may perhaps permit me some time to print. It was in my view by a combination of these two movements that the diluvial phenomena to which I refer were produced. This cause is at all events an efficient one, and is therefore not like so many of the physical causes appealed to by the current school of Uniformity, both inefficient and transcendental.

V.—ON CERTAIN GNEISSES WITH ROUND-GRAINED OLIGOCLASE AND THEIR RELATION TO PEGMATITES.

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IN the course of my work in the Highlands of Forfar, I have been much struck with the mode of occurrence of certain light-coloured gneisses, of undoubted igneous origin.

They are intruded into the surrounding rocks in an infinite number of thin bands or sills, generally interlacing, and often not more than two feet thick; sometimes not exceeding an inch. Their bulk in some areas exceeds considerably that of the older rocks, at other times it is far less.

Two points are easily noted; first, they have no selvage edge; secondly, they have a very characteristic aspect, due to rounded grains of oligoclase.

Commencing in an area where these characters are well marked, we find that the rock consists of oligoclase, muscovite, biotite, quartz, and microcline, but the last mineral bulks far less than the more basic felspar. It is the oligoclase that is so round-grained in form, and gives the rock its characteristic appearance. The micas, especially the muscovite, may easily be seen to have sharp angles.

Going southwards, that is, away from an area where gneisses predominate, we observe the round-grained character to become less marked, and the oligoclase to form a smaller proportion of the whole rock. Still further south, the gneissose character becomes less marked, the oligoclase is further diminished in amount, while muscovite begins largely to exceed the biotite.

In this phase the rock begins to be much permeated with coarse pegmatite, which forms a massive fringe to the southern edge of the gneiss, this fringe attaining in one case a breadth of 700 yards. The pegmatite consists essentially of microcline, quartz, and muscovite, the oligoclase being usually very small in quantity, and not visible to the unaided eye. That this rock consolidated much as we now see it is obvious from the vast area of contact metamorphism that accompanies its intrusion. How then was it produced? I learned the solution of the enigma from a normal granite. A common type of granite consists of potash-felspar, quartz, oligoclase and two micas; the first-named mineral usually attaining the greatest size, and being most striking to the eye. But examine

a broad dyke, belonging to the same original magma, and its appearance is seen to be very different. The potash felspar is no longer visible to the unaided eye, but it forms with the quartz a finely granitic matrix, in which the earlier crystals of consolidation, the two micas and oligoclase, are porphyritically embedded. Still further, if the rock is slightly decomposed, the latter mineral, somewhat tabular in form with conspicuous development of the clinopinacoid, is seen to have an outer shell, fairly well marked off from the much more *rounded inner portion*. The oligoclase obviously came up in this form, and completed its growth from the magma in which it lay, which later portion has been shown by Prof. Sollas¹ to be more acid in character than the core. The round-grained crystals then, of our round-grained gneiss, want their outer rim of later growth. How is this to be accounted for? If such a granite-magma be intruded during or towards the close of a powerful earth-movement, it may be forced, by the tremendous pressure, into every possible plane of weakness in the surrounding rocks. Now, obviously, it is not the crystals, but the liquid portion of the rock that must enter first, and all the crevices must be opened to the diameter of the oligoclase crystals before any of them can enter. The acid portion then of the magma, containing the constituents of potash felspar, must travel somewhat in advance of the crystals of earlier formation. In addition, the continuance of the pressure will still further force the liquid from the solid crystals, leaving at last just sufficient of the magma to fill the interstices between them. Thus, in my opinion, has the perfect form of round-grained gneiss been produced, which is by no means uncommon. The more acid magma will travel furthest, and finally consolidate as pegmatite. Put back the pegmatite into the gneiss, and you have the composition of a normal granite. The round-grained character of the oligoclase is thus seen to be due to the draining off of the magma, from which it normally finishes its growth.

To turn now to the question of the absence of selvage edges to the gneiss. Obviously a coarse-grained intrusion of an inch in thickness would only be possible if the country rock were nearly at the same temperature as the magma. There is further evidence tending to this conclusion, but as some parts of it are matters of dispute, it may be omitted for the present.

From the foregoing remarks we may draw the conclusion that neither a round-grained gneiss of the above type, nor its accompanying pegmatite, is in any true sense a metamorphic rock; both consolidated as we now see them. In addition, it would be more accurate to describe the pegmatite as being *extruded from* the gneiss, than intruded into it. The latter view implies a later date, while both are obviously of the same age. Like any other rock, such gneisses and pegmatites are liable to *subsequent* metamorphism.

¹ See Prof. Sollas' paper, "Contributions to a Knowledge of the Granites of Leinster," Trans. Roy. Irish Acad. vol. xxix. p. 427.