
Chapter 21 Early Basic Cone-Sheets

Introduction

It has been explained in Chapter 1 that there are innumerable basic cone-sheets in Mull, and that they are separable into two main groups. Members of the early group are lettered bl on the one-inch Map, Sheet 44, where they are for the most part treated as a complex, with seldom any attempt at showing intersections of one individual sheet by another. The Early Basic Cone-Sheets are mainly olivine-dolerites, and are inclined at an average angle of about 45° towards a centre (approximately C1, (Figure 18) and (Figure 58), pp. 138, 338), that underlies the more south-easterly of the two calderas as shown in (Plate 5) (p. 165). Individual cone-sheets are often 30 or 10 ft. in thickness, while, in the aggregate, the complex must, in Creach Beinn, exceed 3000 ft. The cone-sheets traverse a wonderful variety of country-rock, and, in addition, cut one another again and again; but, in spite of this, their general regularity is very striking. Moreover, pm-cone-sheet boundaries can still be traced through the segmented country-rock into which the complex has been intruded, and these boundaries are marked by heavy lines on the one-inch Map. E.B.B.

Each sheet consolidated with chilled margins, no matter what the country-rock; even where one sheet cuts another, a glance at the mutual junctions suffices to indicate which is the later of the two. Only where there is clear independent evidence that the sheets have been greatly altered since consolidation, are their chilled margins obscured or obliterated. In the vicinity of the Ben Buie and Corra-bheinn Gabbros, sometimes for a distance of 50 yds., chilled margins fail in the great majority of the local representatives of the early Basic Cone-Sheets; contact-alteration has led to recrystallization, and this has masked the original fine texture of the margins of the sheets.

Further consideration of the Early Basic Cone-Sheets is divided in the sequel under the headings Distribution, Time-Relations, Convenient Exposures, and Petrology. (C.T.C)

Distribution

The outcrop of the sheet-assemblage is for the most part a conspicuous scenic feature of Mull geology, as well as a marked characteristic of the one-inch Map. It starts near Beinn Chreagach Mhor, which rises above Glen Forsa in the north, passes through Creach Beinn, above Loch Spelve in the south-east, and returns northwards across Glen More, in the neighbourhood of Derrynaculen Cottage. This course, viewed broadly, is of horse-shoe form, open to the north-west. Probably the north-west gap in the outcrop is original, though it may have been accentuated by subsidence of the north-western caldera of Plate V. (p. 165), and also by the intrusion of the Late Basic Cone-Sheets of Chapter 28 and the Beinn a' Ghràig Granophyre of Chapter 32. The external limit of the assemblage-outcrop, though not abrupt, is very marked, and nowhere more so than on the slopes of Creach Beinn. The internal limit is also well-defined, but it can only locally be demonstrated as an original feature—where, for instance, there are comparatively simple tracts of lava in the northern Beinn Bhearnach, at the head of Glen Forsa, and again in the western part of Beinn Fhada, above Loch Sguabain in Glen More.

About Loch Spelve, one can recognize another interesting feature in the distribution of the Early Basic Cone-Sheets. There is a fairly consistent lack of parallelism between the margins of the assemblage-outcrop, on the one hand, and those of individual sheets on the other. The relationship has somewhat the geometry of false-bedding, and is quite clearly defined on the one-inch Map. The way in which individual sheets obliquely approach, and then die out along, the outer margin of the assemblage-outcrop is particularly obvious. That a similar relation holds also for the inner margin is best appreciated on comparing the sheet-complex exposed above Torness Cottage in Glen More with the lava-slopes of Beinn Bhearnach, north-west of Sgùrr Dearg—for though some of the detail here is difficult to unravel, the broad contrast is very marked indeed. E.B.B.

Time-relations

Of superinduced irregularities in the assemblage-outcrop of the Early Basic Cone-Sheets, the most pronounced are the gaps due to the later intrusion of the Ben Buie and Corra-bheinn Gabbros. Details are reserved for Chapter 22, but it may be stated here that a very large number of sheets, classed in the present chapter as Early Basic Cone-Sheets, are cut through by these two gabbros. It would afford a basis for a simple time-classification if the two gabbros concerned behaved precisely in the same manner in this matter. Almost certainly, however, the Corra-bheinn Gabbro is somewhat the later of the two, for it cuts off a series of porphyritic olivine-dolerite cone-sheets, many of which, on the other side of Allt Ghillecaluim, traverse the Ben Buie Gabbro (see one-inch Map, where a small selection of the evidence is presented). These particular porphyritic dolerite sheets are characterized by numerous small felspar-phenocrysts, a feature which is lacking in the great bulk of the Early Basic Cone-Sheets cut through by the Ben Buie Gabbro (and also in the Late Basic Cone-Sheets of Chapter 28). An approximate time-scale may thus be adopted: (1) Main Early Basic Cone-Sheets, non-porphyritic; (2) Ben Buie Gabbro; (3) Continuation of Early Basic Cone-Sheets, with small felspar-phenocrysts; (4) Corra-bheinn Gabbro (followed by Late Basic Cone-Sheets). (O.T.C)

Other time-relationships of the Early Basic Cone-Sheets are summarized in (Figure 35), which, among other things, shows the sheets traversing, undisturbed, the Loch Spelve Anticline and the agglomerate-masked margin of the early caldera (cf. one-inch Map and (Plate 5), p. 165). There is no more impressive exposure bearing upon this point than is afforded by the head-waters of Abhuinn an t-Stratha Bhàin, between north Beinn Bhearnach and Dùn da Ghaoithe, where lenticles of baked fossiliferous Lias limestone can be seen with vertical bedding cut abruptly across by much less highly inclined basalt and dolerite sheets. The same point is well-illustrated again in the more accessible sections of Creagan MOT., east of Loch Spelve (Càrn Bàn Section, (Figure 25), p. 174). Here, two massive unbroken dolerite-sheets, dipping 45°–60° to west or south-west, cut through shattered Tertiary lavas and Mesozoic sediments, which, standing up on end, strike north and south. Moreover, between these two localities, close observation and detailed mapping reveal the continuous existence of the north-east limb of the Loch Spelve Anticline, with Tertiary and Mesozoic rocks steeply inclined towards the north-east; whereas the landscape of the district is determined by Early Basic Cone-Sheets steeply inclined towards the south-west.

Another feature of (Figure 35) which calls for comment is the clear fashion in which the Early Basic Cone-Sheets cut through the agglomerates of the Sgùrr Dearg district (Chapters 15 and 16). This relationship holds from Sgùrr Dearg to Beinn Chreagach Bheag in the north-west, and to Creach Beinn in the south-west. It is not only that the sheets again and again cut actual agglomerate in this region, but also they are often found in an unbroken condition separated by shattered bands and lenticles of such rocks as Moine gneiss, Trias sandstone, Tertiary lava, and Tertiary granophyre.

The immunity to shattering so commonly exhibited by the Early Basic Cone-Sheets occasionally fails. In the Lussa River and the neighbouring slopes of Beinn Bhearnach, south of Sgùrr Dearg, the sheets are somewhat broken, and are veined with epidote, as is so frequently the case with lavas in Central Mull. Indeed their sheet-nature would be difficult to realize, were it not that there are many exposures of lenticles of the Torness Felsite which here serves as country-rock. Actual breaking up of Early Basic Cone-Sheets to yield agglomerate has not been noted anywhere in Mull; but it is certain that the explosions, which followed the consolidation of the Ben Buie Gabbro west of Loch Ardeglais (Chapter 22), must be of later date than the main mass of sheets now under consideration.

(Figure 35) shows a few Acid Cone-Sheets cut by Early Basic Cone-Sheets. This is a relation very commonly met with, but, as pointed out in Chapter 19, there is no evidence for a definite time-separation between the Early Acid and the Early Basic Cone-Sheets.

It seems, rather, that most of the more prominent intermediate and acid cone-sheets of Mull were intruded during the earlier phases of the Early Basic Cone-Sheet period. This association of basic, intermediate, and acid in one long period, combined with the frequent combination of basic margins with acid or intermediate interiors, makes it fairly certain that some of the Early Basic Cone-Sheets must be olivine-free basic or sub-basic rocks of the types which characterize the Late Basic Suite of Chapter 28. Be this as it may, the field-observer soon realizes the validity of the general rule that Early Basic Cone-Sheets in Mull are olivine-dolerites, often of considerable thickness and exposed in craggy scarp faces, as in Creach Beinn; whereas, Late Basic Cone-Sheets are olivine-free basic to sub-basic rocks of finer texture, apt to be individually thin and to cover themselves beneath long slopes of scree, as in Beinn Talaidh. In bulk, the two suites have a somewhat different distribution—the Late Basic Cone-Sheets fall within the horse-shoe outcrop of the Early Basic

Suite, but there is a sufficient overlap to allow of countless intersections of the Early by the Late.

While there is abundant evidence that the main folding-movement, which centred about the south-eastern caldera of (Plate 5) (p. 165), was completed before the introduction of the Early Basic Cone-Sheets, there is good reason to believe that the subsidence of the north-western caldera, ringed round by the obviously more recent Loch Bà. Felsite of Chapter 22, was developed, if not initiated, at a later stage. (Figure 36) shows what appears to be a pronounced displacement of the outcrops of two particularly large Early Basic Cone-Sheets where they encounter the Loch Bà Felsite. These two sheets are the gabbros, or coarse dolerites, of Beinn Chreagach Mhòr and Bheag respectively. The reason why the evidence is somewhat inconclusive is that exposures of the gabbros in the critical region are much obscured by later sheets and morainic drift. The details are as follows:

1. At the summit of the hill from which it takes its name, the Beinn Chreagach Mhòr sheet is about 200 ft. thick, and is a coarse black-and-white gabbro. Elsewhere, it is generally not so thick, and is a fine-grained dark gabbro. Its outcrop is easily traced downhill into Glen Forsa, along the line shown in (Figure 36), until the alluvium (see one-inch Map) is reached. Then, inside the Loch Bà Felsite dyke, there occurs a lenticle of the same type of dark gabbro between minor cone-sheets in a small tributary burn that drains from the east into Glen Forsa; another lenticle is met with in the main river; while others again (coarse-grained and black-and-white) appear in the Gaodhail River that enters the glen from the west. Of these exposures, only the small lenticle in the eastern tributary is important from the point of view of deciding whether or no a shift of outcrop occurs at the Loch Bà Felsite.
2. The coarse dolerite of Beinn Chreagach Bheag runs, as a line of crag, down to the bottom of Glen Forsa to end abruptly in a little cliff just where neighbouring exposures show that the Loch Bà Felsite lies concealed beneath moraine. There is nothing to suggest a direct westward continuation of the dolerite once the dyke is crossed; whereas, about 300 yds. down the glen, near the southern end of a ruined village named Corrachadh, bare rock of the Beinn Chreagach Bheag character can be followed as a low ridge, 400 yards long, leading away from the Loch Bà Felsite until lost sight of beneath alluvium.

Convenient exposures

All that remains, before turning to the petrology of the group, is to indicate a few sections of interest which do not happen to have been mentioned in preceding paragraphs:

1. Coire Bearnach, approached from the road that skirts the northern termination of Loch Spelve, supplies very good exposures of cone-sheets in gneiss.
2. A section showing typical cone-sheets with well-exposed chilled margins is afforded near the road just mentioned, westwards for some little distance from Rudh' Àird a' Chaoil. E.B.B.
3. An excellent coast and road section is met with east of Glenbyre Farm, on Loch Buie. In the same district, an unusually thick and gently inclined dolerite sheet (Beinn Chàrsaig) is regarded as belonging to the suite. G.V.W.
4. Stream-sections show dark dolerite-sheets cutting pale Derrynaculen Granophyre on the north face of Glen More, and are particularly diagrammatic on account of the colour-contrast. (C.T.C)

Petrology

The Early Basic Cone-Sheets are represented by about 80 slides in the collection. They are on the whole a very uniform assemblage of non-porphyrific olivine-dolerites with ophitic lilac-coloured augite.

Only two Early Basic Cone-Sheets have furnished examples of fresh olivine. These are the most massive -sheets of the group, the Beinn Chreagach Mhòr Sheet ([S16448](#)) [NM 6316 3905], on the north side of the Mull centre, and the Beinn Chàrsaig Sheet ([S14916](#)) [NM 5562 2376], on the south. Elsewhere, olivine has been converted, probably in large measure by posterior pneumatolysis, into chlorite and serpentine.

The felspar is zoned labradorite. The augite is of the purplish titaniferous variety, but is generally paler than that of the lavas (Chapter 10); in fact, strongly tinted augite is exceptional ([S18975](#)) [NM 6878 2844].

In several of the examples, there are interspaces filled by chloritic and serpentinous products. In others, a distinct acid mesostasis is discernible ([S18962](#)) [NM 7006 3123], ([S18964](#)) [NM 6982 3127], and the containing rock becomes practically a quartz-olivine-dolerite, allied in structure and composition to the more basic products of the differentiation-series discussed in Chapter 30. More acid types are represented in the collection, but before considering them it will be well to say a few words concerning the structure of the predominant and more thoroughly basic varieties.

Main type

As a rule, the structure displayed by these rocks is a variant of the ophimottled type already referred to as characteristic of a great proportion of the Plateau Basalts (Chapter 10). Of the three chief minerals, augite, felspar, and olivine, the felspar has had the most extended time-range of crystallization: for, starting in company with augite, it finished in company with olivine. The result is a separation of augite-felspar aggregates from surrounding felspar-olivine aggregates ([S15559](#)) [NM 6974 3089], ([S16448](#)) [NM 6316 3905], ([S18965](#)) [NM 6918 3104], ([S18968](#)) [NM 6864 3098].

The relatively early date of the augite is obscured by its almost complete refusal to exhibit crystal-boundaries. Zonal growth is shown by a marked deepening of the purple tint of the augite towards its irregular margins. Commonly the early formed augite-felspar crystallizations occur in clusters, and in such cases the zonal coloration of the augite is in relation to the margin of the cluster as a whole.

The felspar often changes its type of development from the central portions of the augite-felspar aggregates towards the margin of the aggregates, or towards the felspar-olivine areas beyond. The central felspar-growths tend to be skeletal and sometimes rudely radiate ([S15637](#)) [NM 5721 2785], ([S18965](#)) [NM 6918 3104]. They are, in some measure, a converse of the cervicorn growth of augite in felspar-crystals, characteristically developed in many of the sub-basic rocks of Mull (Chapters 28 and 30). Wherever a felspar can be traced outwards towards, or across, the margin of an augite-aggregate, it not infrequently shows a marked increase of width, while the felspars of the felspar-olivine areas occur for the most part in well-formed lath-shaped crystals.

The olivine varies considerably in form and in its relation to associated felspar. It may be hypidiomorphic, but not infrequently definitely ophitic. The only important accessory is titaniferous magnetite, which occurs as skeletal growths, sometimes earlier than the augite, but perhaps more often of later formation.

The above remarks cover most of the examples from a typical roadside collection made between Ardachoil and Ardura Farms on Loch Spelve ([S18962](#)) [NM 7006 3123], ([S18963](#)) [NM 6996 3124], ([S18964](#)) [NM 6982 3127], ([S18965](#)) [NM 6918 3104], ([S18966](#)) [NM 6907 3105], ([S18967](#)) [NM 6869 3105], ([S18968](#)) [NM 6864 3098], ([S18969](#)) [NM 6843 3105], ([S18970](#)) [NM 6819 3012], ([S18971](#)) [NM 6831 2942], ([S18972](#)) [NM 6847 2913], ([S18973](#)) [NM 6852 2899], ([S18974](#)) [NM 6840 2884], ([S18975](#)) [NM 6878 2844], ([S18976](#)) [NM 6874 2844], ([S18977](#)) [NM 6869 2846], ([S18978](#)) [NM 6861 2853], ([S18979](#)) [NM 6855 2857]. Two specimens, however, call for attention. One ([S18974](#)) [NM 6840 2884] introduces to our notice a subordinate porphyritic type; the other ([S18963](#)) [NM 6996 3124] a sub-basic type. There is no conclusive evidence to show that these two particular rock-specimens belong to the Early Basic Cone-Sheets, although their position, far from any recognizable development of Late Basic Cone-Sheets, makes it extremely probable. In the following descriptions, closely allied petrographical material has been employed, collected from other localities where there is little or no uncertainty regarding the age-relationships of the sheets concerned.

Porphyritic type

Dr. Clough has shown that there is a development of porphyritic Early Basic Cone-Sheets in the time-interval that separates the intrusion of the Ben Buie and Corra-bheinn Gabbros. These porphyritic rocks are typically represented by sheets ([S16381](#)) [NM 5893 2723], ([S16392](#)) [NM 5978 2712], which cut the main outcrop of Ben Buie Gabbro, and by others ([S17407](#)) [NM 6495 2795], ([S17408](#)) [NM 6498 2794], ([S17409](#)) [NM 6511 2791], which traverse the satellitic mass in Coire na Feòla. It is unnecessary to enter into detail, since these porphyritic types are petrologically identical with

the porphyritic Central Mull lavas described in Chapter 10, except that their texture is distinctly coarser than is usual in the case of extrusive rocks. Sections show abundant small phenocrysts of very basic plagioclase feldspar, marginally zoned, in a coarse granular base of olivine (as pseudomorphs), hypidiomorphic augite, and feldspar. Olivine and, less frequently, augite are sometimes associated with the feldspar in glomero-porphyritic aggregates.

Sub-basic types

The roadside exposure of Early Basic Cone-Sheets, between Ardachoil and Ardura farmsteads, shows how intimate is the connexion between the normal olivine-rich type and the sub-basic type that has quartz-dolerite affinities. One example [\(S18976\)](#) [NM 6874 2844] showing augite-feldspar aggregates, followed by feldspar-olivine additions, has, locally, a mesostasis of the type common in quartz-dolerites, though in this case the texture is too fine for detailed interpretation. Two other examples from the same series [\(S18962\)](#) [NM 7006 3123], [\(S18964\)](#) [NM 6982 3127] show a more pronounced separation of acid mesostasis that is evidently, in large part, composed of quartz and alkali-feldspar. These examples of Early Basic Cone-Sheets are less rich in olivine than usual, and their augite is not so highly coloured. The order of crystallization of their constituents, also, departs slightly from that normally observed in these rocks, for the augite and basic feldspar continued to grow to a considerable extent after the formation of olivine had ceased, and hence there is no tendency for olivine to concentrate near the interstices occupied by the acid mesostatic material.

Three specimens [\(S16361\)](#) [NM 6018 2553], [\(S16365\)](#) [NM 5984 2561], [\(S16366\)](#) [NM 6025 2559] from the foot of Ben Buie, almost certainly belonging to the pre-gabbro suite of cone-sheets, afford examples of transition between quartz-dolerite and craignurite. It is particularly interesting to note in them an important development of columnar augite in connexion with their mesostasis. As noted in the craignurites (Chapter 19), many of these columnar augites have a core, now preferentially replaced by hornblende, which, no doubt, originally consisted of either enstatite-augite or a rhombic pyroxene.

An example [\(S18963\)](#) [NM 6996 3124], already mentioned, from the Ardachoil-Ardura road-section, is similar to some of the Late Basic Cone-Sheets of Chapter 28, and will be referred to later in connexion with them as affording a connecting link between the ordinary Talaidh Type of quartz-dolerite and the variolitic type of Cruachan Dearg (p. 304). E.B.B.

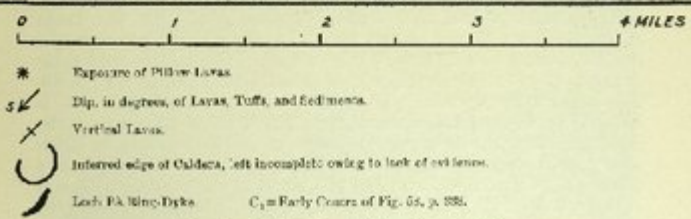
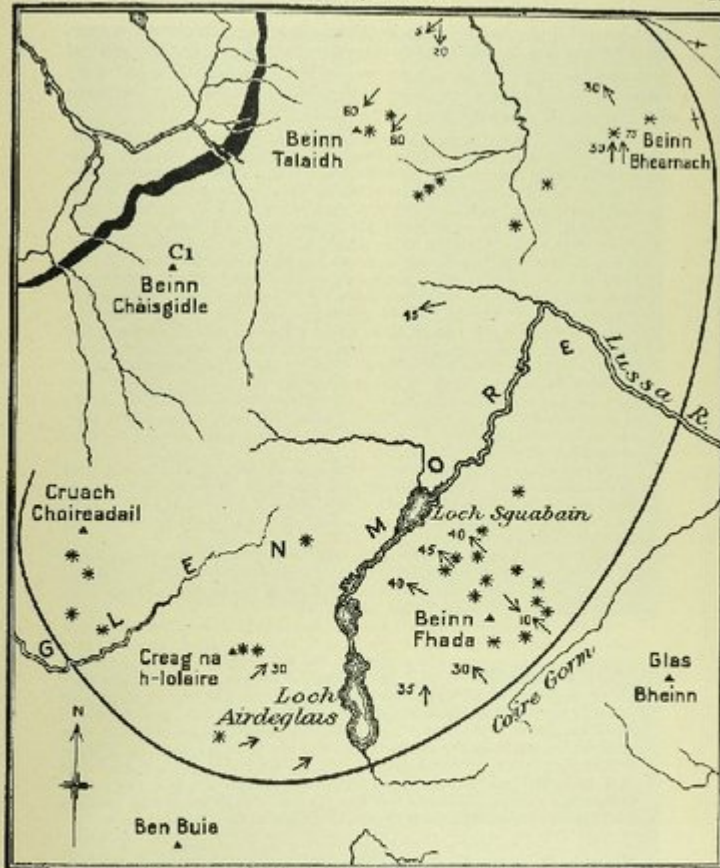
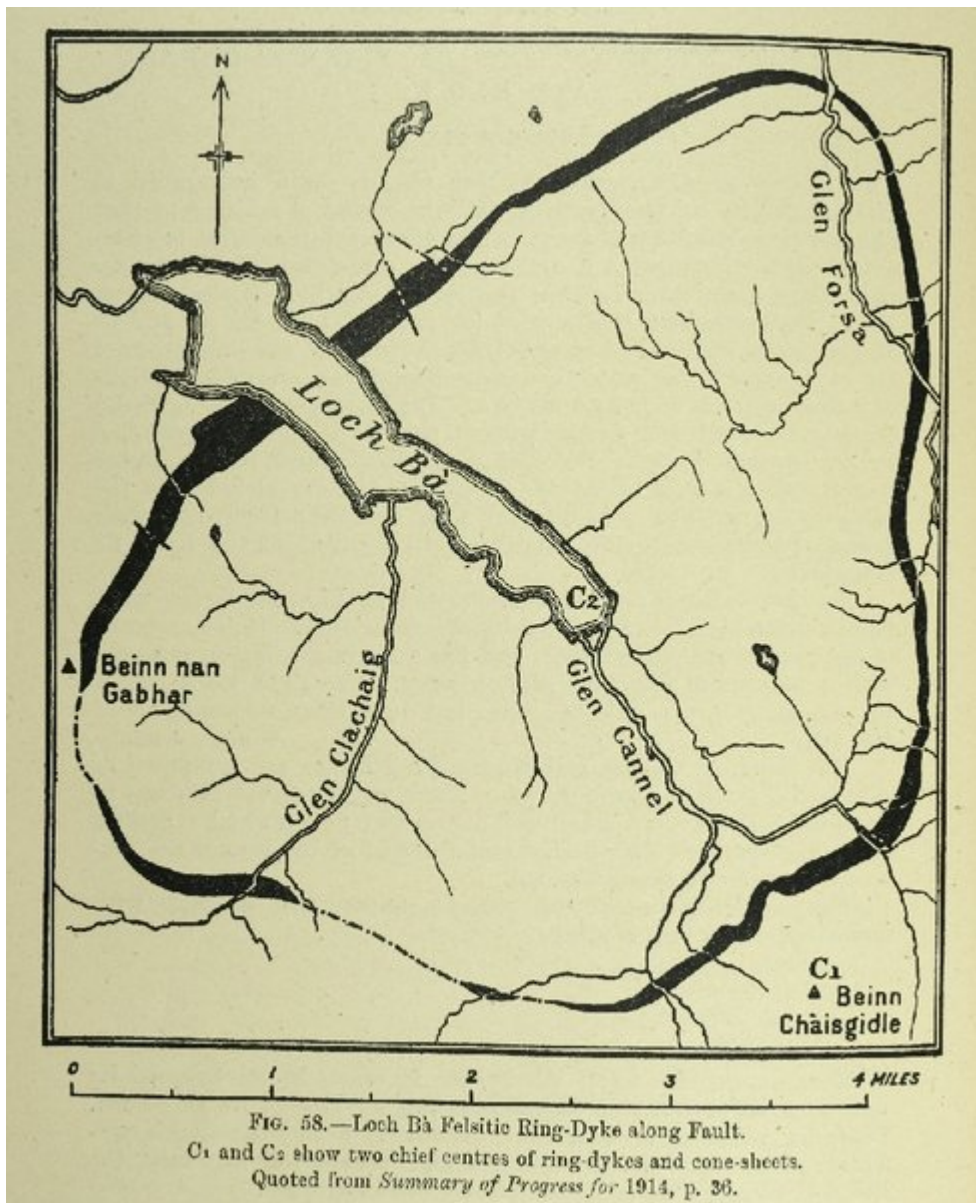
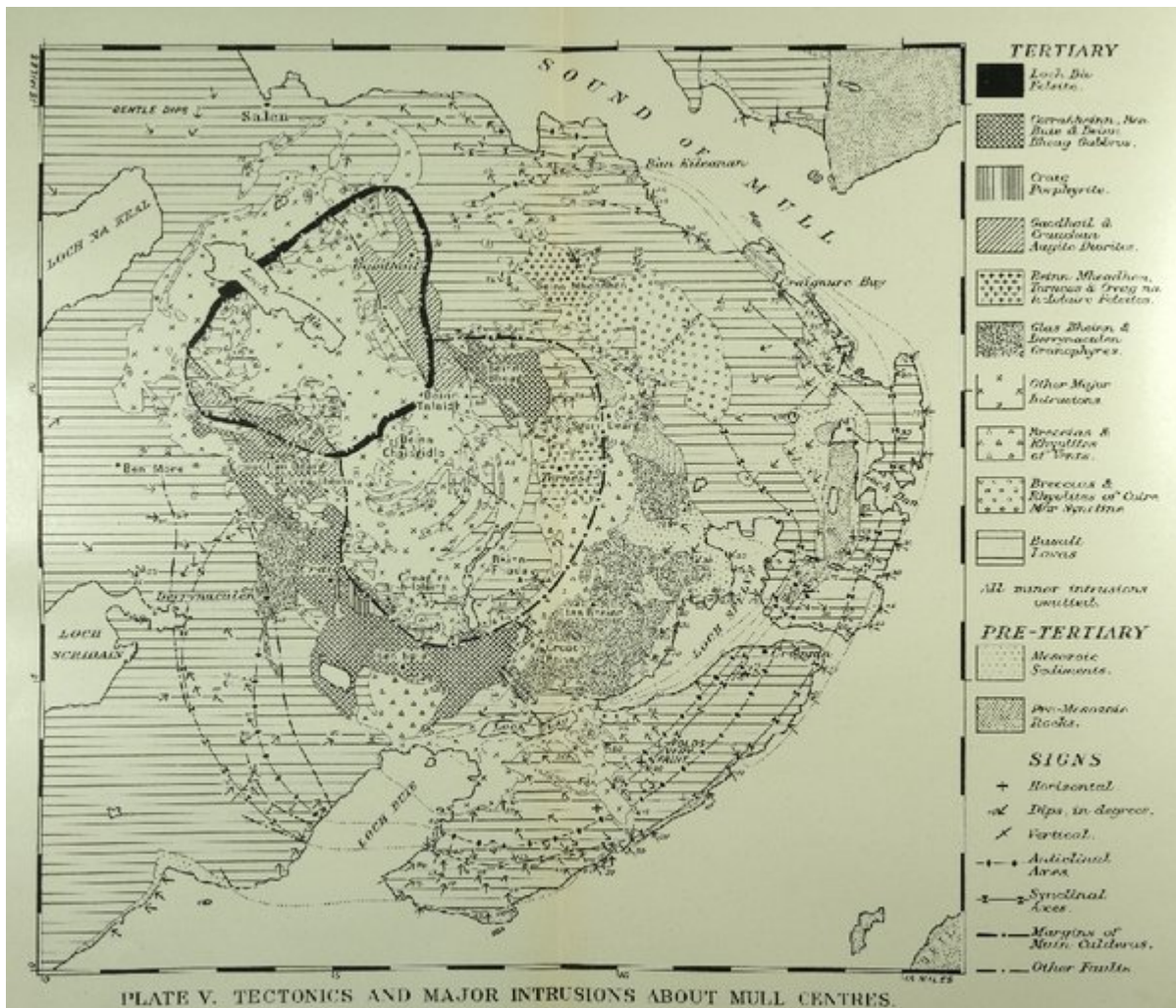


FIG. 18.—Distribution of Pillow-Lavas, Mull.
 Quoted from 'Summary of Progress for 1914,' p. 40.

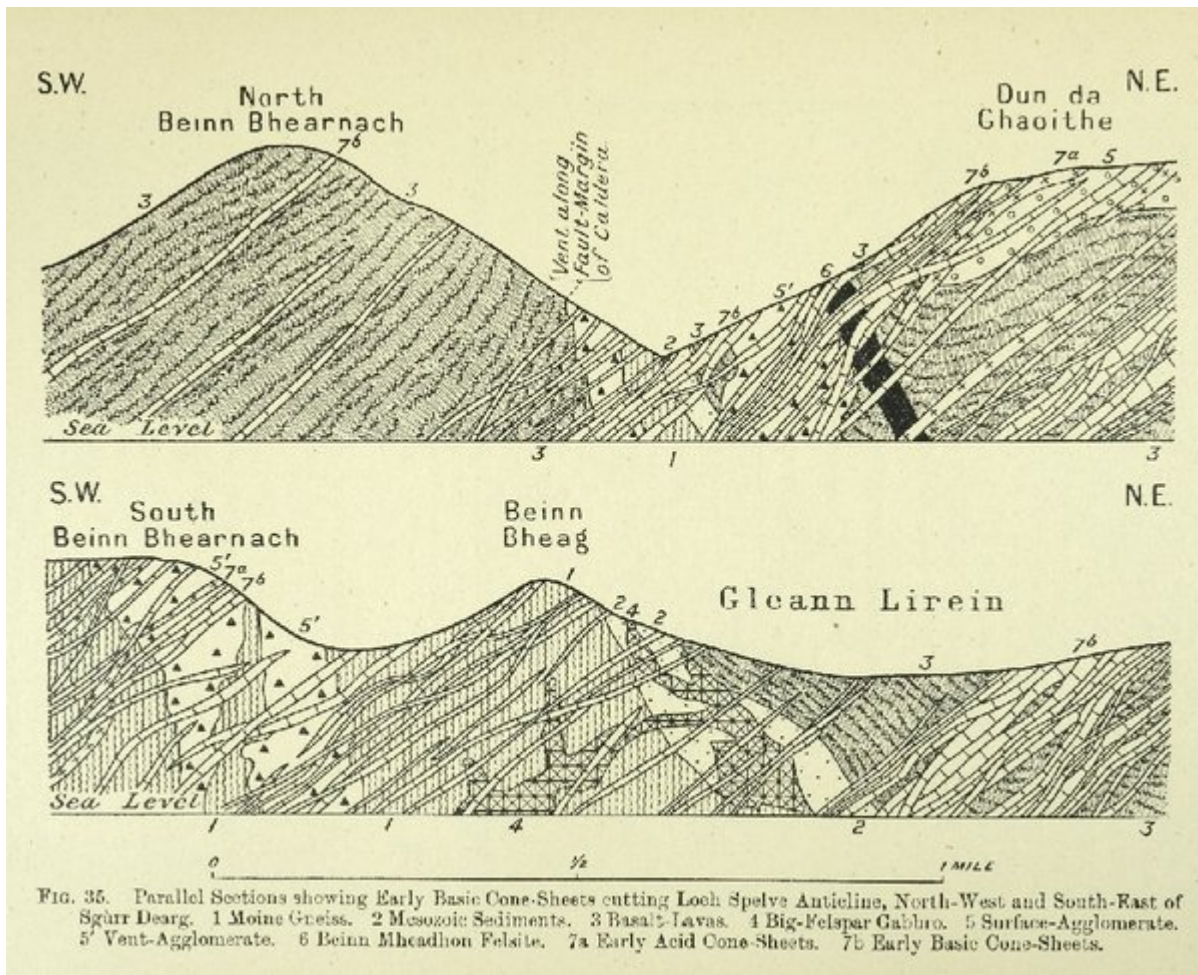
(Figure 18) Distribution of Pillow-Lavas, Mull. Quoted from Summary of Progress for 1914, p. 40.



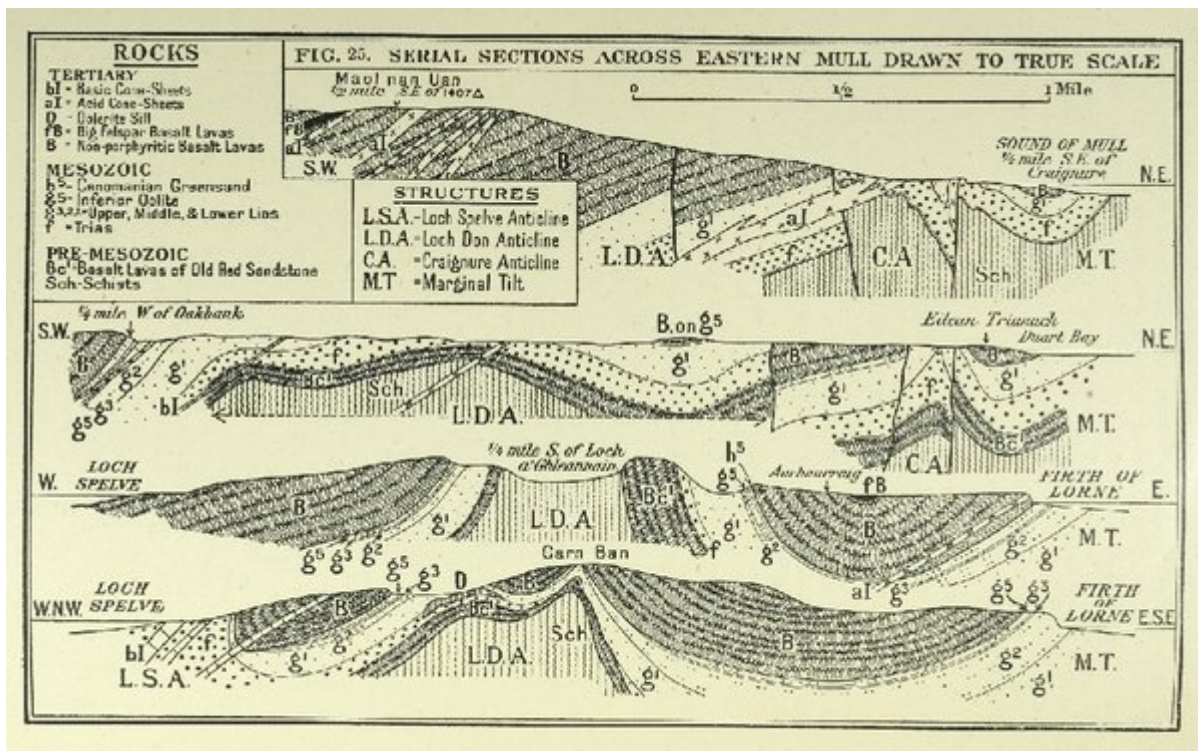
(Figure 58) Loch Bà Felsitic Ring-Dyke along Fault. C1 and C2 show two chief centres of ring-dykes and cone-sheets. Quoted from Summary of Progress for 1914, p. 86.



(Plate 5) Map showing calderas, major intrusions, and folds

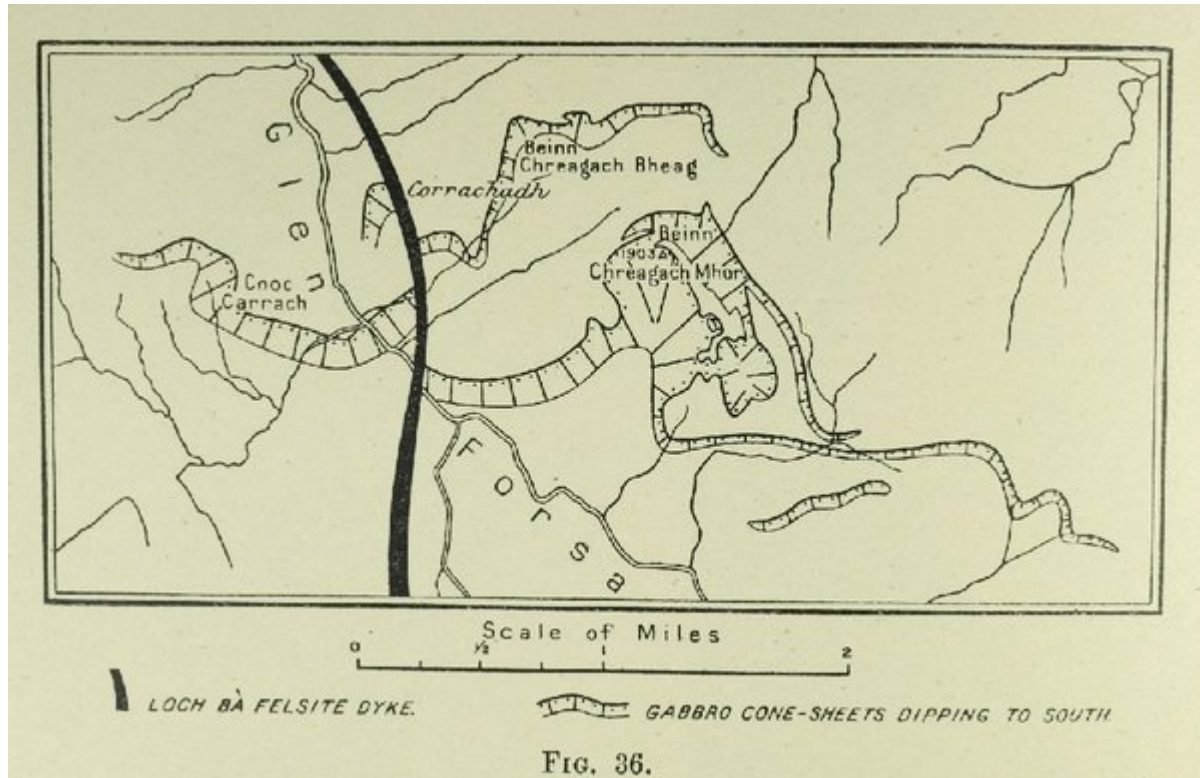


(Figure 35) Parallel Sections showing Early Basic Cone-Sheets cutting Loch Spelve Anticline, North-West and South-East of Sgùrr Dearg. 1 Moine Gneiss. 2 Mesozoic Sediments. 3 Basalt-Lavas. 4 Big-Felspar Gabbro. 5 Surface-Agglomerate. 5' Vent-Agglomerate. 6 Beinn Mheadhon Felsite. 7a Early Acid Cone-Sheets. 7b Early Basic Cone-Sheets.



(Figure 25). Serial sections across Eastern Mull drawn to true scale. Rocks, Tertiary: bl = Basic Cone-Sheets al = Acid Cone-Sheets D = Dolerite Sill fb = Big Felspar Basalt Lavas B = Non-porphyrritic Basalt Lavas. Mesozoic: h⁵ =

Ceitomanian Greensand g^5 = Interior Oolite $g^{3,2,1}$ = Upper, Middle & Lower Lias f = Trias. Pre-Mesozoic: Bc^1 = Basalt Lavas of Old Red Sandstone; Sch = Schists. Structures: L.S.A. = Loch Spelve Anticline. L.D.A. = Loch Don Anticline. C.A. = Craignure Anticline M.T. = Marginal Tilt.



(Figure 36) Early Basic Cone-Sheets of Beinn Chreagach Bheag and Beinn Chreagach Mhòr probably displaced at Loch Bà Felsite.