(4) " The composition and paragenesis of the biotites of the Carsphairn igneous complex." By Mr. W. A. Deer (communicated by Professor C. E. Tilley).

Three biotites have been analysed from the granites, tonalite, and hornblende hybrid of the Carsphairn intrusion. Their compositions are closely related to the enclosing rock when the mineral has crystallized under normal magmatic conditions. During the hybridization process this relationship is less strong due to changing equilibrium conditions. Their structural formulae, derived from partial X-ray analysis, have been calculated, and the formula suggested by Pauling is accepted in preference to Mauguin's. The X*n* group (co-ordination number 6) varies from $n = 2{\cdot}5$ to 3. In biotites from the intermediate rocks *n* approaches 3, and the mica becomes richer in the phlogopitic molecule. The biotites are related as members within a single intrusion and show characteristic features distinguishing them from biotites of other complexes.

CORRESPONDENCE.

THE AUGITE-BIOTITE-DIORITE OF THE NEWRY COMPLEX

SIR,—In the October number of the GEOLOGICAL MAGAZINE Professor Shand takes exception to certain statements of mine about the rocks of Slievegarron, which I have called augite-biotite-diorite. Before proceeding to discuss the main point at issue, I frankly confess to an error of omission. My statement that the analysed rock is " undersaturated ", to which Professor Shand rightly objects should, of course, have read " normatively undersaturated ". That the rock really is undersaturated in this chemical sense is shown by the appearance in the norm of 6·25 per cent. of nephelite and 15·73 per cent. of olivine. I cannot, however, resist the temptation to point out that in the very act of protesting Professor Shand commits a precisely similar offence. He refers to augite-biotite diorite as " diorite ", which it certainly is not. Fortunately the matter is less serious than if a chemist referred to nitro-glycerine as glycerine.

The real question is that of the name which should be given to the rock under discussion. The rock is the predominant member of a series which ranges from biotite-pyroxenite to andesine-rich types. Mineralogically, it is accurately described as *augite-biotite-diorite* since in addition to augite and biotite the essential minerals are andesine and hornblende.

Although one-quarter of the rock is made up of biotite and the plagioclase is An_{35}, the rock becomes a soda gabbro in Professor Shand's classification. Perhaps the incongruousness of a *potash* soda gabbro leads Professor Shand to desert the facts and agree with Professor Bailey " that gabbro-diorite is the most appropriate name for the rock ". It is very easy to show that the

rock is not a gabbro-diorite. In Tröger's *Kompendium*, p. 146, we learn that the term gabbro-diorite was introduced by Törnebohm for normal gabbro with uralitic hornblende, and that by later authors it has been adopted both for plagioclase-rich gabbro (= ossipite) and for rocks which chemically and mineralogically stand midway between diorite and gabbro. The augite-biotite-diorite of Slievegarron is demonstrably none of these things. It is not a normal gabbro for its plagioclase is An_{35}; it is not plagioclase-rich, for it actually contains less plagioclase than typical gabbro; and far from standing between diorite and gabbro it stands, both chemically and mineralogically, between plagioclasite and biotite-pyroxenite. Obviously the rock is not a gabbro-diorite, and the very modes cited by Professor Shand show that it is not, though by failing to quote the figures for biotite he hides the real contrast. Yet Professors Bailey and Shand, both members of the B.A. Committee on Petrographic Classification and Nomenclature, not only pronounce the rock to be a gabbro-diorite, but go out of their way to proclaim their opinion to the world.

The Slievegarron rocks under discussion do not differ from gabbro in the direction of diorite, but in the direction of alkali-rich gabbro. The suggestion that they might be described as biotite-essexite-gabbro was intended to emphasize this alkaline character of the rocks, with a view to drawing attention to a significant difference from gabbro-diorite. The suggestion arose from the observation that texturally, as well as mineralogically and chemically, the rocks bear a remarkable resemblance to others which have been described as essexite or essexite-gabbro. It may be noted in passing that the term essexite does not exclude andesine, and that a rock is none the less alkaline because a considerable proportion of its alkali is potash. Chemically, the rock falls comfortably into Niggli's essexite-gabbro magma group, as the following figures show :—

	si	*al*	*fm*	*c*	*alk*	*k*	*mg*
Augite-biotite-diorite .	114·5	23	43	21·5	12·5	·30	·61
Essexite-gabbro magma	105	23	43	24	10	·25	·45

Niggli himself points out that in the gabbro-diorite magma group the *si* values are higher (average 135) and the *alk* values (for corresponding values of *si*) lower than in the essexite-gabbro magma group. Here is further proof that the augite-biotite-diorite is not a gabbro-diorite.

A biotite-augite-diorite from Predazzo is precedent for the term augite-biotite-diorite, and it may be noted that although the Predazzo rock is considerably less rich in alkalies (Slievegarron, 6·31; Predazzo, 4·36 per cent.), yet it also falls into Niggli's essexite-gabbro magma group. Professor Shand does not give any reason for objecting to my use of the name augite-biotite-diorite. The only one I can think of which he may have had in mind is that the rock contains more than 30 per cent. of coloured minerals, and so lies

outside the group of rocks which he calls " soda diorite ". As to this it is only necessary to remark that the rock has not been called " soda diorite ", and that the artificial limitation which applies to " soda diorite " does not by any means apply to diorite or to augite-biotite-diorite.

As to the meaning which I attach to the term augite-biotite-diorite, I think I have explained this as clearly as even Professor Shand could wish by providing a detailed description of the rock, accompanied by a mode, a chemical analysis, a norm, and a figure. If Professor Shand or any other " student of rock names " objects to the term because of the relatively high proportion of mafic minerals, and to the alternative " biotite-essexite-gabbro " because the alkali mineral is biotite instead of nepheline or aegirine, then there will be an obvious case for coining a new name.

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