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ORIGINAL ARTICLES.

I.—On the Close of the Highland Controversy.

By Professor Charles Lapworth, LL.D., F.G.S.;
Mason Science College, Birmingham.

ALL those British geologists who have interested themselves in the long-vexed question of the geological position and true mode of origin of the Metamorphic rocks of the Highlands of Scotland must have read with the greatest interest and pleasure the clear and vivid "Report on the Geology of the North-West of Sutherland," by Messrs. Peach and Horne, in the pages of "Nature"[1] for November last; and the manly and candid Introductory Observations by the Director-General of the Geological Survey. Not only does the publication of this Report put an end to one of the most keenly agitated controversies in the history of British Geology, but it explains and harmonizes the diverse views of the contending parties. The issue appears to me to be most creditable to all concerned. For many years the Highland controversy has appeared to outsiders, and to those geologists who were unaware of the difficulties attending the stratigraphy of the older rocks, as a trivial dispute between the Geological Survey on the one hand and a few misguided amateurs on the other. So simple and so irresistible appeared to be the facts and arguments advanced by Sir Roderick Murchison and his followers in proof of a naturally conformable upward succession from the unaltered Silurian rocks of the North-West into the overlying metamorphic rocks of the Highlands, that they carried conviction to the minds of geologists of the first rank, from Lyell downwards. So overwhelming indeed was the concensus of opinion in favour of the general accuracy of Murchison's conclusions, that those geologists, who have so strongly denounced and so steadily endeavoured to disprove it, have had by no means an easy or a pleasurable task. That they committed some mistakes and drew some erroneous conclusions during the prosecution of their investigations was inevitable, from the very novelty of the work, and the complicated nature of the stratigraphy. But when these mistakes are set off against the gigantic error which these investigators so successfully opposed, there will be found to be a most substantial balance in their favour, for which the future student of these old rocks will give them due credit.

The story of the origin, the publication and the extraordinary success of the Murchisonian hypothesis of the Highland sequence, in spite

[1] Nature, 1884, vol. xxxi. p. 29.

of the manly opposition of Nicol; and of the labours, the discoveries, and the conclusions of its opponents, from the date of the bold re-opening of the controversy by Dr. Hicks, down to the issue of the report of Messrs. Peach and Horne, will form a most interesting and instructive chapter in the history of British Geology. It is to be hoped that some geologist, who is familiar with all the facts, and has not identified himself with either of the contending parties, will write this story for the information and edification of our scientific public in general, while the subject is still fresh in the minds of all.

By myself, the Murchisonian hypothesis has been objected to upon two grounds: *first*, because I believed that the assumed stratigraphical proofs upon which it was founded were erroneous, and that their general acceptance delayed the discovery of the true laws of the stratigraphy of the older convoluted rocks; *second*, because the supposed ascending succession in the North-West seemed to shut up geologists in general to a theory of regional metamorphism, which I regarded as impossible and absurd. Some of my ideas respecting the worthlessness of Murchison's stratigraphical evidences, were published in the first part of my uncompleted paper on the "Secret of the Highlands," together with a short sketch of the stratigraphical phenomena that might reasonably be expected in these mountain regions.[1] The actual stratigraphy of the more important parts of the Durness-Eriboll district, and a sketch of the probable agency and mode of metamorphism of its schists, I trusted to be able to develope in the final parts of that paper; but a severe illness contracted by myself in working out the rocks in the North-West has prevented the execution of this task. Indeed, there is now no longer any absolute necessity for its completion, for the conclusions at which I arrived seem to me to be identical in all their essentials with those recently published by Messrs. Peach and Horne.

A brief summary of my own results in so far as they affect the age, composition, and mode of formation of the eastern schists, as deduced from the remarkable stratigraphical and metamorphic phenomena apparent in Durness and Eriboll, will be found in the brief communication printed in the appendix to these remarks. It was written mainly to show the difference between my own views and the views of those, on the one hand, who believed in the Archæan age of all the Eastern metamorphic rocks, and of those, on the other, who held that because the Durness Limestone was succeeded, with apparent conformity, by the metamorphic schists in Sango Bay, the latter were geologically newer. It was read on my behalf by my friend Mr. J. H. Teall at the ordinary meeting of the Geologists' Association on the 4th of July last, and is here reprinted, from an advanced proof, by the kind permission of the Council of the Association. It is not referred to in this place, as establishing any selfish claim to priority, for the officers of the Survey reached their conclusions in complete ignorance of my results, and from a totally different direction, while they have gone far beyond me in working

[1] See Geol. Mag. Decade II. Vol. X. 1883, pp. 120, 193, and 337.

out the details of the subject. Should there be, however, any stray geologists who still hesitate to accept the statements of Messrs. Peach and Horne respecting the extraordinary nature of the stratigraphical phenomena in our British mountain region, and fail to appreciate the brilliant light thus thrown upon the true mode of origin of some of the crystalline schists, it may aid them in arriving at a correct opinion to note for themselves how two sets of investigators, coming to the Durness-Eriboll district with theoretical views almost diametrically opposed to each other, have independently arrived at, and independently made known, the same general conclusions, as regards (1) the sequence; (2) the extraordinary stratigraphical phenomena; (3) the mode of metamorphism; (4) its Post-Cambrian date.

We are now for the first time in a position to take stock, as it were, of the common acquisitions of all parties on the subjects of the stratigraphy and metamorphism of the rocks of the North-West Highlands. The more vital conclusions laid down in the Report of Messrs. Peach and Horne, or incidentally covered by it, are summarized below. It will be apparent on testing the references given (which include merely a single citation for the different investigators in each case) that they are in thorough accord with similar conclusions arrived at by one or by many of the opponents of the Murchisonian hypothesis, a circumstance which affords a strong presumption of their general correctness, and a high probability that they will soon be accepted by all.

Synopsis of our present ideas of the Geology of the Rocks of the North-West Highlands.

(*a*) The Sequence.

1. The unaltered Palæozoic rocks of North-west Sutherland and Ross consist of four[1] main members—the Torridon Sandstone, the Quartzite, the Fucoid Group, and the Durness Limestone.
2. These major groups admit of subdivision into several recognizable zones,[2] capable of being easily identified upon the ground.
3. The Durness-Eriboll Limestone is the newest sedimentary rock[3] in the district.
4. The Upper Quartzite and Upper Limestone of Murchison are non-existent;[4] the so-called Upper Quartzite is the Lower Quartzite repeated, and the so-called Upper Limestone is in reality a repetition of a part of the Durness Limestone itself.

(*b*) The Stratigraphy.

5. There is no[5] conformable upward succession, as held by Murchison and his followers, from the Silurian Rocks into the Eastern Gneissic series; for—

[1] Nicol, Quart. Journ. Geol. Soc. 1856, p. 20, etc. Hicks, Q.J.G.S. 1878, p. 813. Callaway, Q.J.G.S. 1883, p. 358, etc. Lapworth, Geol. Mag. 1883, p. 123, etc.

[2] Lapworth, Geol. Mag. 1883, p. 126, etc. Callaway, Q.J.G.S. 1883, p. 358, etc.

[3] Nicol, Q.J.G.S. 1861, p. 88, etc. Callaway, Q.J.G.S. 1881, p. 244. Lapworth, Geol. Mag. 1883, p. 127.

[4] Nicol, Q.J.G.S. 1861, p. 91, etc. Hudleston, Geol. Mag. 1882, p. 394. Lapworth, Geol. Mag. 1883, p. 127. Callaway, Q.J.G.S. 1883, p. 367.

[5] Nicol, Q.J.G.S. 1861, p. 86. Hicks, *ibid.* 1883, p. 157. Callaway, Q.J.G.S. 1883, p. 357. Lapworth, Geol. Mag. 1883, p. 127.

6. In some spots the basement beds of the local Palæozoic rocks rest unconformably [1] upon one member of the Eastern metamorphic series: while—
7. Generally speaking, the line of junction of the unaltered Palæozoic rocks and the Eastern Metamorphic Series is a great fault [2] and overthrust, along which—
8. The Eastern metamorphic series has been forced [3] over the Silurian rocks by Earth-movements which have acted since Lower Silurian (Ordovician) times.
9. The schists and gneisses of Sango Bay and Farrid Head, which repose locally upon the Durness Limestones, do not form part of a continuous sedimentary succession. They are a part of the Eastern or Upper Gneissic Series, and they are separated from the Durness Limestone by planes of fault.[4]
10. As these schists, etc., of Sango Bay are similar in character and arrangement to the zones of pressure schists occurring above the great overthrust in Eriboll,[5] nearly 10 miles to the S.E. they afford a rough index of the enormous distance to which the metamorphic rocks have been forced over the underlying sedimentary and unaltered deposits.
11. Much of the Eastern Gneiss is merely the Archæan [6] gneiss repeated; the Logan Rock of the Assynt district is generally the Archæan [7] brought up from below the overlying sedimentaries, and the Arnaboll Rock of Eriboll [8] is a part of the same Archæan (Hebridean) gneiss.

(*c*) The Metamorphism.

12. The petrological, lithological, and mineralogical distinctions between the Hebridean gneiss and the Logan [9] and Arnaboll Rocks and their equivalents are primarily due to the extraordinary mechanical disturbances [10] to which the latter have been subjected.
13. The planes of schistosity in the Eastern Metamorphic Schists, etc., between and above the great fault-planes, are not planes of bedding: [11] they are planes of shearing and cleavage, gliding planes (thrust-planes) along which the rocks have yielded to the lateral crust-pressure.

[1] Lapworth, Geol. Mag. 1883, p. 127. Callaway, Q.J.G.S. 1883, p. 407. Compare Hicks, 1880, Geol. Mag. p. 21.
[2] Nicol, Q.J.G.S. 1861, p. 86. Callaway, Q.J.G.S. 1883, p. 357, etc. Hicks, Q.J.G.S. 1883, p. 157. Lapworth, Q.J.G.S. 1883, p. 421.
[3] Callaway, Q.J.G.S. 1883, p. 410. Lapworth, *loc. cit.* Compare Nicol, Q.J.G.S. 1861, p. 110, and Hicks, Geol. Mag. 1880, p. 17.
[4] Nicol, Q.J.G.S. 1861, pp. 87, 88. Callaway, *ibid.* 1881, p. 241. Lapworth, see Appendix.
[5] Lapworth, 1884, see Appendix, p. 104.
[6] Nicol, Q.J.G.S. 1861, p. 95. Hicks, *ibid.* 1878, p. 818, etc. etc.
[7] Bonney, Hudleston, Proc. Geol. Assoc. 1879, p. 75; Q.J.G.S. 1880, p. 95. Callaway, *ibid.* 1883, p. 410.
[8] Lapworth, Q.J.G.S. 1883, p. 422, etc.
[9] Compare Bonney, Q.J.G.S. 1880, p. 95, etc.
[10] Lapworth, 1884, see Appendix, p. 103.
[11] Lapworth, 1884, *loc. cit.* Compare also Bonney, Q.J.G.S. 1883, p. 415, etc.

14. By the agency of this lateral earth-thrust, the Archæan, the plutonic, and included patches of sedimentary rocks have been locally sheared and flattened out into rocks resembling hälleflintas [1] and rhyolites, even finely-laminated shales.
15. This Eastern Metamorphic Series of Sutherland and Ross not only contains Archæan rocks, but also local patches of metamorphosed Palæozoic,[2] intrusive, and segregatory rocks, together with local patches of material probably compounded of all these in different degrees.[3]
16. This Eastern Metamorphic Series has received its present strike, pseudo-bedding and its present foliated and mineralogical characteristics through the agency of the crust movements which have operated within the district since Lower Silurian times.[4]

Some of these conclusions may appear startling at first sight to those who have not followed with interest and appreciation the more recent developments of our knowledge of the geological phenomena of mountain districts. But they agree precisely with the results which have been already worked out by extra-British investigators. The stratigraphy of the North-West Highlands, as I have more than once suggested, is precisely of the same character as that so admirably described and illustrated by Heim [5] in his magnificent work upon the Alps of Central Switzerland. The metamorphic phenomena of the north-west, too, are identical with those so minutely detailed and photographed in Lehmann's most valuable work on the metamorphic rocks of the Saxon [6] Erzgebirge. Continental geologists, British amateurs, and the officers of the Geological Survey are now at one and the same point. They stand together on the shore of a new world of geological discovery, full of the richest promise.

But it must not be forgotten that the results already attained in the north-west are merely the preliminary sketches for a great and a most necessary work, namely, the detection of the chief laws of mountain stratigraphy and the discovery of the more important processes of regional metamorphism. Investigators are certain to crowd in hosts to the new ground in search of fresh discoveries, and geological pamphlets upon the district will soon be thick as leaves in Vallambrosa. All this will advance the science greatly, and much good will come of it. But before we can advance far beyond our present standpoint, it is absolutely requisite that the debatable region shall be accurately mapped and its complicated stratigraphy unravelled. This is a work which can only be accomplished speedily and in its entirety by the Geological Survey. And it is a preliminary and necessary work of the very first importance, for upon its speedy and satisfactory completion hang some of the most vital problems in British stratigraphical as well as in general theoretical geology.

[1] Lapworth, *loc. cit.* 1884.
[2] Compare Hicks, 1883, Q.J.G.S. p. 147.
[3] Lapworth, 1884, *ibid.* p. 104.
[4] Lapworth, 1884, *ibid.* p. 105.
[5] Heim, *Mechanismus der Gebirgsbildung*, Basel, 1878.
[6] Lehmann, *Entstehung der Altkrystallinischen Schiefergesteine*, Bonn, 1884.

By means of their recent labours in the Durness-Eriboll district Messrs. Peach and Horne have familiarized themselves with the minutest details of its component formations, and have studied and interpreted its astounding stratigraphical phenomena in the area where they are most completely dissected by nature for the benefit of the investigator. No one who has the real interest of geology at heart but will earnestly hope and trust that they will uninterruptedly continue the work they have so excellently begun until it is thoroughly complete from Eriboll to Skye.

May we soon see a Monograph upon the debatable land of the North-West, that shall compare with those fine works issued by the American Survey, and shall demonstrate both to our scientists and to the educated public at large that the members of our British Survey can not only lay down correctly upon their maps the true places of the economic treasures of the rocky floor of our country, but that they can interpret minutely and correctly the most complicated geological phenomena of our mountain regions!

But a work of this kind need not clash in the slightest degree with the contemporaneous work of amateurs in the same or in corresponding fields of research. The subject is perfectly free and open to all. Every investigator has a right to address himself to any part of the work he pleases, and the right, if he deems it fitting to exercise it, to demand a full recognition of the importance of his own contribution to the common stock of discovery. No investigator, or body of investigators, has any claim, beyond that conceded by courtesy, to a monopoly in any special department of geology, local or theoretical. The only available geological possessions of the investigator are his abilities, his opportunities, and the fruits of the good work he has done in the past. The only authority he dare recognize with safety is Nature herself. The extremest penalty for the slightest departure from the course she has marked out, whether committed wilfully or in ignorance, will be mercilessly exacted by her tardy but sure-footed avenger—Time.

It seems to me that these are the conclusions that every one who knows the facts is certain to draw for himself, from the startling and sudden collapse of the brave Murchisonian hypothesis in our midst, and that they ought to have the effect of banishing partisanship, and of teaching us scientific toleration and mutual respect.

At the present time the several groups of students of these old rocks are all met together upon one and the same elevated platform of a common opinion, having climbed up painfully thereto from many different directions. The old subject of dispute has utterly disappeared, and there is no longer any reasonable excuse for dissension. We have all been partly right and partly wrong. It is a time for a hearty laugh all round, a time to shake hands and be friends.

The inauguration of the Murchisonian hypothesis of the Highland succession marked the beginning in Britain of a period of bitter controversy, of estrangement of Survey men and amateurs, of decline in geological enthusiasm, and of comparative feebleness of geological research. Let us trust that its downfall marks the commencement

of a new and a happier period like that of the earlier years of the present century, when all British geologists shall meet upon an equal footing, in mutual communion and sympathy, and when the only rivalry between parties shall be in vieing with each other in developing the unknown treasures in that new geological world of wonder now opening up before our eyes, where authority and precedent are alike unknown, and where so much awaits discovery that there is room and work and hope for all.

Appendix.

On the Stratigraphy and Metamorphism of the Rocks of the Durness-Eriboll District.[1]

By Charles Lapworth, LL.D., F.G.S.,
Professor of Geology and Mineralogy, Mason Science College, Birmingham.

In [2] the district round Eriboll and Durness, the so-called Eastern (or Upper) Gneiss is composed of two very distinct members. The older member is the Arnaboll Gneiss, which is, in my opinion, nothing more nor less than the so-called Laurentian (or Lower Gneiss) brought up to the east of the Assynt (Durness-Eriboll) series by gigantic overfolds.

The younger member, which is composed of the schistose metamorphic rocks of the Moen and Central Sutherland, contains within it—forming almost inseparable parts of its mass—long strips and patches of the lower zones of the Assynt (Durness-Eriboll) series. The schistose quartzites or the quartz-schists (of some authors) of the Sutherland Schist Series are actually nothing more than the crushed and mechanically metamorphosed ends of long wedges of the Assynt Series, and are often in visible continuity upon the ground with the unaltered Assynt beds.

I hold that the Sutherland Schistose Series is composed of a complete intermixture of Archæan and Assynt rocks, the two series being so interfolded and interfelted together that (exception being made of those zones near the great overfaults where the metamorphism is incomplete) they can never be separated in the field, but must be mapped simply as "metamorphic."

The planes of foliation and schistosity in the (so-called) Upper Metamorphic Series of Sutherland are not planes of bedding; they are planes of cleavage—that is, gliding-planes, along which the rocks have yielded to the irresistible pressure of the lateral Earth-creep during the process of mountain-making. This pressure was so extraordinary that granites, syenites, pegmatites, gneisses, and quartzites have been crushed to powder, and have been finally flattened out into rocks having all the external characters of hälleflintas and even finely laminated shales. Every stage of the crushing process is recognizable in the field and under the microscope, from the coarsest pegmatite and gneiss down to the so-called metamorphic shales, schists, and slates. Hence the most highly metamorphosed

[1] Read at Ordinary Meeting of Geologists' Association, July 4th, 1884.

[2] The communication is printed as read. A few words have been added by Prof. Lapworth for the sake of clearness of description. These are given in brackets.—J. J. H. Teall.

rocks of Eriboll are not the coarse Hebridean Gneisses, but the fine slaty schists.

The process of rock-folding in the region is exceedingly complex, and has resulted in most remarkable phenomena. The rock-folds (and faults) are of all grades, from miles across down to microscopic. In some cases the original dividing plane (either bedding plane or fault plane) of two successive rock-sheets has been twisted into the form of spirals, cornucopias, etc. Folding, interfolding, buckling, shearing, stretching have all taken effect again and again along the junction (fault or bedding) plane between the Sedimentaries and Archæan; and innumerable protrusions of igneous rock—plutonic—have forced their way in numberless veins in the latter (Archæan) up to the former (Sedimentaries). At present, even near the line where the two distinct sets of rocks retain their recognizable individuality, the schistose layers that form the so-called lowest beds of the Eastern Schists are (occasionally) compounded of materials of such different origin that even in the same hand-specimen (from one locality) I believe that it can be sometimes demonstrated that certain parts of a layer may be mainly Assynt, other parts mainly Archæan, and other parts mainly intrusive or segregatory. The result is a comparatively homogeneous schist; but who shall indicate its geological age?

Schists composed of Archæan, Ordovician (sedimentary), and intrusive rocks respectively, form part and parcel of one and the same (lowest or heterogeneous) zone in the Eastern (Schistose) area, and intermingled with them occur schists (apparently) composed of mixtures of all three in different degrees. Here and there near the junction line (between the present Durness-Eriboll Series and the present Eastern Metamorphic Series) we can say: This band (*a*) is essentially or wholly Archæan; this (*b*) is certainly Ordovician; and this (*c*) probably intrusive rock. But as we go further east all recognizable distinctions vanish one by one, and in the present state of our knowledge all that we can presume to say is, that, considered as a whole, the Eastern Schist of Central Sutherland is in all probability an intimate compound of sheets of (1) Archæan, (2) Sedimentary, and (3) Intrusive rocks, which have been crushed into slaty rock, in which crystallization has set up along the cleavage planes.

The quartz, and possibly some of the mica, of the Upper Schists may have been largely derived from the Sedimentaries; hence the highly quartzose nature of these schists. Their felspar has either been derived from the Archæan, or from intrusive plutonic rocks.

So far as my own observations go, there seems to be no trace whatever of any sedimentary rock in the Durness-Eriboll region of more recent date than the Durness Limestone. The thin, so-called Upper Quartzite band of Sango Bay is the crushed basement zone of the Lower Quartzite. The green schists overlying it are pressure schists, formed and brought over in the great overfault. The same zone occurs again in Eriboll, along the great fault-line of the Upper Schist series. If (like those geologists who erroneously maintain that these Sango Bay Schists, etc., naturally succeed the Durness Limestone)

we regard these green schists, etc., above the Limestone in the Sango Bay section as (forming part of) a true (sedimentary) sequence, we can prove with equally valuable evidence, indeed upon identical grounds—

(1) In Sango Bay that these green schists overlie the Limestone.

(2) In (near) Arnaboll that they follow at once to the basement bed of the Quartzite.

(3) In Eriboll (in some localities) that they are interstratified with the Hebridean.

(4) And (in other localities) that they trough the Lower Quartzite, coming out from below it.

(5) And also, as in Craig Faolinn, that they are the junction (transition) beds of the Lower and Upper Gneissic Series.

In other words, that they are below the Ordovician, above the Ordovician, in the Quartzite, above the Quartzite, in the Hebridean, and in the Upper Gneiss (so called) all at one and the same time!

I believe at present that the great area of metamorphic schists of Sutherland and the Central Highlands is, as a whole, neither Archæan nor Ordovician. The Sutherland Gneiss—Arnaboll—is Archæan. The Sutherland Schist has been manufactured[1] since Silurian times. For all I know, there may be large areas (in the Central Highlands, etc.) composed wholly of Archæan (Laurentian) rocks, or of Cambrian or pre-Cambrian rocks. When the metamorphism of the Highland area began I think that it is impossible to say, and may be always impossible. One thing seems pretty clear to me—the so-called oldest beds of the Highland succession of the Schistose Series of the N.W. Highlands are the newest in point of time. The zone of intermixture and metamorphism (in Sutherland) travelled to west from east, and the last beds (schists) manufactured are those now in contact with the Assynt Series in Durness, Eriboll, and Assynt.

Strikes, dips, and visible sequences are worse than useless in these metamorphic rocks as indices of chronological sequence. I cannot help believing that we have in the Highlands merely the remains of a degraded mountain complex. That fragment of the N.W. Highlands where the fossil-bearing beds occur, is the newest (of its component ranges) in point of time. Some ranges were certainly in existence in the Highlands in the Old Red times, and, for all we know to the contrary, some in Silurian times also. The Highland area has, I consider, been the theatre of mountain-making, and of igneous action again and again, since then. If the same crumpling has taken place over its whole surface as has certainly taken place in Eriboll, its present width must be the merest fraction of its original extent, and the manufacture of its schists and gneisses may have gone on in some localities below its surface from pre-Cambrian times to the present without interruption.

The attempt to claim all its (Central Highland) rocks as pre-Cambrian is perhaps a little more justifiable than the attempt to

[1] (*i.e.* the heterogeneous materials of which it is composed have undergone re-arrangement, and have received a new and a common set of petrological features, through the agency of the great Earth-mill).

claim them as Silurian. At present the disproof of the "*visible ascending succession*" of the Murchisonian party is a brilliant triumph for the Nicolites. But the truth lies, I cannot help believing, between the two views. If I can prove my case, we shall find :—

(1) That there is no recognizable chronological sequence (or invariable succession of superposition) in the metamorphic Highland area corresponding to that among the sedimentary formations (for the planes dividing the truly metamorphic layers are not planes of deposition, but planes of shearing and cleavage).

(2) Many of its (the Highland) schists are composed of Archæan materials (rocks), which have received their present pseudo-bedded arrangement since Ordovician times.

(3) What proportion of its schists and gneisses is composed of Archæan, sedimentary, or intrusive materials respectively is in all probability an insoluble question.

(4) Its *gneisses* may be either Archæan or (some) possibly formed by intrusion (injection of plutonic rocks) in later ages.

(5) Its *schists* may be composed either of crushed *Archæans*, crushed *intrusives*, or of a mixture of these with sedimentaries.

(6) Its (so-called) *slates* may be (according to the locality, either normal slates or) crushed rocks not yet crystallized (and) of either Archæan, sedimentary, intrusive, or of mixed origin.

II.—On some Quartz-Felsites and Augite-Granites from the Cheviot District.

By J. J. Harris Teall, M.A., F.G.S.

In previous communications to the Geological Magazine[1] I have described at some length the petrographical characters of the lavas and tuffs of the Cheviot District. It was proved that they are, at any rate for the most part, of an andesitic character, and that some of them are so little altered as to be thoroughly entitled to the term andesite, unless we are prepared to adopt the unphilosophical system of making geological age, *per se*, a factor in petrographical nomenclature. If we leave out of account the modifications in structure and composition which have been superinduced on the rocks by the various agents of change, then the Cheviot lavas and tuffs belong to the three fairly well characterized groups of the augite-, hypersthene-, and mica-andesites.

It is interesting to note that pumice and ash having essentially the same chemical and mineralogical composition as the Cheviot hypersthene-andesite was erupted in immense quantities by the volcano of Krakatoa in the autumn of last year : a fact which testifies in a striking manner to the uniformity in volcanic phenomena during immense periods of geological time.

In the present communication I propose to describe some intrusive rocks that occur in the Cheviot district. They belong to two well-marked groups—the quartz-felsites and the augite-biotite-granites.

[1] Notes on the Cheviot Andesites and Porphyrites, Geol. Mag. 1883, pp. 100, 145, 252.