Chapter 28 Late Basic Cone-Sheets

Introduction

The Late Basic Cone-Sheets are lettered tI on the one-inch Map, Sheet 44: t because Beinn Talaidh is virtually built of them; and I because they are steeply inclined towards a centre, or series of centres, on the line C_1 C_2, (Figure 58) (p. 338). Their distinguishing petrological character, as compared with the Early Basic Cone-Sheets of Chapter 21, is an absence of olivine. The average thickness of individual sheets is perhaps not more than 10 or 15 ft., and is certainly less than in the case of the Early Basic suite. Their texture too is finer; in fact, in Cruachan Dearg, it is often vitreous, but elsewhere this is uncommon. The most general type is a fine- grained quartz-dolerite or tholeiite (always albitized), which shows a great tendency to break up into brown-weathering slabs. Instead of giving prominent scarps like the Early Basic Cone-Sheets, these Late Sheets are apt to cover themselves with featureless scree. Where, as so often, they cross scarps due to the early series, their habit is to weather back in nicks; and the same is characteristic of their outcrops among the gabbro crags of Ben Buie, Corra-bheinn, and Beinn Bheag. As in the case of other cone-sheets, the inclination is often about 45°; but, perhaps, the average is rather steeper than this. Nearly vertical examples are by no means rare, but they are definitely non-typical. Every sheet has consolidated with a chilled top and bottom. (C.T.C), W.B.W

No better introduction to the Late Basic Cone-Sheets could be desired than is afforded in the Gaodhail River, above the track which leads up Glen Forsa from the Sound of Mull road, east of Salen. An accurately measured section is illustrated in (Figure 49). It runs at right angles to the strike of the sheets for about 600 yds. Of this distance, 128 yds. are obscured by gravel, and, in the remaining 472 yds., there occur 124 Late Basic Cone-Sheets with 73 interspaces of coarse intrusions, classed in (Figure 49) as country-rock. The total thickness of Late Basic Cone-Sheets actually exposed is 660 ft., and that of country-rock 342 ft.—a ratio of about 2:1. In one part of the section, for a distance of about 400 ft. this proportion stands at 12:1.

The measured section of (Figure 49) includes less than half of the belt of Late Basic Cone-Sheets shown on the one-inch Map as crossing the River Gaodhail; and it is certain that 2000 ft. is not an excessive aggregate thickness to assign to the sheets of this neighbourhood. Their great aggregate bulk is the more readily appreciated on turning from the River Gaodhail to Beinn Talaidh, where one finds a mountain 2496 ft. high, for the most part built of thin Late Basic Cone-Sheets. W.B.W.

Corra-bheinn and Cruachan Dearg, on the other side of the Mull axis of symmetry, repeat many of the conditions of Beinn Talaidh and the Gaodhail River. It has been stated in Chapter 22 that the Corra-bheinn Gabbro, for 100 or 200 yds. inwards from its southern and western margins, is practically free from cone-sheets, except where such are included as xenoliths. Farther in, cone-sheets of Lath Basic types begin to appear, at first sparsely, but afterwards more abundantly and in thicker belts, until, at the summit of Corra-bheinn, they form more than half the rock and make up multiple sheets 30 or 40 yds. wide at the outcrop. Even here, they have not reached their full development, for, on Cruachan Dearg, there is evidence for a thickness of at least 1000 ft. of cone-sheets with only here and there a thin intercalated wedge of the gabbro country-rock still happily preserved. Where the rock, just south-west of the cairn, is quite bare, we can never pass a greater thickness of rock than 8 or 9 ft. without coming to a chilled margin; but it is possible that many of these margins belong to thin sheets which have split thicker ones. (C.T.O.) Further information will now be considered under three headings —Distribution, Time-Relations, and Petrology.

Distribution

The one-inch Map, owing to its small scale, has to indicate the distribution of the Late Basic Cone-Sheets in a somewhat diagrammatic fashion. Where lenticles of country-rock are shown on this Map in the midst of a ground-colour of Late Basic Cone-Sheets, one must realize that the lenticles are generally much smaller than represented, and at the same time much more numerous. Apart from size and number, as little as possible has been sacrificed; but, in certain cases, it has been found impracticable to convey on the one-inch Map any idea of the tune-relations of country-rock to associated.

Late Basic Cone-Sheets. For instance, near Gaodhail Cottage, in Glen Forsa, southwards to the tributary Allt nan Clàr, an important intermediate cone-sheet (aI) is shown as having a fairly continuous outcrop: in point of fact, this acid sheet, wherever seen, is cut into thin slices separated by Late Basic Cone- Sheets. E.B.B.

As a first approximation, it may be stated that the assemblage-outcrop of the Late Basic Cone-Sheets centres on the head of Loch Bà, (C_2 of (Figure 58), p. 338). For a mile or two from this centre (according to direction), few or no sheets are to be met with, even in rocks like basalt-lava, which are undoubtedly older than the sheets. Beyond this limit, for the next mile or two, crowded sheet-assemblages are encountered, except where obliterated by some later intrusion, as, for instance, near the foot of Loch Bà. Beyond this again, the sheet-assemblage fails, though for some distance stragglers are encountered. W.B.W., J.E.R.

The main gaps in the assemblage-outcrop are due to interruption by later intrusions, and, as such, will be dealt with incidentally in the sequel. In Glen More, above Ishriff, there is evidence of a fairly important partial gap of an original character. There are quite considerable areas of basalt-lava in this district (B and pB, (Figure 52), p. 308), and these are very sparingly cut by cone-sheets, although they lie where one might expect a continuation of the Late Basic Cone-Sheets that figure prominently in Cruach Choireadail farther west. E.B.B.

Time-relations

Enough has been stated, in the present and foregoing chapters (21, and 22), to indicate a time-scale running as follows: (1) Early Basic Cone-Sheets; (2) Corra-bheinn Gabbro; (3) Late Basic Cone-Sheets.

The injection of Late Basic Cone-Sheets continued intermittently through a very long period, in fact, nearly to the close of igneous activity. Thus it happens in several cases that an intrusion belonging to a different category may cut some of the Late Basic Cone-Sheets, and in turn be cut by others. The quartz-Gabbro of Coir' a' Mhàim (south-east of Corra-bheinn) supplied the first-recognized example of this, which is now accepted as a commonplace of Central Mull. (C.T.C)

It has been pointed out that, in an approximate sense, the Early Basic Cone-Sheets centre about C_1 of (Figure 58), and the Late Basic Cone-Sheets about C_2. There is evidence to suggest that the migration of the centre of sheet-activity was somewhat gradual. Two instances supporting this contention may be cited:

1. A Ring-Dyke of quartz-gabbro, with subordinate associated granophyre, runs from the east slope of Beinn Talaidh through Loch Sguabain, in Glen More (1 of (Figure 52) and (Figure 53), pp. 308, 312), to Cruach Choireadail (cf. (Plate 6), p. 307, and one-inch Map). It is known as the Glen More Ring-Dyke, Chapter 29, and, during this long continuous part of its outcrop, it cuts almost all the Late Basic Cone-Sheets with which it comes in contact—and these locally are very numerous. Beyond Cruach Choireadail, the Glen More Ring-Dyke has a discontinuous outcrop leading through Coir' a' Mhhim and Coir' an t-Sailein to Tòrr na h-Uamha. If one compare the Coir' a' Mhàim and Coir' an t-Sailein exposures with those of Cruach Choriedail and Glen More, one finds the number of sheets cutting the ring-dyke distinctly increased in relative importance, though they still remain far inferior to the number which the ring-dyke cuts. Towards the western end of the Tòrr na h-Uamha outcrop, this change is accentuated; in fact the Glen More Ring-Dyke, as represented in Tòrr na h-Uamha, comes to be freely cut by Late Basic Cone-Sheets; and these, from their position, seem referable to a more north-westerly centre than those of Cruach Choiredail. The only criticism, that might be offered in this connexion, would be a suggestion that the Tòrr na h-Uamha outcrop should not be referred to the Glen More Ring-Dyke. (C.T.C), E.B.B., E.M.A.

2. Just inside the Glen More Ring-Dyke, lies the Ishriff Ring-Dyke, composed of granophyre. Throughout most of its course, the Ishriff Ring-Dyke cuts the great majority of the Late Basic Cone-Sheets which it encounters; but where it crosses Maòl nam Fiadh (2, (Figure 53), p. 312), and takes its place at the back of Coire Ghaibhre, it is cut to pieces by Late Basic Cone-Sheets. Here again the cutting sheets seem, from their position, to belong to a more northwesterly centre than the ones that are cut. E.B.B.

In the light of these two examples, it is apparent how carefully one has to proceed in matters of this kind. Thus, half-way between Glen More and Beinn Chàisgidle, Late Basic-Cone-Sheets cut very freely through a whole series of ring-dykes.

It would be unsafe to infer from this that the Ring-Dykes of Beinn Chàisgidle are earlier than those of Glen More, for it is quite probable that the Cone-Sheets themselves are of materially different dates in the two districts. Again, a first glance at the one-inch Map might suggest a comparison between the relative immunity from cone-sheets of the ring-dykes of the Glen More district with that of the Knock and Beinn a' Ghràig Granophyres, which belong to the ring-dyke system as developed near the foot of Loch Bà, (Chapter 32). But any such comparison is misleading. The Glen More and Ishriff Ring-Dykes are, in all probability, separated from the Knock and Beinn a' Ghràig Ring-Dykes by an interval of time that admitted of extensive cone-sheet injections. As already pointed out, what is taken as a continuation of the Glen More Ring-Dyke through Tarr na h-tramha is freely cut by Late Basic Cone-Sheets in its western part. In the same neighbourhood, the Beinn a' Ghritig Granophyre cuts every sheet it encounters.

The manner in which the Beinn a' Ghràig and Knock Granophyres cut through great numbers of Late Basic Cone-Sheets will be treated in greater detail in Chapter 32. All that need be emphasized at this juncture is that apparently one at least of these granophyres was followed by a minor revival of cone-sheet injection (p. 345). J.E.R.

In comparing the dates of ring-dykes and cone-sheets, it is probably safe to refer the Glen More and Ishriff Ring-Dykes of Chapter 29 to the latter part of the first half of the Late Basic Cone-Sheet period, and the Knock and Beinn a' Ghràig Ring-Dykes of Chapter 32 to a similar stage of the second half of the same period. The wonderfully continuous felsite of the Loch Bà Ring-Dyke of Chapter 32, so far as can be determined, is later than all the cone-sheets of Mull. E.B.B., J.E.R.

Petrology

The Late Basic Cone-Sheets may be divided petrographically into two main types, namely, the quartz-dolerites and tholeiites that compose the greater part of Beinn Talaidh, and the variolites and tachylytes best seen in Cruachan Dearg. These types are often intimately associated in the field, and are sometimes linked by examples of a transitional character. Other variants from the normal representatives have affinities with such types as the craignurites (p. 227), leidleites (p. 281), and certain central types of lava (Chapter 10).

Situated well within the pneumatolytic zone of Central Mull ((Plate 3), p. 91), the Late Basic Cone-Sheets have shared to a varying degree in the general albitization and propylitization that have affected the rocks of this region; but, in addition, the alkalinity of their own residual magma seems to have produced in them albitization and other changes, before or during the last stages of consolidation. In the case of these sheets, it is thought that a large proportion of the mineral-changes which are characteristic of them as a group are referable to auto-pneumatolysis, dependent partly upon composition and partly upon locality. The influence of composition is shown by the much more general albitization of these late sheets as compared with their predecessors, the Early Basic Cone-Sheets of Chapter 21. The influence of position on their final state is suggested by the fact that the intensity of albitization among the Late Basic Cone-Sheets varies somewhat according to locality, and, in the case of the quartz-dolerites, appears to have progressed to a less extent in the sheets of Cruachan Dearg, than in those of the Gaodhail River. This difference is still further emphasized by a comparison with the Tertiary region of Ardnamurchan, where sheets, otherwise identical with those of Mull, are often not albitized to any appreciable extent. It can be readily understood that the conditions of Central Mull during the intrusion-period of the Late Basic Cone-Sheets may have been such as to favour the process of auto-pneumatolysis that appears to be an innate tendency of the sub-basic magma. But, whatever the conditions that controlled the albitization, it is certain they allowed the individual sheets to chill at their margins, and to develop a type of crystallization in keeping with their hypabyssal nature.

Talaidh type of quartz-dolerite

(Anal. VIII.; (Table 2), p. 17)

The most prevalent variety of Late Basic Cone Sheet is a moderately basic rock of quartz-dolerite affinities (S18467) [NM 5684 3313]. Texturally, the sheets are fine-grained rocks of a dark brownish-grey colour. They are usually devoid of porphyritic crystals, and seldom carry olivine as one of their constituent minerals. They are composed of a moderately basic plagioclase, augite, titaniferous magnetite and ilmenite, alkali-felspar of predominating albitic character, and quartz.

One of their chief characteristics, however, is the seemingly early separation of the more basic and larger individual crystals, and crystal-groups, from an acid residuum, and the segregation of this acid mesostasis into well-defined regions, where it is consolidated with a type of crystallization differing from that of the rest of the rock, and more or less peculiar to itself. The amount of mesostatic, or intersertal, material present in any portion may vary within fairly wide limits, and is naturally greater in the more acid varieties that approximate to the craignurites in composition.

For the purposes of description, it will be convenient, as well as logical, to consider the mineralogical and structural features of the type in two sections—one dealing with the coarser and earlier crystalline constituents, and the other with the fine-grained acid mesostasis. Further, we shall take for the basis of our description the comparatively unaltered representatives of the type, that occur mainly on Cruachan Dearg, and to a less extent in the Gaodhail River.

Early constituents

Most of the augite appears to have separated from the magma during the period occupied by the crystallization of the relatively basic plagioclase, and may be in hypidiomorphic, ophitic, and seemingly eutectic, relationship with the latter within the same field of view. It is usually of a pale brownish tint, but occasionally shows a lilac tinge and slight pleochroism indicative of the presence of titanium.

The dominant type of crystallization of the augite is columnar. The columns are usually a little less than a millimetre in length and a fifth of a millimetre in breadth, and show a general lack of well-defined crystal-faces other than those of the prism-zone. They are elongated parallel to the C axis, and thus show traces of the prismatic cleavages parallel to their length. In cross-section, they frequently have a roughly octagonal outline due to the somewhat equal development of the prisms and pinacoids. They have the peculiarity of almost always carrying moderately large, and frequently well-formed, crystals of magnetite in their peripheral portions—a peculiarity also met with among the quartz-dolerites of West Lothian.<ref>J. D. Falconer, Igneous Geology of the Bathgate and Linlithgow Hills, Trans. Roy. Soc. Edin., vol. xlv., 1908, Pl. II., Fig. 2, p. 150.</ref>

Frequently, the crystals are simply twinned parallel to the orthopinacoid, and, almost invariably, show traces of salitic striation. This striation sometimes occurs throughout the crystals, but, at other times, is developed locally, more particularly at the crystal-borders and in the neighbourhood of the twin composition-plane.

A character of these columnar crystals, as in the acicular augites of the craignurites (p. 226), is the occurrence of a slender central rod of serpentinous material that presumably replaces original rhombic pyroxene or enstatite-augite.

As commonly happens with columnar augites, of which the crystallization from a sub-basic magma was accompanied by a marked separation of an acid residuum, the crystals are sometimes curved and otherwise distorted. This is due to intercrystal pressure through the movement or withdrawal of the liquid mesostasis from the immediate neighbourhood. Similar curving of columnar augites has been noted by us in the less basic portions of the differentiated mass of Cruach Choireadail (p. 325), and was described and figured by Dr. Falconer<ref>J. D. Falconer, *op. cit.,* p. 140, and Pl. II., Fig 3</ref> from the quartz-dolerites of Linlithgow.

In association with felspar, the columnar augites occasionally take on a stellate grouping, both augite and felspar crystals radiating from a common centre. This would appear to be the first stage of a structure which is highly characteristic of certain varieties of the Talaidh Sheets. In such rocks, the augite, commencing from a centre, spreads out sectorially by a continuous branching of several stocks in a cervicorn (antler-like) growth. Between crossed-nicols, it appears that this structure is not that of an ophitic individual with simultaneous extinction of its component parts, but that each stock has its own orientation, and that the extension of each branch is in the general direction of the prismatic zone-axis. In some of the fine-grained Talaidh Sheets that have tholeiitic affinities, this cervicorn structure of the augite is most conspicuously developed (S14810) [NM 6060 3814], (Figure 50)B).

The main felspar of these rocks builds columnar once-twinned, somewhat narrow crystals, that frequently attain greater lengths than the columnar augites with which they are associated. Often, they adopt a stellate grouping, and show a remarkable constricted development of their initial portions.

The extinctions vary somewhat from their central to marginal parts, and indicate a range of composition from acid labradorite, through andesine, to oligoclase. Like the columnar augites, they have frequently suffered deformation and have become curved (S16558) [NM 5684 3314], or even broken, when the bending was too severe.

Cervicorn association of felspar and augite most commonly occurs within the limits of a single felspar-crystal of somewhat tabular form, and may possibly represent a eutectic crystallization. Less frequently, however, the augite growths may pass from one individual felspar to another, and thus indicate the independent and earlier crystallization of the pyroxene.

Iron-ore is usually an abundant constituent. That, which occurs in intimate association with the columnar augite, appears from its form to be either magnetite or titanomagnetite; but, scattered indiscriminately through the rock, are moderately large grains and patches which, from their manner of alteration, seem to be ilmenite.

Mesostasis

The mesostasis is mainly collected into well-defined areas and varies considerably in amount. It appears as a very fine-grained crystalline mass, usually turbid, characterized by the acicular habit of its ferromagnesian constituent, and, to a less extent, of its felspar. It is composed of acicular augite and long narrow crystals of oligoclase in a somewhat chloritized microcrystalline matrix of alkali-felspar and quartz. Occasionally, quartz-patches reach moderately large dimensoins, and, sometimes, it is possible to detect a granophyric relation between quartz and alkali-felspar in the finer portions of the matrix. Apatite, as slender needles, is frequently abundant (S14806) [NM 6060 3817]. The acicular augite has usually been replaced by green fibrous hornblende or chlorite in a pseudomorphous manner. In rocks of this type, with a more than usually acid composition, the amount of mesostatic material becomes proportionately greater, and, at the same time, the ferro-magnesian mineral throughout the rock tends to assume the acicular habit. Such sheets reproduce, in a great measure, the essential characters of the more basic varieties of craignurite, and we may regard them as connecting links between the craignurites and the quartz-dolerites of Talaidh Type (S17225) [NM 5750 3110], (S17890) [NM 6002 2830].

Albitization and other secondary changes

As was stated above, these rocks of quartz-dolerite character have the inherent faculty of auto-albitization which they exercise to a variable degree. Where the acid residuum (mesostasis) is in contact with the earlier products of consolidation, it has frequently exerted upon them a local corrosive action. The original relatively basic felspars of the rock have been eaten into and replaced by a fresh growth of felspar of more alkaline character, and the columnar augites have developed on their exposed surfaces a fringe of fibrous green hornblende. These replacements may, in extreme cases, extend throughout the respective crystals.

Passing now to the more general type of alteration, we find it fairly well exemplified by sheets of Talaidh Type in Cruachan Dearg (S16561) [NM 5684 3314], (S16562) [NM 5684 3314], but more particularly by those of Gaodhail River (S14792) [NM 6098 3864], (S14793) [NM 6093 3862], (S14794) [NM 6087 3860], (S14795) [NM 6083 3856]. Here, all the larger and relatively basic felspars show albitization in every stage of development, from strings of albite traversing the crystals to practically complete conversion into albite or albite-oligoclase. Similarly, we meet with the general change of augite into green fibrous hornblende.

Variolitic rocks of Cruachan Dearg

A series of fine-textured more or less tachylytic sheets, occurring on Cruachan Dearg, and, to a more limited extent, at other localities, possess an extremely beautiful variolitic structure (Figure 51). On occasion, dark spherules, measuring up to a quarter of an inch in diameter, are discernible in the hand-specimen, but this is the exception rather than the rule. A beautiful rock of this character (S17909) [NM 5976 2834] was found by Mr. E. G. Radley to contain 50.66 per cent. of silica.

These variolitic rocks consist of slender radiating and branching prismatic crystals of augite, sometimes showing titaniferous colouration, joined together transversely by numerous short rods of magnetite, and set in a colourless glassy matrix that makes but a small proportion of the rock. This base has sometimes denitrified (S16553) [NM 5686 3321], (Figure 51)A) to a variable extent, giving rise to an indefinite cryptocrystalline, or feathery, felspathic mass in which are included small definite patches of clear quartz. Felspar, in elongated form, occasionally accompanies the augite and contributes to the variolitic structure (S16557) [NM 5682 3313], (Figure 51)B); but, at other times, it forms small porphyritic and skeletal individuals (S14808) [NM 6060 3816] that have no definite relation to the augite. A silica-determination by Mr. Radley gave 53.65 per cent. for the figured specimen (S16553) [NM 5686 3321].

With the development of a cervicorn, rather than a delicate variolitic, structure on the part of the augite, and an increase in the number of recognizable felspar-crystals, these rocks pass over into variolitic and tholeiitic varieties of the Talaidh Type. In all these transitional varieties (S16408) [NN 549 436], (S18963) [NM 6996 3124], (S17917) [NM 6000 2817], the cervicorn structure of the augite is the most distinctive feature, and shows clearly that this growth is an independent expression of the crystallization of the augite, that is to say, it can take place without the intervention of any other crystalline phase.

A word may be said in conclusion concerning a beautiful variant of the variolitic type collected from the Gaodhail River (S14805) [NM 6060 3820]. It contains small well-shaped phenocrysts of partly albitized acid labradorite in a sub-variolitic ground-mass. The latter consists of cervicorn augite with abundant rods of magnetite, and elongated crystals of oligoclase, in a clear but chloritized base of alkali-felspars and quartz. R.H.T.; E.B.B.

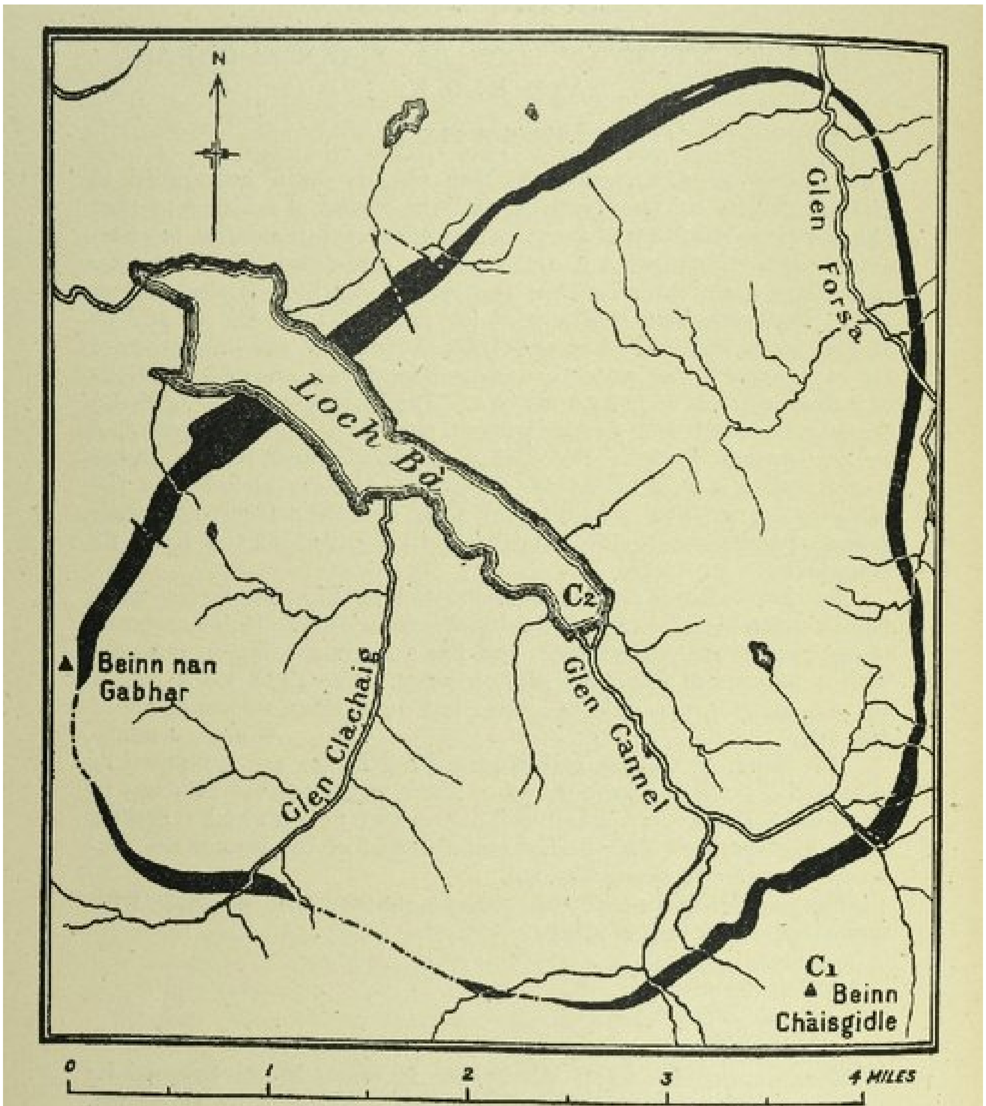


Fig. 58.—Loch Bà Felsitic Ring-Dyke along Fault.
C1 and C2 show two chief centres of ring-dykes and cone-sheets.
Quoted from *Summary of Progress for* 1914, p. 86.

(Figure 58) Loch Bà Felsitic Ring-Dyke along Fault. C1 and C2 show two chief centres of ring-dykes and cone-sheets. Quoted from Summary of Progress for 1914, p. 86.

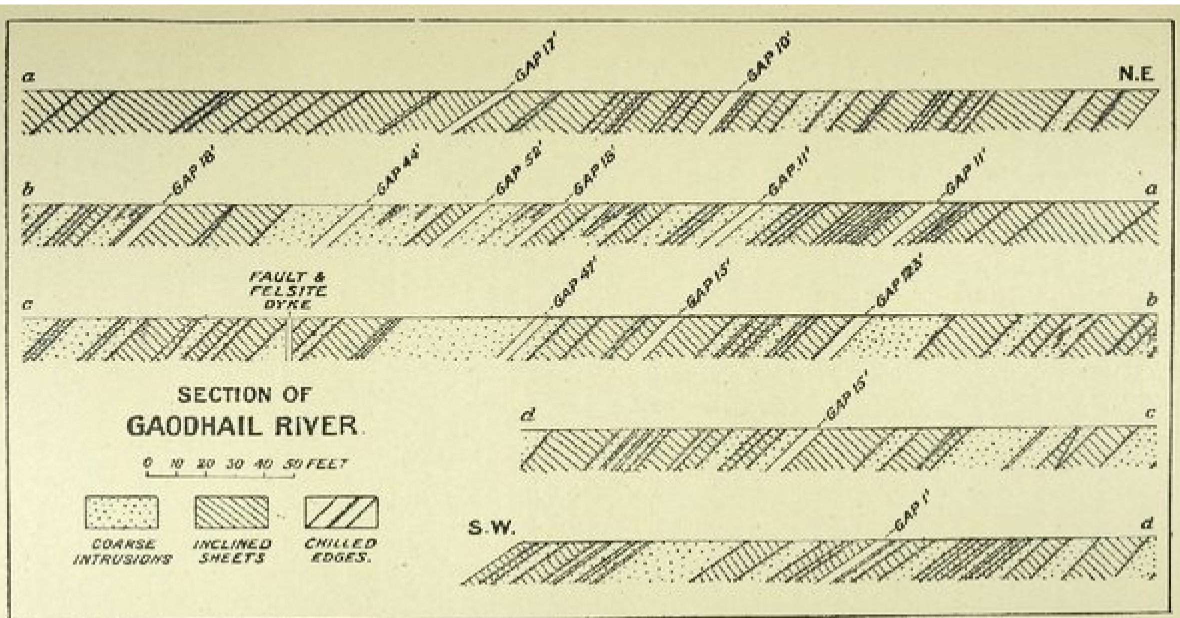


Fig. 49.—Late Basic Cone-Sheets (Inclined Sheets) exposed in Gaodhail River. Chilled edges only shown where observed. Gaps not drawn to scale and figures given refer to horizontal distances measured in feet.

(Figure 49) Late Basic Cone-Sheets (Inclined Sheets) exposed in Gaodhail River. Chilled edges only shown where observed. Gaps not drawn to scale and figures given refer to horizontal distances measured in feet. Quoted with slight alteration from Summary of Progress for 1910, p. 36.

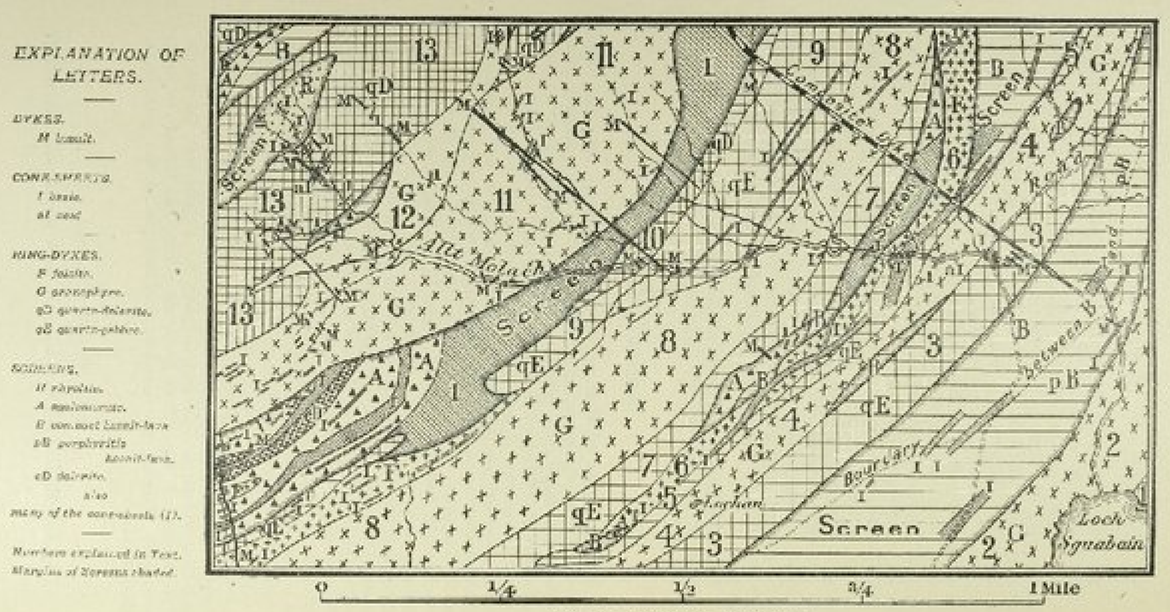


Fig. 52.—Ring-Dykes. Allt Melach.

(Figure 52) Ring Dykes, Allt Melach.

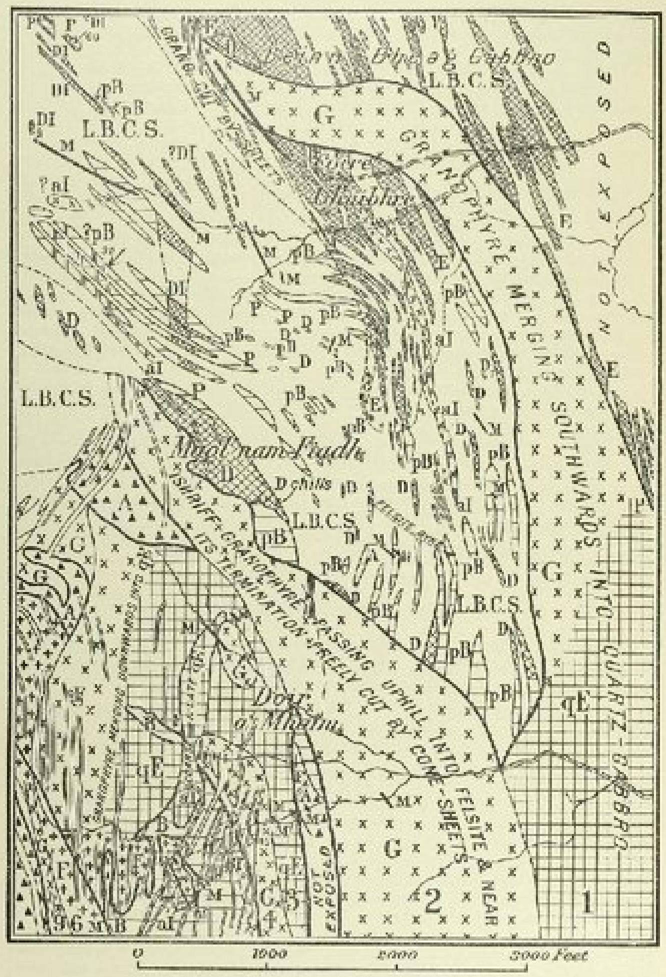


Fig. 53.—Ring-Dykes, Maol nam Fiadh.

Dykes: M basalt,

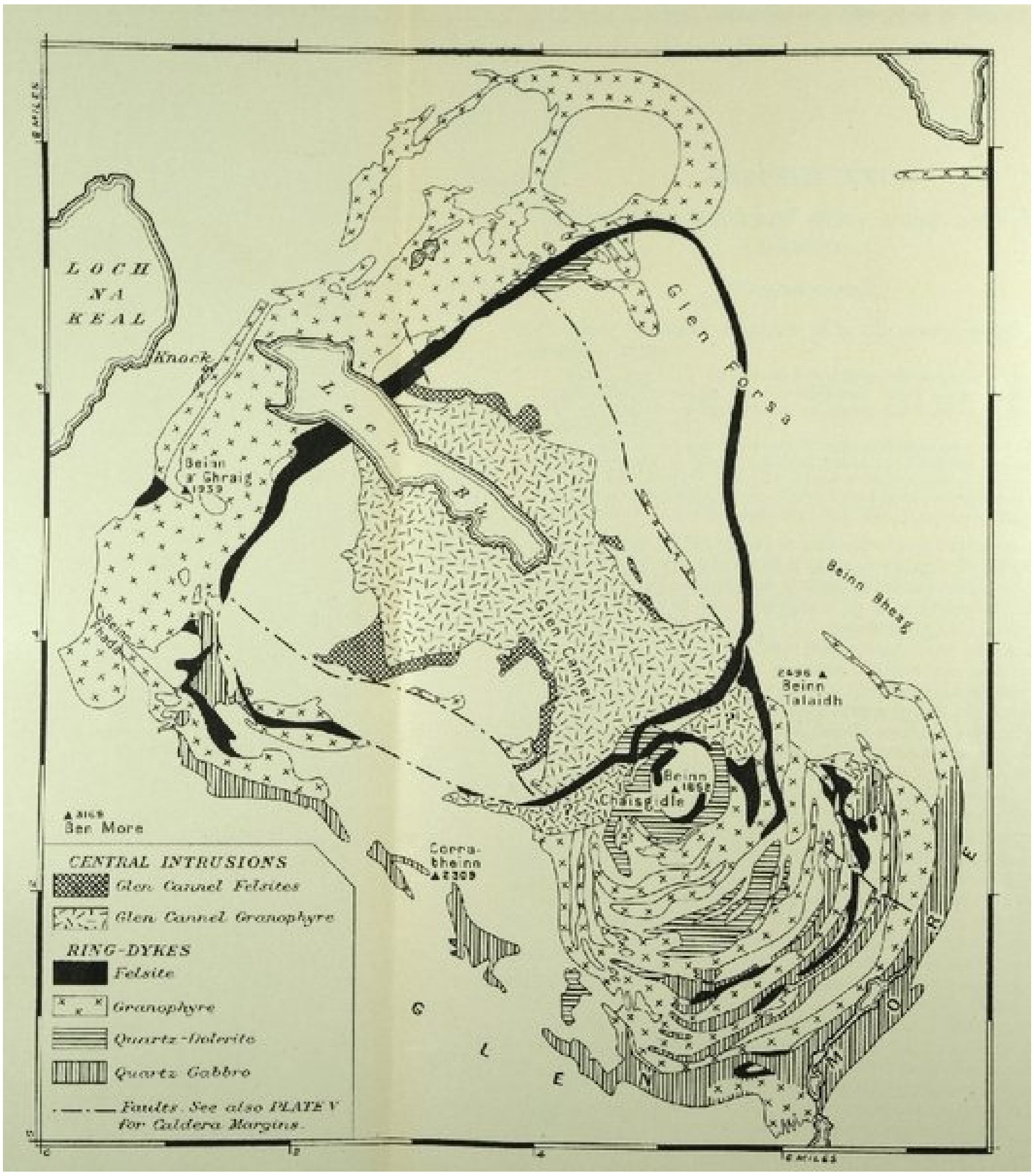
Cone-Sheets: DI dolerite; aI acid; L.B.C.S. Late Basic Cone-Sheets (shown without ornament).

Ring-Dykes: F felsite; G granophyre; qE quartz gabbro.

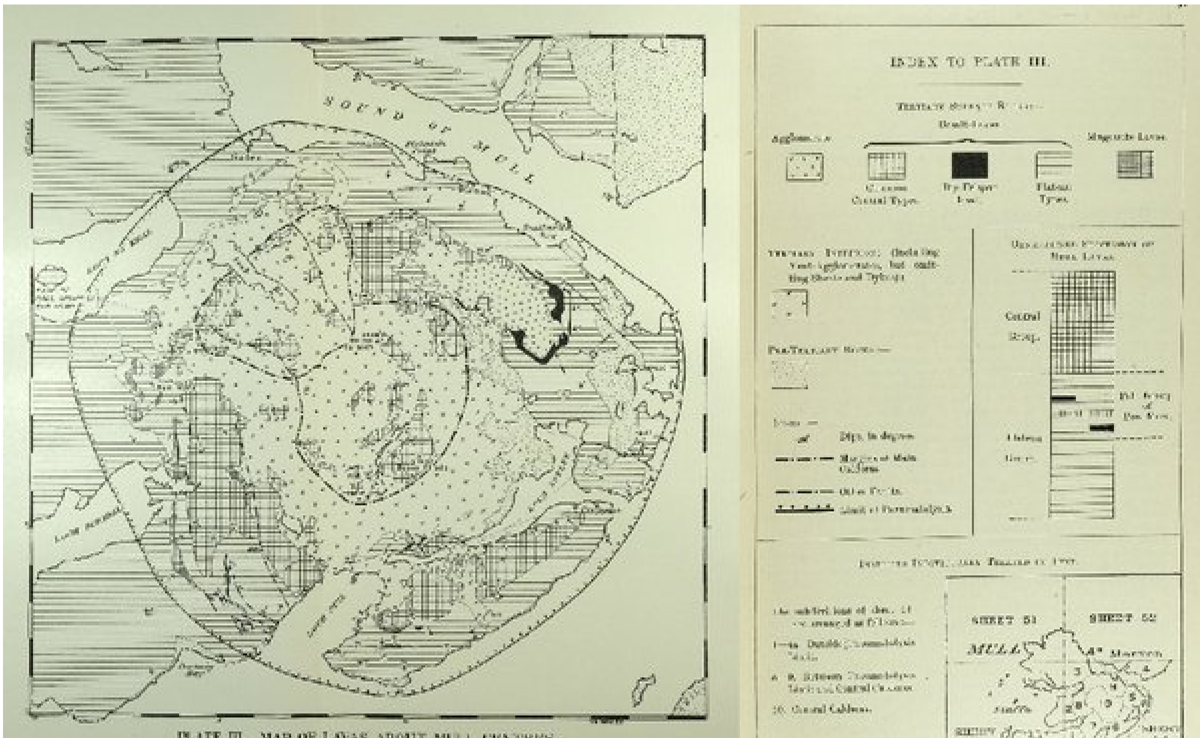
Screens: A agglomerate; B compact basalt lava; pB porphyritic basalt-lava; P pillow-lava; D dolerite; E gabbro; also many of the cone-sheets.

Numbers as in Fig. 52, see Text.

(Figure 53) Ring-Dykes, Maol nam. Fiadh. Dykes: M basalt, Cone-Sheets: DI dolerite; aI acid; L.B.C.S. Late Basic Cone-Sheets (shown without ornament). Ring-Dykes: F felsite; G granophyre; qE quartz-gabbro. Screens: A agglomerate; B compact basalt-lava; pB porphyritic basalt-lava; P pillow-lava; D dolerite; E gabbro; also many of the cone-sheets. Numbers as in Figure 52, see Text.



(Plate 6) Map showing ring-dykes



(Plate 3) Map showing the distribution of lava-types and the limit of pneumatolysis

TABLE II.—NON-PORPHYRITIC CENTRAL MAGMA-TYPE OF FIG. 2.

	Tholeiite Salen Type	Basalt Staffa Type			Basalt Compact Central Type		Tholeiite Brunton Type		Quartz-Dolerite and Tholeiite Talaidh Type		
	I.	II.	III.	A	IV.	V.	VI.	VII.	VIII.	IX.	
SiO_2	47·35	47·80	49·76	52·13	50·54	53·78	51·53	51·63	52·16	53·97	SiO_2
TiO_2	1·75	....	0·94	....	2·80	2·28	1·57	2·00	3·25	1·24	TiO_2
Al_2O_3	13·90	14·80	14·42	14·87	12·86	12·69	11·05	11·77	11·95	14·65	Al_2O_3
Fe_2O_3	5·87	....	3·95	....	4·13	3·44	2·73	3·23	4·86	3·62	Fe_2O_3
FeO	8·96	13·08	7·77	11·40	8·75	8·94	10·98	10·47	9·92	6·32	FeO
MnO	0·23	0·09	0·20	0·32	0·32	0·53	0·45	0·35	0·18	0·30	MnO
(Co, Ni)O	nt. fd.	....	nt. fd.	....	0·06	nt. fd.	nt. fd.	0·04	....	nt. fd.	(Co, Ni)O
MgO	5·97	6·84	5·30	6·46	4·63	2·58	5·21	5·02	3·77	4·49	MgO
CaO	10·65	12·89	10·22	10·56	8·71	6·36	9·68	9·34	7·14	7·98	CaO
BaO	....	....	0·04	....	nt. fd.	0·09	nt. fd.	0·03	....	0·04	BaO
Na_2O	2·73	2·48	2·49	2·60	2·89	2·74	3·48	2·90	2·36	2·51	Na_2O
K_2O	0·54	0·86	1·83	0·69	1·43	2·27	0·86	0·91	1·74	1·52	K_2O
Li_2O	....	....	tr.	....	nt. fd.	nt. fd.	tr.	nt. fd.	....	tr.	Li_2O
$H_2O - 105°$	1·16	1·41	1·03	1·19	2·25	2·19	1·26	1·40	1·95	0·94	H_2O : 105°
H_2O at 105°	1·04		2·04		0·17	1·19	0·71	0·68	0·56	1·92	H_2O at 105°
P_2O_5	0·24	....	0·21	....	0·34	0·55	0·22	0·29	0·24	0·27	P_2O_5
CO_2	0·32	....	0·06	....	0·33	0·08	0·08	0·11	0·18	0·51	CO_2
FeS_2	....	....	0·04	....	nt. fd.	0·42	0·26	0·08	....	0·09	FeS_2
S	0·23	....	....	....	....	....	....	....	0·18	....	S
	100·94	100·25	100·30	100,22	100·24	100·13	100·07	100·27	100·44	100·40	
Spec. grav.	2·96	....	2·72	....	2·90	2·68	2·93	2·95	2·91	2·83	

(Table 2) Non-Porphyritic Central Magma-Type of Figure 2

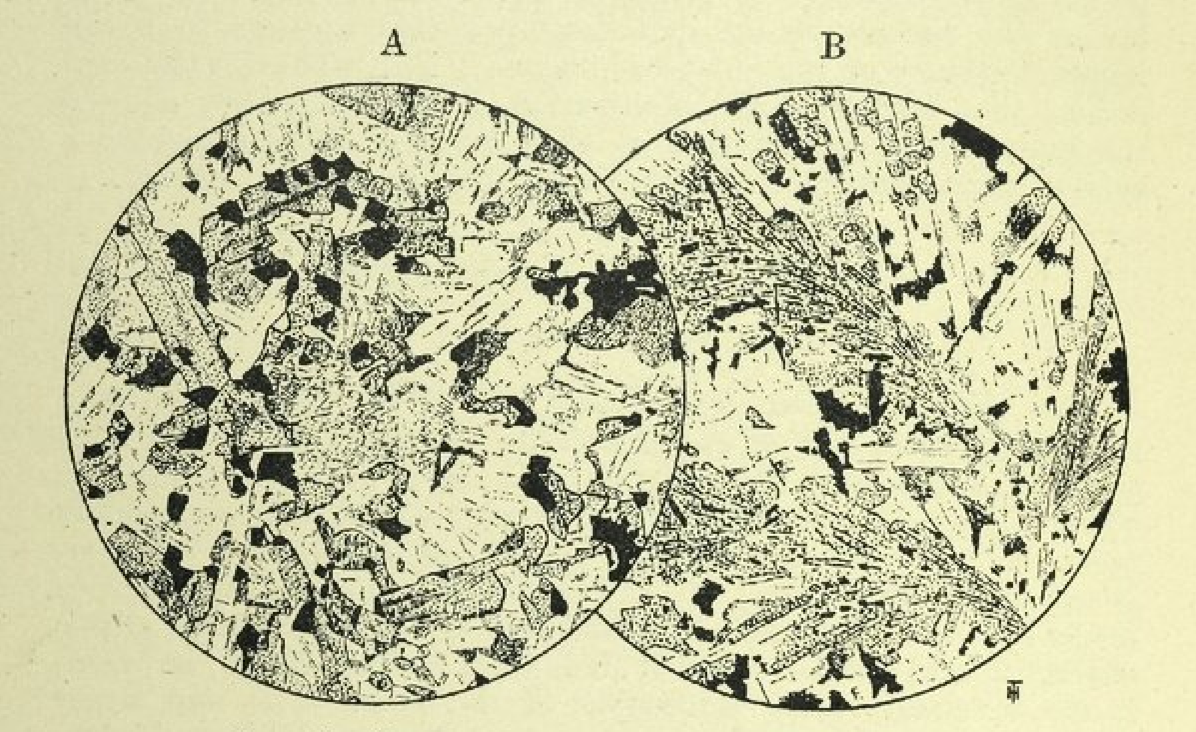


FIG. 50.—The Talaidh Type of Late Basic Cone-Sheets.

(Figure 50) The Talaidh Type of Late Basic Cone-Sheets. A. [(S14867) [NM 5354 2242]] x 17. Quartz-doleiite. The section shows columnar augite associated with titaniferous magnetite, a colourless moderately basic and albitized plagioclase, and a mesostasis of alkali-felspar and quartz. B. [(S14810) [NM 6060 3814]] x 17. Quartz-dolerite. Mineralogically similar to the above, but with a highly characteristic cervicorn development of its augite (p. 303).

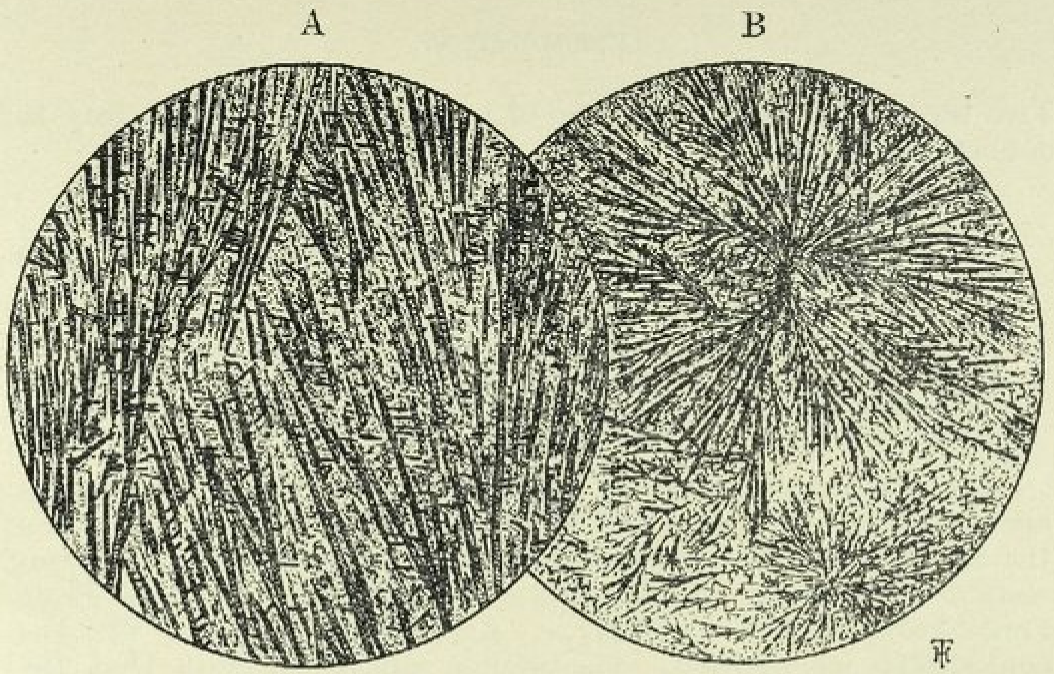


Fig. 51.—Variolite-Sheets of Cruachan Dearg.

(Figure 51) Variolite-Sheets of Cruachan Dearg. A. [(S16553) [NM 5686 3321]] x 17. Radiating and branching prisms of augite traversed transversely by short rods of magnetite, and set in a colourless devitrified matrix of indefinite felspathic material in which are small definite areas of clear quartz. B. [(S16557) [NM 5682 3313]]. Augite with attendant magnetite, and accompanied by elongated crystals of felspar, giving rise to a sub-spherulitic variolitic structure. The section shows two definite centres of radiation.