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## Chapter 12 Early granophyres

### Introduction

An account will now be given of three important granophyre-intrusions lettered oG on the one-inch Map, Sheet 44. They lie outside the margin of the south-eastern caldera of Central Mull (Plate 5).

The two first occur close together, between the margin of the caldera and Loch Spelve, and may be grouped under one name—the Glas Bheinn Granophyre. The remaining mass occurs near the western end of Glen More and is known as the Derrynaculen Granophyre.

A fluxion-rhyolite, seen on the foreshore near Bànn Eileanan on the Sound of Mull, is also dealt with. Like many other felsites, it is lettered F on Sheet 44.

The subject-matter will be discussed under three headings:

1. The field-relations of the intrusions.
2. Their possible connexion with the arcuate fold-system which surrounds the south-eastern caldera of (Plate 5); the folding itself is considered in detail in Chapter 13.
3. Petrology.

### Field-relations

#### Glas Bheinn Granophyre

(Plate 5) and the one-inch Map, Sheet 44, show quite clearly the position of the two main outcrops of the Glas Bheinn Granophyre, separated, along the course of the Lussa River, by a tract of sandstone referable to the Trias.

Throughout the greater part of its extent the granophyre is so invaded by dolerite-sheets belonging to the Early Basic Cone-Sheet assemblage (Chapter 21), that its outcrop is reduced to a multitude of discontinuous strips and lenticles which are reproduced in somewhat diagrammatic fashion on the one-inch Map. The only considerable exposures free from such interruptions occur near the Loch Spelve road in the neighbourhood of Maol Odhar and Cnoc na Faoilinn.

Most of the masses mapped as Glas Bheinn Granophyre are of one general type: a normal granophyre intensely crushed. In Maol Odhar, where the granophyre can be most conveniently examined, the crushing is less pronounced than usual.

In the Cnoc na Faoilinn neighbourhood, the Glas Bheinn Granophyre is seen to be a complex, though this is, so far as is known, of quite local significance. (Figure 24) shows that what is generalized as granophyre in Sheet 44 includes, at this place, a porphyritic felsitic-looking rock which the microscope proves to be inninmorite. West of the Cnoc na Faoilinn Inninmorite, the Glas Bheinn Granophyre is perfectly normal in composition; east of it, it is distinctly more basic than usual: It would seem probable that one is dealing here with a complex of three intrusions, all of them crushed and of manifestly early date.

The crushing which so constantly affects the Glas Bheinn Granophyre equally characterizes the associated Moine gneiss and Triassic sandstone. The granophyre does not show satisfactory contacts with Tertiary lavas; but the crushing does not betoken Pre-Tertiary age, for it extends very definitely into the lava-area, as in Killeen on the east side of Loch Spelve.

The Tertiary date of the Glas Bheinn Granophyre is established on the strength of field-evidence supplied by exposures along a little stream, which drains past Seanvaile Cottage into Camas an t-Seilisdeir on Loch Spelve. About 300 yds. up from the road, there are excellent exposures of a permeation-zone connecting the Glas Bheinn Granophyre with the sandstone of the neighbourhood. The correlation of the Loch Spelve sandstones and conglomerates with the Trias is almost a certainty; and so too is the Tertiary age of any intrusion which cuts a Mesozoic sediment in the Hebrides. In agreement with this, one may add that the petrological type of the granophyre is distinctly Tertiary. Another stream-exposure of a somewhat similar nature to that of Seanvaile lies half a mile south-west of Cnoc na Faoilinn (Figure 24). It is interesting as affording an additional example of granophyre full of foreign quartz, but it is only analogy with the Seanvaile exposure that suggests derivation of this quartz from Triassic sandstone.

The relatively early date of the Glas Bheinn Granophyre as compared with other Tertiary intrusions is shown by the following facts: the crushed granophyre passes insensibly in many exposures into mixed volcanic breccia occupying vents (p. 205); both granophyre and breccia are cut by innumerable uncrushed dolerite sheets of the Early Basic Cone-Sheet suite (p. 207); a large proportion of these early cone-sheets are in turn cut by the Bert Buie Gabbro (p. 245); the Ben Buie Gabbro is itself earlier than a host of other Mull intrusions.

The relations of the granophyre to the breccia or agglomerate of the many associated vents suggest that it owes its widespread crushing largely to explosions which opened up the vents. The agglomerate of the vents, it may be added, is, everywhere in the neighbourhood of the granophyre, very largely made up of granophyre-fragments. E.B.B.

### **Derrynaculen Granophyre**

The position of this intrusion, a couple of miles up Glen More from the head of Loch Scridain, is easily recognized on (Plate 5) (p. 165) and the one-inch Map, Sheet 44. Like the Glas Bheinn mass, the Derrynaculen Granophyre is freely cut by Early Basic Cone-Sheets, and many of these in their turn by Ben Buie Gabbro (p. 246). The main differences from the Glas Bheinn Granophyre are the general absence of crushing, and the fact that the intrusion invades the Plateau and Central Groups of the Tertiary-lava sequence of Chapter 5. (C.T.C.)

### **Bàn Eileanan Rhyolite**

Very little need be said about this rhyolite. It is exposed on the shore and in the cliff of the low raised beach south of Bàn Eileanan, where the axis of the Caignure Anticline crosses the coast-line north of Scallastle Bay on the Sound of Mull. It is characterized by irregular and contorted fluxion with an apparent anticlinal disposition. The exposures suggest that one is dealing with the top of an acid intrusion that might be expected to have considerable lateral extent a little below the surface. On the ground of difference of character, it is improbable that there is any intimate connexion between this rhyolite and a granophyre-dyke which has been traced for a couple of miles inland along the same line of strike (*cf.* one-inch Map, Sheet 44).

The rhyolite may possibly be connected in origin with the Caignure Anticline; but very little significance can be attached to this suggestion.

### **Possible connection of early granophyres and folding**

(Plate 5) shows an arcuate system of folds which characterizes south-eastern Mull. (Figure 25) and (Figure 35), pp. 174, 237, bring home the degree of disturbance connected with the development of this fold-system. A remarkable feature of the fold-system as a whole is that it centres upon an area of profound subsidence, the more southeasterly of the two calderas of (Plate 5). It seems certain therefore that the fold-system as a whole cannot be accounted for by any definitely central intrusion.

If one looks outside the inferred margin of the south-eastern caldera, one finds two suites of major intrusions which are worth considering from the point of view of the origin of the folding: on the one hand, one notes the Glas Bheinn and Derrynaculen Granophyres; and on the other hand, the Ben Buie Gabbro. The latter cannot be held to be intimately connected with the folding, for it freely cuts Early Acid and Basic Cone-Sheets, which are themselves certainly later than

the main folding-epoch (pp. 222, 236). This limits the enquiry very considerably.

In considering the case of the Glas Bheinn and Derrynaculen Granophyres, it is well to remember that the Ben Buie Gabbro may in large measure mark the site of a former extension of the granophyre-complex. Vent-agglomerate of pre-Ben-Buie age is a conspicuous feature of the country between Loch Fuaran and Gleann a' Chaiginn Mhòir, and it consists very largely of granophyre-fragments.

That the Glas Bheinn Granophyre may be intimately connected with the folding-movement is definitely suggested by its position in the heart of a very pronounced broken anticline, the Loch Spelve Anticline of Chapter 13. Its associates at the surface are almost always Pre-Tertiary rocks—Moine gneiss or Triassic sandstone. In the same way, the Derrynaculen Granophyre is found in the core of an anticline which locally brings to view a mugearite, associated with basalt of Plateau Type, from beneath a great covering of the Central Group of Lavas ( (Plate 3), p. 91).

The main uncertainty is whether the granophyre-intrusions are not of too early a date to be correlated with the folding. The Glas Bheinn Granophyre is certainly earlier than a great series of volcanic vents which opened up in its neighbourhood more or less along the line of the caldera edge ( (Figure 30), p. 204). Now these vents seem to have supplied the agglomerate which occupies the Coire Mòr Syncline (Chapter 15)—itself richly charged, with granophyre-fragments. Some may hold that the agglomerate-filling of the syncline antedates the folding that made the syncline, in which case, of course, the exposed portion of the Glas Bheinn Granophyre would seem to have consolidated before the folding commenced (p. 196). On the other hand it is suggested in Chapter 15 that certain local circumstances are more in keeping with the view that the Coire Mòr agglomerate was showered down into a synclinal hollow already formed; and this allows of the view that the granophyre as a whole and the syncline are contemporaneous.

If one adopts the conclusion that the granophyre is responsible for the folding, it is not difficult to picture the sequence of events. The granophyre may have risen from the depths in dyke-like form guided by the fracture bounding the caldera, until, on approaching the surface, it came into an environment where expansion was possible by virtue of the complex yielding of the masses constituting its walls and roofs.

## Petrology

### Glas Bheinn Granophyre

The general character of the Glas Bheinn Granophyre is represented by eight slices [\(S15053\)](#) [NM 66 32], [\(S15556\)](#) [NM 6863 3167], [\(S15557\)](#) [NM 6836 3144], [\(S15558\)](#) [NM 6836 3144], taken from the outcrop north of the Lussa River, and [\(S15063\)](#) [NM 6843 2994], [\(S15868\)](#) [NM 691 295], [\(S17416\)](#) [NM 6650 2964], [\(S17418\)](#) [NM 6643 2657] from that lying south of the river. Both outcrops seem to show the same varieties. None of the material is fresh, a feature in keeping with the relatively early date of the granophyre combined with its position well inside the Pneumatolytic Limit of (Plate 3), p. 91. The most satisfactory specimens can be gathered on the hill-face south-west of the main road at the summit of the rise, one quarter of a mile south of Ardura Farm. A slice from this locality [\(S15063\)](#) [NM 6843 2994], which may be considered typical, contains a considerable proportion of zoned labradorite-crystals fringed by micropegmatitic growths of quartz and orthoclase merging outwards into a general coarse granophyre matrix. The original ferro-magnesian minerals are augite with basal striation (salitic), and greenish-brown hornblende. Both minerals occur as ill-formed crystals moulded, as a rule, on their felspathic companions. Neither of them are acicular in habit. As accessory minerals, one may note apatite in abundance, and iron-ore; the latter includes both pyrites and magnetite, and is commonly associated with the augite. Most of the augite has been urilitized, both here and elsewhere; in fact, only one other slice of the series [\(S15556\)](#) [NM 6863 3167] shows this mineral in an unaltered condition. As regards the other slices, it may be noted that an acicular habit never becomes a strongly marked feature of the augite although it is by no means wholly wanting.

Two stream-sections, both of them close to the Loch Spelve road, have already been noted as affording exposures of marginal assimilation of foreign quartz by the Glas Bheinn Granophyre. The exposure one-sixth of a mile north-west of Seanvaile Cottage is represented by four slices [\(S17411\)](#) [NM 6803 2892], [\(S17412\)](#) [NM 6803 2892], [\(S17413\)](#) [NM 6803 2892], [\(S17414\)](#) [NM 6803 2892], and that west of the gneiss in Abhuinn Coire na Feòla by two [\(S17420\)](#) [NM 6685 2713]—[\(S17421\)](#) [NM 6685 2713]. Of these slices [\(S17412\)](#) [NM 6803 2892] may be taken as a simple type. It shows a

moderately fine-grained sandstone composed of subrounded grains which have, in many, cases, been separated by growth of alkali-felspar. There is practically no micropegmatite. In [\(S17414\)](#) [NM 6803 2892], the feldspathic growths are on a larger scale, and the quartz is relegated to the ground-mass. Often the individual grains of quartz are separated, but equally often several remain in contact furnishing little clusters. The feldspars are chiefly perthitic orthoclase with a certain amount of independent albite. In another slide [\(S17421\)](#) [NM 6685 2713], perhaps more definitely igneous, there are phenocrysts that once consisted of basic plagioclase now represented by albite and epidote.

Another slice from the granophyre-margin near Seanvaile Cottage [\(S17415\)](#) [NM 6798 2843], a third of a mile south-west of the cottage, strongly suggests a final stage of incorporation of the neighbouring sandstone. The rock is exceedingly rich in quartz, but most of this mineral is in definite, though simple, micrographic relationship with orthoclase, so that one cannot be certain of its elastic origin. In keeping with the richness in quartz, one notes that augite has been displaced by hornblende and biotite. The hornblende is strongly pleochroic brown and green, the biotite brown and yellow. Both minerals occur in irregular plates and are often intergrown. Early crystals of basic plagioclase also occur,

Attention has been directed to two minor subdivisions which are locally separable from the main mass of the Glas Bheinn Granophyre at Cnoc na Faolinn, above Loch Spelve (Figure 24). Each of these subdivisions is represented by three slices, the outer, lying to the west of the 355 ft. cairn, by [\(S15064\)](#) [NM 673 277], [\(S17061\)](#) [NM 6745 2770], [\(S17063\)](#) [NM 6728 2714], the inner by [\(S15869\)](#) [NM 673 277], [\(S17062\)](#) [NM 6681 2723], [\(S17417\)](#) [NM 6737 2776]. The outer or more easterly Cnoc na Faolinn intrusion approaches closely to the normal Glas Bheinn Type but it appears to be richer in labradorite, and might perhaps be better styled a quartz-augite diorite, with hornblende quite subordinate. A fair proportion of the augite, now wholly uralitized, crystallized simultaneously with the basic plagioclase in graphic intergrowth.

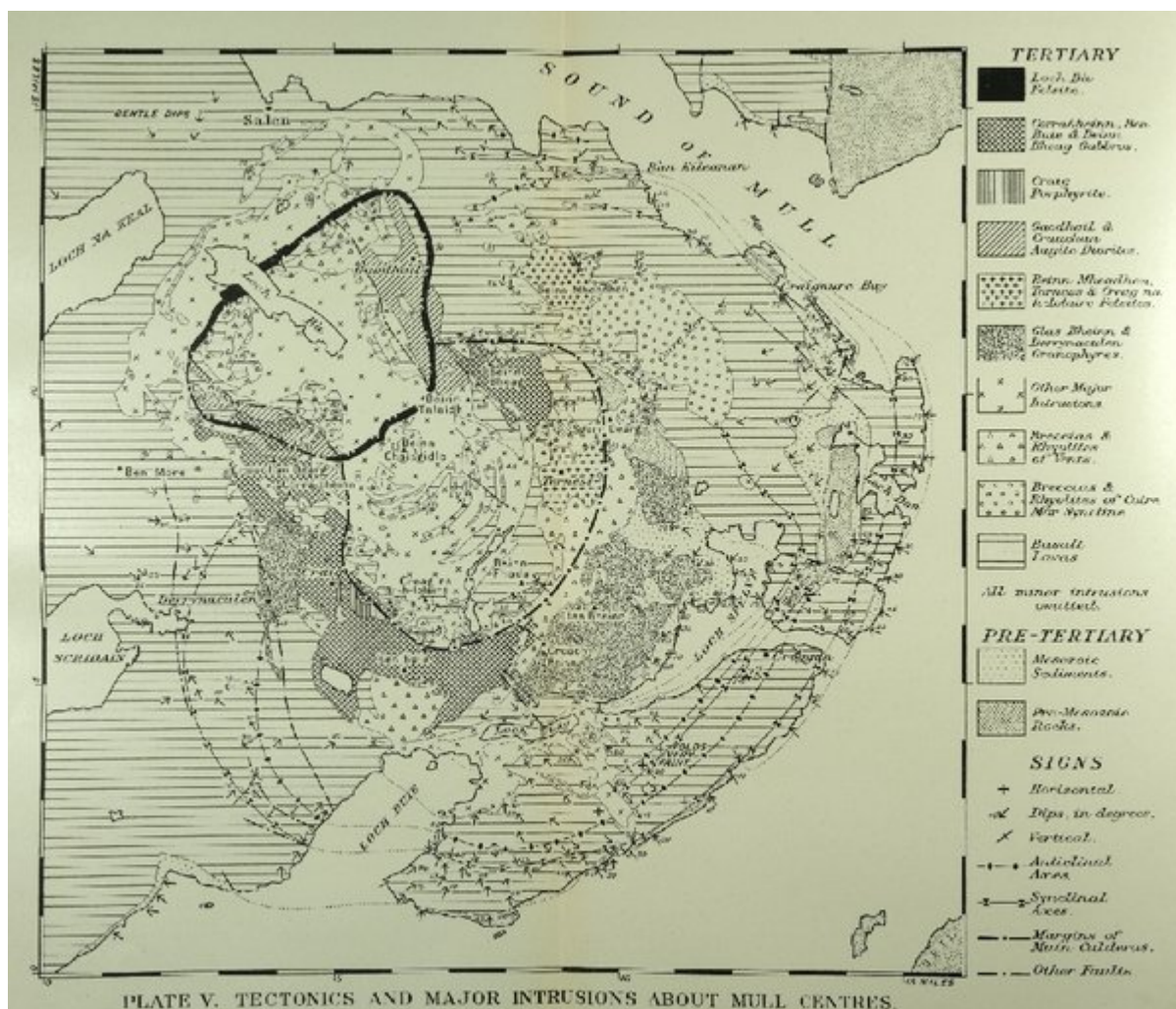
The inner Cnoc na Faolinn intrusion is a rather acid inninmorite (p. 282).

### **Derrynaculen Granophyre**

The Derrynaculen Granophyre of the Glen More District is represented by seven slides [\(S15612\)](#) [NM 5740 2934], [\(S15613\)](#) [NM 5713 2975], [\(S15614\)](#) [NM 5709 2979], [\(S15615\)](#) [NM 5725 2995], [\(S15616\)](#) [NM 5744 2922], [\(S15617\)](#) [NM 5698 3021], [\(S15649\)](#) [NM 5691 3025]. Here again the material shows considerable alteration of the pneumatolytic type resulting in the uralitization or ehloritization of the augite. Magnetite accompanies these secondary products and some of it is clearly secondary. In [\(S15612\)](#) [NM 5740 2934], contact-alteration by the Ben Buie Gabbro has produced aggregates of biotite and iron-ore in place of the pneumatolytic products. The Derrynaculen Granophyre is evidently a fairly homogeneous mass. It differs from the Glas Bheinn Granophyre mainly in showing a greater tendency to acicular structure as regards its augite pseudomorphs and lath structure as regards its feldspars. It is a granophyre of crainuritic affinities and in composition and in general character agrees well with the analysed specimens [\(S15550\)](#) [NM 7167 3731], [\(S16803\)](#) [NM 7167 3731] described on p. 226.

### **Ban Eileanan Rhyolite**

This little intrusion north of Scallastle Bay, on the Sound of Mull, is illustrated by the slide [\(S16465\)](#) [NM 6746 4092], which shows clearly the fluxion-structures so characteristic of the intrusion in the field. The ground-mass of the rhyolite was evidently glassy at the time of its consolidation. It is now devitrified, yielding cryptocrystalline aggregates and fairly definite little crystal-patches consisting in the main of alkali-felspar. Small well-shaped pseudomorphs in chlorite and calcite after augite are common, and minute strings of iron-ore probably represent needles of the same material. An interesting feature is the occurrence of little xenoliths of soda-granophyre and, less frequently, of fine-grained basalt. E.B.B.



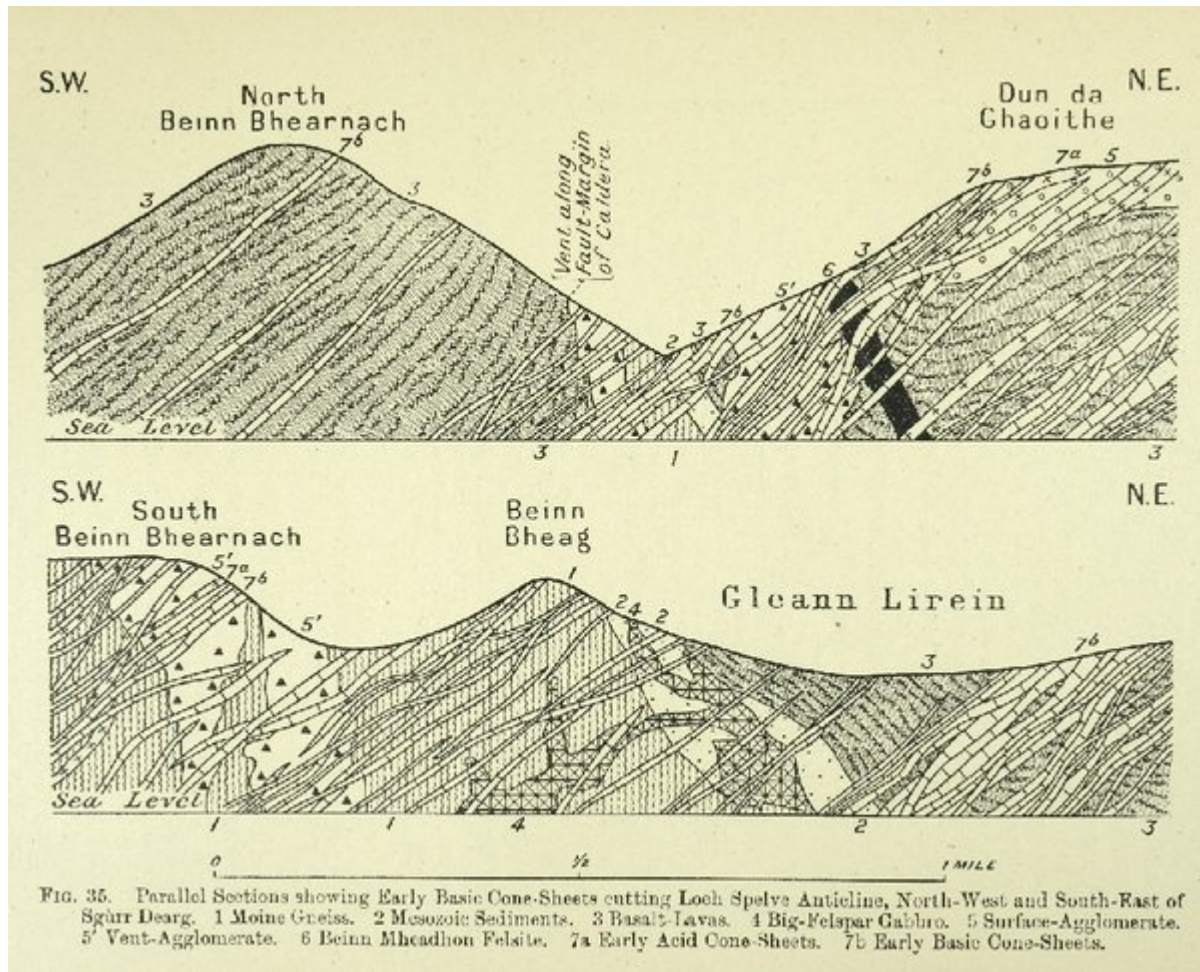
(Plate 5) Map showing calderas, major intrusions, and folds







(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-porphyrific Basalt Lavas. Mesozoic: h<sup>5</sup> = Ceitomanian Greensand g<sup>5</sup> = Interior Oolite g<sup>3,2,1</sup> = Upper, Middle & Lower Lias f = Trias. Pre-Mesozoic: Bc<sup>1</sup>=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 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.







breaks down to Agglomerate in stream just south of map. F. Glas Bheinn Granophyre breaks down to Agglomerate; also small patch of Trias Conglomerate 30 yards within Vent. G. Glas Bheinn Granophyre breaks down to Agglomerate; the dips show inclination of Shale bedded in Agglomerate. H. Glas Bheinn Granophyre breaks down to Agglomerate or Breccia with associated Shales. I. Small outcrop, or large boulder, of Big-Felspar Gabbro breaking down to Agglomerate. J. Trias Conglomerate, perhaps a boulder in Agglomerate. K. Bedded quartzose Breccia of Agglomerate period; dip steep and irregular.