North end of Bellegreve Bay*).—Is a rock of the same family, but consisting only of labrador felspar (rather decomposed) and hornblende, with a fair amount of iron-oxide and a little apatite. The hornblende contains a considerable quantity of opacite, often belonitic, and arranged along the cleavage-planes; it is sometimes rendered quite opaque.

33 (*Mont Crevelt*).—Is a rock generally similar in character, but the felspar is greatly decomposed, and the hornblende looks rather altered.

19 (*Delancy Quarry*).—Has also a general resemblance, so far as the two dominant minerals are concerned, but it contains a considerable amount of brown mica, and is rather rich in apatite. It also exhibits a slightly banded arrangement of its minerals. The colourless mineral, interbanded with the mica, occurs exactly like the calcite figured by Zirkel (*Micr. Petrogr.* pl. v. fig. 1, cf. pl. ii. 4, iii. 3). It shows colours resembling those of a pyroxenic mineral with the crossed nicols, and appears to extinguish nearly or quite simultaneously with the mica, and with the only plane of cleavage (faintly marked).

34 (*Dyke? Shore, near Mont Crevelt*).—Is a much more minutely crystalline rock, containing micro-porphyrific felspar, in a ground-mass of felspar and hornblende, greatly altered. I should imagine

that this was from a dyke, and that the hornblende was a secondary formation from augite, so that the rock had once been a basalt.

18 (*Dyke Junction, Delancy Quarry*).—Appears to be a junction specimen, a rock somewhat of the latter character cutting one of the former, both being a good deal altered. A vein of chalcadonic quartz cuts the finer rock. It is very possible that the coarse rock was once a gabbro and the other a basalt.

44 (*Quarry south of Baubigny Mill*).—This rock is coarsely crystalline, and consists of felspar, agreeing best with labradorite, hornblende, and a little brown mica, apparently rather altered, a little apatite and magnetite (?); the hornblende appears to have crystallized later than the felspar, and may perhaps have been produced by paramorphic or pseudomorphic action from a pyroxenic constituent.

MICA-TRAP.

The two specimens which may be included under this general designation come from the south-east of the island, one from Moulin Huet on the south, and the other from Bec du Nez on the east coast. The former (12) has a glassy-looking ground-mass of a very pale brown tint, which is thickly studded with crystals of brown mica, many of them not exceeding about 0·001" in diameter, while others are as much as 0·03", the latter including portions of the ground-mass, flakes of an almost opaque iron-mica, and microliths of apatite (?), together with a considerable amount of a mineral presently to be described. The ground-mass shows a rather indistinct trachytic structure, apparently consisting of a mass of elongated felspar microliths. The mineral mentioned above is at present evidently a secondary product. It is colourless, and occurs in prism-like flakes, not unlike one of the white micas which give moderately bright colours and have a silvery look with crossing nicols. Extinction takes place when the longer edges of the flakes are parallel with the vibration-planes of the crossed nicols, and, on the whole, I think that the mineral is probably talc. It occurs partly scattered in the slide, but also aggregated in more or less definite crystalline forms, which are outlined fairly continuously by granules of opacite. Within these it has a tufted habit, and is associated with a little ferrite. Exact parallels may be found in the excellent figures of rocks akin to mica-traps in the well-known work of Fouqué and Levy, or in Professor Barrois's recent volume*, where both augite and hornblende are figured as associated with mica, and these bear a general resemblance to our mineral. I may, however, note that in the former book, plate xxvi. (*Porphyrite andésitique micacée*, &c.) and plate xxvii. (*Porphyre syénitique micacée*, &c.) there is a mineral (replaced by serpentinous products) which in external form much resembles the above. The authors, with a little hesitation, ascribe it to bastite. That in the Moulin-Huet rock we have a magnesian bisilicate there can be little doubt. I should place it in the group for which I proposed the name of kersantite-porphyrte.

The specimen from Bec du Nez (29) has a more definitely crys-

* *Recherches sur les Terrains Anciens des Asturies et de la Galice*, pl. 1 & 2.

talline structure, consisting of elongated crystals (rather microlithic in habit) of oligoclase associated with a very brown mica, and a third mineral much altered and almost opaque; ferrite and opacite are scattered about the slide. This third mineral, more highly magnified, appears to consist of a mixture of minerals, chloritic and ferruginous. It is not impossible a replacement of a pyroxenic mineral. Barrois notices the presence of gedrite in kersantite, a mineral whose chemical composition would be not unlikely to give rise to the appearances here described.

40 (*Rocquaine Castle*).—This rock consists of subangular fragments (generally less than .01" diameter), among which a clear quartz predominates, scattered in a ground-mass, which appears to be composed of quartz, felspar, and a green filmy mineral, possibly a chlorite, but more probably, I think, a variety of hornblende. This, I think, has certainly been formed *in situ*, and the ground-mass generally appears to have undergone some alteration. The rock has the aspect of a slightly altered sedimentary rock.

47 (*Rocquaine Castle*, "pocket" of coarse rock in finer).—In the greater part of the slide it has the appearance of a magnesia-mica gneiss (such as have been already described), which has evidently been considerably crushed, and here and there becomes quite pulverized, assuming an appearance which reminds us of No. 40.

45 (*Fort Doyle*).—A most perplexing rock: nearly half the slide, with a small portion of the exterior of the remainder, appears to be a diorite or a coarse hornblendic gneiss, poor in quartz (consisting mainly of a plagioclastic felspar and hornblende), indicating considerable crushing *in situ*; but between these there is a zone about $\frac{1}{4}$ inch wide presenting a singular resemblance to a schist or schistose rock not highly altered, consisting of minutely granular quartzose and felspathic materials, associated with filmy scales of a greenish micaeous mineral, in which are rarely scattered a few rather larger grains of quartz or felspar.

These three specimens are most perplexing. Taking 40 by itself, I came to the conclusion, though not without suspicion, that it was probably a slightly altered rock of sedimentary origin. As regards 47, had I taken it alone, I should have been of opinion that it was almost certainly one of the coarser gneisses crushed *in situ*. 45 looks like an interbanding of a minutely constituted not very highly metamorphosed schist in association with a coarse felspar-hornblende gneiss, which has been rather crushed. But is this association possible? It would be rash to give an absolute denial, with our present very limited knowledge of the metamorphic rocks and the effects of the agents of metamorphism, and I once collected specimens, near the top of the Bernina Pass, in Switzerland, where a coarse gneiss and a rather compact green schist appeared to occur in true association; but in every other case that I have seen where finer and coarser foliated rocks are associated, the constituents of the finer under the microscope exhibit a more complete crystallization than is seen in the Guernsey specimens, and even in the instance at the Bernina (which was rather imperfectly exposed) the green

schist differs in some respect from that of Guernsey, so that without the very strongest evidence, from field examination, I hesitate to admit the possibility of such an association as this Guernsey specimen would require. We might have here a sedimentary rock of ancient date, which was in part an arkose of granitoid materials; but so far as I have been able to study rocks of this kind, their evidence is not favourable to this identification. But examination of rocks from the Highknads, and of some specimens from the Cheviots sent to me by Mr. Clough, has shown me that the results of local crushing are occasionally so singular, and, if I may use the phrase, rocks thus maltreated play such tricks that I incline to hold this to be the most probable explanation of these Guernsey specimens*.

EXPLANATION OF PLATE XX.

(Geological Sketch-Map of the Island of Guernsey.)

This map is reduced from Grigg's (Guerin's) map. It represents the outline at high water. At low tide a large additional area is laid bare; many of the bays are then almost deserted by the sea, and Lihou becomes connected with the mainland. Only the most important roads are marked, either such as the visitor would naturally use, or such as are mentioned in the text. The boundaries can only be regarded as approximations to the truth; in particular, the line between the gneiss and the diorites is, in the centre of the island, almost entirely conjectural.

DISCUSSION.

Mr. REDMAN mentioned some facts illustrating the great hardness and durability of the Guernsey granite. These facts proved that the Guernsey granite was the most durable of the Channel-Island granites, and very much more so than the Aberdeen granites as laid down in the West India Dock tramway over forty years back.

Prof. SEELEY inquired why the author, in his map of Guernsey, had grouped the syenites and diorites together; and what were the felspars which they contained, or the circumstances which showed their relation to each other. He inquired what the author intended to imply when the gneiss in the south of the island was termed metamorphic, and the granites and other rocks in the north were termed igneous. It seemed to the speaker that, under the conditions of contortion in which the metamorphic rocks were admitted to be produced, it followed that the deeper-seated mass not only became more

* The above notes were written in ignorance, for the most part, of the results of Mr. Hill's work in the field. In a few cases I have struck out an expression of doubt, where it was removed by stratigraphical evidence; but I leave these last paragraphs as they were written, because I think they afford a fair specimen of the "guesses after truth" which can be made with a microscope. He was, I believe, not quite satisfied at first as to the nature of the rock of which 45 is a specimen; but after a reexamination of the locality, he tells me that he is convinced that this rock is only a case of peculiar local crushing in the mass, of which 35 is a more normal specimen. 36 is from a rock which is close by 45. This, however, consists mainly of quartz and felspar, and can hardly be a part of the same rock.

heated, but experienced pressure from more than one direction, which would cause the parallelism of the gneissose structure to be interfered with by throwing the crystals out of their schistose arrangement, so as to form the confused structure of a granitic rock. If this were possible, the gneiss and syenite might both be metamorphic. In Guernsey he would suggest that under the strain which the rocks had experienced in contortion, and while their materials were still in what might conveniently be termed a plastic state, the rock materials of the island had been faulted, with a downthrow to the south, so that the gneiss had been brought into juxtaposition with the syenite. The slip need not have been great in amount for subsequent denudation to have laid bare the rocks in the positions which the author had described. The speaker would ask whether the specimen exhibited, which appeared to include a junction between stratified and igneous rocks, might not rather be due to a minor fracture in a semiplastic rock, and be partly the consequence of foliated structure developed parallel to the fracture, and partly of the nature of a veinstone. He considered that the remarkable development of schistose structure in the rocks which the author termed igneous, and which, like all schistose structure, must be attributed to pressure, was strong evidence in favour of the gneiss and syenite being contemporaneous, and favoured his contention that in Guernsey they had consolidated under the same conditions.

Mr. RUTLEY considered that the term "Hornblende-gabbro" employed by the author was a very useful petrographical name. He did not think the difference of colour in some of the rocks was of much importance, especially as indicating bedding. He pointed out the interest attaching to the felstones of the Channel Islands, and remarked that spherulitic felstones somewhat similar to those of North Wales and the Lake Districts, which are of Silurian age, occur in Jersey. He suggested that some of the rocks in the Channel Islands might possibly be of the same age.

Mr. TOPLEY was inclined to regard the parallel structure in the gneissic rocks as bedding, and not foliation; and the thickness of the strata is enormous. The rock sold as "granite" in Guernsey is really a syenite. There is no direct evidence that the beds are Archæan; but if such be their age, they may probably be correlated with the oldest rocks of Malvern.

Mr. TEALL agreed with the author that parallel structure might be developed in igneous rocks by mechanical pressure. Diorite dykes in the Ardennes might be seen passing into amphibolite schists at their margins. Dr. Lehmann, in his recent work, called attention to the production not only of foliation, but also of structures simulative of bedding by the action of mechanical forces. The speaker did not think that a persistent dip for a considerable distance in regions of crystalline schist could be taken as indicating a regular succession of enormous thickness.

Mr. MARR asked if some of the igneous rocks might not be contemporaneous lava-flows. He remarked on the frequency of the

inclusion of gneiss-fragments in granite, and suggested that this might be regarded as a crucial test as to the granitic nature of the rock.

Dr. HICKS thought with the last speaker that some of the rocks might be lava-flows. He said that included fragments, such as are common in some Scotch granites, were never found in the so-called granitoid rocks of Wales.

The PRESIDENT said that in the hornblende-gabbros the hornblende might not improbably be altered augite. The diorites and syenites pass into one another by the most insensible gradations.

The AUTHOR said that his paper was in part devoted to proving that the views expressed by Prof. Seeley were not applicable to these igneous rocks. The felstones of Guernsey were like those of Jersey, and it was not impossible that it might be practicable to fix the age of those rocks.