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## Chapter 13 Rocks of Lower Old Red Sandstone age "Granite" Complex of Etive

### Introduction

We continue to employ the convention that "granite" between inverted commas includes quartz-diorite as well as granite as understood by petrographers. The Etive "Granite" Complex (8, (Figure 18), p. 129) is one of the largest of its kind in Scotland. It reaches from the tributaries of Glen Coe — or from Glen Coe itself if we include the Fault-Intrusion — south-west to the right-angle bend of Loch Etive [NN 000 330]. Its length is about 18 miles, its breadth about 10. Much the greater part lies in Sheet 45 (Geol.) to the south of Sheet 53. Sheet 45 covers not only Loch Etive [NN 000 330], but also Ben Cruachan [NN 0696 3046], Ben Starav [NN 125 427] and Beinn a' Bhuidh [NN 093 283], names that will recur in the sequel. Kynaston had the privilege of mapping almost the whole complex, and his final descriptions are to be found in the memoirs dealing with Sheet 45 (*in* Kynaston and Hill 1908, chapter 8) and Sheet 53 (*in* Bailey and Maufe 1916, chapter 9), in which he established many of the principal features of the complex.

After Kynaston left for South Africa his mapping in Sheet 53 was completed by colleagues. Thus Clough made a new point in tracing a ring-dyke of granite at Meall Odhar, separated in (Figure 19), p. 132; and he was associated with Maufe and the writer in discussion of the complex as a whole in the light of the phenomena of the Cauldron-Subsidence of Glen Coe (1909, pp. 669–675). Much later J. G. C. Anderson re-examined all the evidence in detail, and published what will be for long the standard account (1937a). He made two specially important discoveries:

1. Clough's Meall Odhar Granite, or an approximate equivalent, reappears to the west at Stob Gaibhre [NN 063 467] at the southern border of Sheet 53, and between here and Ben Cruachan occupies in irregular fashion roughly half of the area assigned by Kynaston, in a broad sense, to the Cruachan Granite ".
2. A crescent "screen" of older, often foliated, rock mapped by Kynaston at Beinn a' Bhuidh [NN 093 283] has been definitely proved to consist mainly of altered lavas, attributable to the Lorne traps. Kynaston had recognised lava affinities, but had considered the mass intrusive — probably an early member of the Cruachan suite affected by "movements which accompanied, or immediately preceeded, the intrusion of the enormous mass of the Ben Cruachan granite" (*in* Kynaston and Hill 1908, p. 101).

Anderson also confirmed evidence pointing to gravitational differentiation *in situ* (pp. 169, 170).

If we accept Anderson's correlation between the Stob Gaibhre [NN 063 467] and Meall Odhar Granites, then the Etive Complex in the main consists of three members, which in order of age are: Cruachan "Granite", in large measure quartz-diorite; Meall Odhar Granite, the most acid of the three; and Starav Granite which in the past has sometimes been called after Glen Etive or Black Mount. Taking the complex as a whole the Meall Odhar Granite is of quite subordinate bulk.

The Cruachan "Granite" is older than the north-east dykes of the Etive Swarm (p. 197), the Meall Odhar Granite is older than some, but younger than many others, and probably contemporaneous with one prominent example; the Starav Granite is younger than almost all. These time-relations were determined by Kynaston for the Cruachan and Starav members of the complex, and by Clough for the Meall Odhar member at Meall Odhar and by Anderson (1937a, p. 508) further south in Allt Brander [NN 050 283] (Sheet 45, Geol.). E. B. B.

### Cruachan "Granite"

The Cruachan "Granite", as exposed at the surface, is divisible into two portions, which are confluent, but still more or less distinct. The one extends northwards into the heart of the Glen Coe Cauldron, while the other surrounds, almost completely, the great core of Starav Granite farther south. The rock is medium-grained and carries both biotite and hornblende. In the northern lobe it is prevalently a true pinkish granite. In the southern lobe it is generally a grey quartz-diorite. H. K.

## Northern Lobe

Unusually acid varieties, consisting almost entirely of quartz and felspar, are met with at high altitudes on Aonach Mòr [NN 193 730], Clach Leathad [NN 240 493], and neighbouring mountains. Drusy cavities are abundant in some places, pointing to a particularly large proportion of occluded gas in the original magma which may quite possibly have been essentially a eutectic residue that collected in the upper part of the boss. H. K., G. W. G.

Anderson after re-examination has written as follows (1937a, p. 504). "The most acid types were found to occur on the long, north-westerly running Aonach Mòr [NN 193 730] ridge and on a parallel ridge to the south-west, immediately across Coire a' Chaolain [NN 207 470]. Mineralogically, these are very similar to the Meall Odhar type, but no evidence could be found of intrusive junctions with more basic Cruachan granite exposed on the valley floors and sides". E. B. B.

The northern lobe invades the volcanic series of Glen Coe. The intrusive behaviour of the "granite" is perfectly certain. Occasional small veins of the "granite" shoot out into the lavas, and fragments of the lavas lie embedded in the "granite". Along the western slopes of the Sant na Crèise ridge, between Clach Leathad [NN 240 493] and Glen Etive, the "granite" is seen cutting across every member of the volcanic series, from the hornblende-andesites at the top, to the rhyolites at the bottom. Everywhere the contacts are remarkably clear, and the alteration of the volcanic rocks easily demonstrable, both in the field and under the microscope. The "granite" veins are often pegmatitic at their margins, and the pegmatite sometimes shows white mica and drusy cavities. H. K.

The junction is sometimes traversed by numerous aplite veins which cut lavas and "granite" alike. G. W. G.

The margin is also generally well defined against the quartzite of Beinn Ceitlein, and is unaccompanied by any marked fringe of minor "granitic" intrusions. Rather more than a mile north-east of the top of Stob Dubh *lit par lit* injection has indeed taken place, but only to a small extent, in a thin band of semipelitic schist lying between the "granite" and the quartzite. Here, in keeping with Kynaston's observation recorded above, the thin "granitic" streaks which have gone along the foliation of the schist are of a distinctly more acid type than the normal "granite". C. T. C.

The mapping of the "granite" margin in the lava country of Lairig Gartain [NN 200 544] and the south-east slopes of Buachaille Etive Mòr [NN 210 538] is mainly due to Grabham, and shows the original roof of the "granite" mass in large measure still preserved from erosion. It is important to note that, although the upper surface of the "granite", thus in part revealed, has a somewhat steeply domed form, the lavas above show no corresponding upheaval. It is safe, therefore, to conclude that the northern lobe of the Cruachan "Granite" is not a laccolith. Further, we know of no section which reveals its base. H. B. M.

## Southern Lobe

Anderson has found that the normal grey hornblende-biotite-quartz-diorite of the southern lobe of the Cruachan intrusion shows a widespread tendency to pass upwards into more acid biotite-granite; but that the latter is somewhat irregularly distributed, and locally appears at comparatively low levels (1937a, pp. 514, 516). This passage phenomenon must not be confused with the abrupt association with possible Meall Odhar Granite, which will be discussed presently. E. B. B.

The grey quartz-diorite of the southern lobe commonly shows a faint foliation in the orientation of its constituent minerals, and of its fairly abundant, dark, flat inclusions. This foliation is approximately vertical, and runs roughly parallel with the curving outline of the intrusion. Thus in Allt nan Gaoirean [NN 130 477] the direction varies between E.S.E. and E. by S., while in Glen Ure [NN 070 475] it has turned round to E.N.E. In all probability the foliation is a flow-structure dating from a late stage in the act of intrusion; it would be very difficult to believe that the flat inclusions could have been reorientated after complete consolidation of the magma without seriously modifying the igneous texture of the main product. Similar foliation attributable to magmatic pressure is of course well known in plutons of quartz-diorite elsewhere. H. K., E. B. B.

The outer boundary in contact with altered schists is sometimes simple and well defined, but is often, on the other hand, exceedingly complex. In the neighbourhood of Beinn Fhionnlaidh [NN 100 500], to the west of Glen Etive, a rock of frequent occurrence consists of an intimate mixture of altered schist and granite, in some parts presenting a profusion of

small elongated fragments of schist embedded in a "granitic" matrix. At times, too, where the "granite" is in contact with quartzite, numerous small fragments of quartzite are distributed freely and closely in the marginal portion of the "granite". The fragments, however, are always angular and sharply defined, and show no signs of partial digestion by the "granitic" magma. The great number of inclusions of all sizes of altered schist in this area forms a striking feature of the Cruachan "Granite". H. K.

An interesting section occurs on the southern slopes of Glen Ure [NN 070 475], where the "granite" comes in contact with a small boss of black and white diorite. The black spots in the diorite are found on microscopic examination to consist of hornblende aggregates, but from the appearance of the rock it is safe to conclude that it was originally an augite-diorite, and that the hornblende is due to contact-alteration. Certainly the diorite is the earlier rock of the two, as it is traversed by veins of "granite" and pegmatite, and, more convincing still, is enclosed as numerous small blocks in the "granite"; these are well seen on a large, smooth, joint face of the granite, where they weather out as small hollows.

In Sheet 53 the complexity observed at the margin of the southern lobe of the Cruachan "Granite" has comparatively narrow limits, and does not materially affect the value of the boundary line drawn by Kynaston. Comparison of the course of this line and that of the contours shows that the boundary is a somewhat irregular, vertical, curved surface — an observation which agrees well with the vertical course of the foliation already referred to. E. B. B.

### **Relation to Etive Dyke-Swarm**

The Cruachan "Granite", Glen Coe lavas, and adjoining schists are cut by a very large number of north-east dykes, most of which are porphyrites. Such dykes occur in profusion in the district included in Sheet 53, and, though absent in the Starav Granite, are met with again, equally numerous, in Ben Cruachan itself at the southern end of the Etive Complex ((Figure 18), p. 129). The dykes everywhere present chilled margins to the rocks which they traverse. H. K.

A point of some interest is that the number of dykes found in the Cruachan "Granite" appears to fall off somewhat rapidly in the central region before the Starav Granite is reached. Much of the ground in which this decrease is suspected is somewhat heavily drift-covered, but Allt nan Gaoirean [NN 130 477] affords a capital section, and its dykes are, comparatively speaking, rather scarce. It has not been found possible, however, to separate the part of the "granite" which is cut by few dykes from that which is cut by many, and no evidence has been obtained to indicate a difference of age. This subject will be raised once more on p. 201. H. B. M., E. B. B.

Fine-grained strings of aplite are common within the Cruachan "Granite", and, except in the neighbourhood of the Starav Granite, they all appear to be older than the suite of north-east dykes. It was impossible to make out any rule in regard to their direction.

Veins of pegmatite, aplite, or micro-granite, which are probably connected with the Cruachan "Granite", are only occasionally found at a considerable distance outside its margin. There is an example on the north side of the River Etive, nearly two-thirds of a mile east of Dalness; the vein here is striking N.N.E., and is at a distance of 200 or 300 yards from the "granite" margin. Another is found about a mile east of Stob Dubh, a little to the west of a later quartz-porphyry dyke.

### **Meall Odhar Granite**

An arcuate outcrop of very acid, practically binary, granite forms a strip between Stob Dubh and Meall Odhar [NN 191 465], and may conveniently be called after the latter mountain. Its presence emphasises the individuality of the two lobes of the Cruachan "Granite" ((Figure 18), p. 129).

For half its course in its type area the Meall Odhar Granite is a marginal intrusion insinuated between the Cruachan "Granite" on the south-west and the schists on the north-east. For the other half of its course, it continues its path south-eastwards without any indication of change, although here it merely separates the two lobes of the Cruachan "Granite". The arcuate character of its course is sufficiently pronounced to mark it as a ring-dyke. It is generally between 100 and 200 yards broad, and is traceable for about 2 miles.

The Meall Odhar Granite usually weathers into bigger blocks, and disintegrates less readily, than the Cruachan "Granite". The margins are never chilled, as illustrated in a hand specimen and slice of a contact with Cruachan "Granite" ([S13764](#)) [NN 1669 4827]. In the south-east it contains rather more biotite than usual, and appears to be divided into three bands, the eastern limits of which, approaching the Starav Granite, are hidden under drift. That it is older than the Starav Granite is shown by its relations to several north-east dykes as described below.

At a point almost a mile south-east from the southern lochan on Beinn Ceitlein [NN 176 490] there are thin seams in the Meall Odhar Granite, in which the rock occurs in a finely sheared, granulitic condition ([S11498](#)) [NN 185 473]. These seams are individually about half an inch wide, and have been traced for short distances parallel to the general run of the intrusion. They lie about 25 yards in from the north-east margin. C. T. C.

A very acid granite, similar in character to that of Meall Odhar [NN 191 465] and intermediate in age between the Cruachan and Starav Plutons, occurs six miles to the west at Stob Gaibhre [NN 063 467], and continues southwards into Sheet 45. It here lies within the southern lobe of the Cruachan "Granite"; and, after some interruptions, it forms, 10 miles farther to the south, "the topmost portions of Ben Cruachan and of many of the neighbouring hills" (Kynaston *in* Kynaston and Hill 1908, p. 84). In Kynaston's opinion this pink granite "may sometimes be seen to pass imperceptibly into the normal grey granite [*cf.* p. 170], or to occur in fairly well defined bands and patches". Anderson is more precise and claims the Stob Gaibhre [NN 063 467] granite and its southward continuation "as a later intrusion... demarcated by sharp junctions" (1937a, p. 492); and he correlates it with Cough's Meall Odhar Granite. He also thinks that much of it occurs as a very irregular, lowly inclined sheet capping the Cruachan "Granite". The shape of an irregular intrusion is notoriously difficult to determine, and it seems possible that this particular intrusion may have burst up from below, and that it tends to make high ground merely because it is specially resistant to weathering — at the same time Anderson's interpretation may very well be correct.

### **Relation to Etive Dyke-Swarm**

It was during an early stage in the phase of dyke injection referred to in connection with the Cruachan "Granite" that the Meall Odhar Granite, at any rate of the type exposure, rose into position.

The majority of the north-east porphyrite dykes, that come in contact, cross it; but some are cut by it. Veins of the granite are seen, for instance, in a north-east dyke, 930 yards south-east of the south lochan on Beinn Ceitlein [NN 176 490]. This dyke is of composite character, for while the outer portions are of one type ([S11496](#)) [NN 1791 4767], the central, later part is slightly darker and more basic; but the granitic strings go into both varieties. The outer part is seen on microscopic examination to have suffered contact-alteration, which is most clearly manifested in the peculiar clouded character of many of the feldspars.

About 200 yards further east, where quartzite gives place to Cruachan "Granite" on the northern side of the Meall Odhar intrusion, strings of the latter again cut porphyrite dykes. In the same locality other small intrusions of the Meall Odhar Granite, in an uncrushed condition, occupy lines of fault which slightly displace various thin aplitic veins belonging to the Cruachan "Granite"

A little further south-east, about 1333 yards south of the above-mentioned lochan, narrow bands of pegmatite traverse the Meall Odhar Granite and the Cruachan "Granite" alike; but they may be genetically connected with the former. About 566 yards south-east of the same lochan strings of aplite and pegmatite are abundant in the quartzite on the north-east side of the Meall Odhar Granite, and have probably originated from it.

It has already been mentioned that Anderson has found evidence further south in Allt Brander [NN 050 283] (Sheet 45) of dykes which are earlier than what is taken, close at hand, to be the local representative of the Meall Odhar Granite. "Two north-north-easterly dykes", he says, "are cut by veins of acid granite and under the microscope show contact-alteration" (1937a, p. 508).

While earlier than some, and later than others, of the great Etive Swarm of north-east dykes, there is reason to believe that the Meall Odhar Granite is contemporaneous with a quartz-porphyry dyke which has been followed for 8 miles

towards the north-east until lost sight of a mile north of Beinn a' Chrùlaiste [NN 246 566]. The two are not continuous since the quartz-porphyry dyke comes to an end 300 yards north of the main margin of the aplitic granite. For the last 200 yards of its course the dyke has been running due south. Turning to the east at 40 yards distance we find another dyke ([S11499](#)) [NN 1777 4787] starting just as suddenly as its neighbour stopped. In composition, texture, width, and direction the two dykes agree, though the specimen quoted happens to be granitic; and there can be little doubt that they are in underground connection. The more easterly dyke can be traced southwards until it seems finally to coalesce with the Meall Odhar Granite, the texture of which it rather rapidly assumes. C. T. C.

The phenomenon just described of a dyke ceasing at some particular point merely to make a fresh start on a parallel line a short distance to one side is of course quite familiar. In fact the quartz-porphyry dyke dealt with in the preceding paragraph furnishes another clear example of the same kind about a mile south-west of Stob Dearg [NN 225 543]. G. W. G.

## **Starav Granite**

Only the northern edge of the Starav Granite is included in Sheet 53. The mass consists of pink quartzose granite, coarser in texture and more acid than the normal Cruachan "Granite"; it is further characterised by a marginal zone with large porphyritic feldspars, both pink and white. Scenically the Starav Granite is remarkable for the nakedness of its rock slopes. H. K.

Kynaston did not attempt to map the boundary between non-porphyritic interior and porphyritic margin, for there is a gradual transition spread over a quarter of a mile. Anderson by drawing an approximate line (1937a, fig. 2) found that the non-porphyritic interior lies well to the north-east of the centre of the Starav Pluton. He showed that the width of the porphyritic edge varies from half a mile in Sheet 53 to 3½ miles in Sheet 45. A similar asymmetry holds in the placing of the Starav Pluton in relation to the Cruachan Pluton. E. B. B.

The margin of the Starav Granite is very simple and approximately vertical. H. K., H. B. M., E. B. B.

## **Relation to Etive Dyke-Swarm**

Before Kynaston left the Scottish Survey he had raised the question whether the Starav Granite might not be later than the majority of the great suite of north-east porphyrite dykes which cut the Cruachan "Granite", and in many cases the Meall Odhar Granite too. This question has been answered in the affirmative: it is now considered that the Starav Granite is later than most, if not all, of these dykes. Before we arrived at this conclusion we revisited several exposures. The results have been already published (Clough, Maufe and Bailey 1909, p.641), and accordingly, so far as they are concerned with localities in Sheet 45 (Geol.), they will only be dealt with in very brief abstract in the present account.

A NNE lamprophyre dyke cuts across the junction of the Starav and Cruachan Granites, and is chilled against both of them, in the bed of the River Kinglass [NN 140 360] (Sheet 45). It differs petrographically from the dykes of the great Etive Swarm, in containing purple augite, and in other characters ([S14189](#)) [NN 1511 3685]. It was at the time the only dyke known to us in the Starav Granite which could possibly be referred to this suite. Anderson has since examined another possible example, a 13-ft microdiorite in the River Liver [NN 100 349] (Sheet 45). He accepts both instances as very late members of the Etive Swarm and compares them with three very late members of the Ben Nevis Swarm, which cut the Inner "Granite" of Ben Nevis (1937a, p. 507). It is difficult to accept this conclusion in regard to ([S14189](#)) [NN 1511 3685].

It has been pointed out that there is apparently a falling off in the number of dykes cutting the Cruachan "Granite" before the Starav Granite is reached; but various sections show that this does not account for the absence of dykes in the latter. The junction of the two granites is exposed for over a quarter of a mile in Allt nan Gaoirean [NN 130 477], and whereas five dykes cut the Cruachan "Granite", none cuts the Starav. Moreover, of these five dykes, four are traversed by aplite veins. The only feature which renders this section in the least inconclusive is the presence of strong shearing along the junction of the two "granites".

Half a mile upstream from the point at which the Starav Granite and the Allt nan Gaoirean [NN 130 477] part company, two more porphyrite dykes are met with, both traversed by aplite veins. These two dykes lie between a quarter and a third of a mile outside the margin of the Starav Granite; beyond this range no instance is known of a porphyrite dyke cut by aplite, although, as already stated, the reverse relation is common. The inference is justified then that the aplite veins where they cut the porphyrite dykes have emanated from the neighbouring Starav Granite. H. B. M., E. B. B.

Similar evidence is afforded south-east of Meall Odhar in Allt Dochard [NN 203 440] (Sheet 45), which flows obliquely across the junction line. Dykes, unfortunately not shown on the one-inch map, are here abundant in the Cruachan "Granite" quite near to the Starav margin, while they are absent in the latter intrusion where hypabyssal texture, these dykes are traversed, in common with the Cruachan it in turn forms the bed of the stream. Although they consolidated with typical "Granite", by numerous aplite veins. In this case the margin of the Starav Granite is only 200 yards away. E. B. B.

The field evidence is corroborated by microscopic study of the dykes. At any rate one of those taken from the contact in Allt nan Gaoirean [NN 130 477] shows evident contact-alteration ([S14178](#)) [NN 1383 4746], and so also do two collected in Allt Dochard ([S14182](#)) [NN 1956 4565]; ([S14183](#)) [NN 1975 4556]. The same phenomenon was observed in another dyke ([S13762](#)) [NN 1504 4768] which cuts the little bit of Cruachan "Granite" exposed in Allt Ceitlein [NN 150 477], close to the edge of the Starav mass. H. B. M.

Another feature of the porphyrite dykes is confined to the neighbourhood of the Starav Granite. A very large proportion of the dykes in Allt Dochard [NN 203 440] are foliated, especially in their chilled margins. Undoubtedly the structure in this case is due to movement after consolidation, probably under conditions of high temperature afforded by the proximity of the Starav Granite. The direction of the foliation is irregular, and it may make any angle up to 45° with the alignment of a dyke. The structure has affected the phenocrysts, especially the ferromagnesian minerals, which are drawn out into long lenticles. It is generally traceable right up to the dyke margins, but is only doubtfully recognisable in the massive Cruachan "Granite" outside. This immunity of the Cruachan "Granite" does not seem to hold along the south-eastern margin of the Starav Boss, six miles further south-west. Here Kynaston reports that "in many parts of Glen Kinglass [NN 140 360], especially about Acharn, the Cruachan granite assumes a well-marked foliated or gneissic structure close to the margin of the coarser, more acid type" (*in* Kynaston and Hill 1908, p.86).

Foliation was also noticed in the Allt Ceitlein dyke, and in three of the dykes in Allt nan Gaoirean [NN 130 477]. One of these latter was practically in contact with the Starav Granite, the other two at distances of about a third and two-thirds of a mile respectively from its margin. It is important to note that the foliation of the dykes is a quite distinct phenomenon from the widespread, slight, protoclastic foliation of the Cruachan "Granite", which has already been alluded to in Allt nan Gaoirean [NN 130 477]. The foliation seen in the "granite" runs very steadily east-south-east in this district, whereas that of one of the dykes, for which a record was taken, is east and west, and of another east-north-east. E. B. B.

Other examples, from a district in which the great majority of the dykes are unaffected, occur about a mile S.S.E. of the Ordnance Station, 1731 ft, on Beinn Ceitlein [NN 176 490], that is, two-thirds of a mile from the edge of the Starav Granite. Here three thin parallel N.N.E. lamprophyre dykes of somewhat abnormal type ([S11471](#)) [NN 1838 4800]; ([S11472](#)) [NN 1835 4790] show indications of shearing, while no corresponding shearing was detected in the "granite" at their sides. The shearing crosses one dyke diagonally in a N.W. or N.N.W. direction, but close to the side becomes nearly parallel with it. The dykes cut various veins of aplite and pegmatite as well as granite.

Some rather similar sheared dykes also occur in the Meall Odhar Granite, and enclose pieces of it at a locality about 800 yards south-east by south from the lochan on the south end of Beinn Ceitlein [NN 176 490], but they are never much more than a foot thick. They show changes in direction, but strike on the average about E.N.E.

This locality lies about half a mile outside the Starav Granite. C. T. C.

## Allt Buidhe Fault

The fault shown in (Plate 4) crossing Allt Buidhe [NN 030 440] in Sheet 45 and continuing thence north-north-east to Glen Ure [NN 070 475] in Sheet 53 throws the Ballachulish Core down towards the Cruachan (plus Meall Odhar) Pluton.

It was originally mapped by Kynaston who traced it southwards to the angle of Loch Etive [NN 000 330] in a great arc, 10 miles long, corresponding roughly with the margin of the pluton (Figure 18). It seems probable that it originated as a partial ring-fault, closely associated with the intrusion of the Etive Complex. H. B. M., E. B. B.

## Mechanics of intrusion

The northern lobe of the Cruachan "Granite" seems to have invaded the Glen Coe Cauldron very shortly after subsidence *en bloc* had ceased, since it merges with the Fault-Intrusion at the east side of the Cauldron (p. 165), although it definitely cuts across the same intrusion at the west side, near Dalness.

Erosion has exposed the domed roof of this northern lobe, and shown that it consists of untilted lavas. Accordingly, it appears probable that the roof has not been bent up, but that the floor has sunk down in order to make room for the invading magma as the plutonic infilling of a subterranean cauldron (Figure 30).

The southern lobe of the Cruachan "Granite" is naturally interpreted in like fashion. Kynaston has shown that it has a steep, smooth, eastern and southern edge which may readily be interpreted as the approximate margin of a subterranean cauldron. The western and north-western boundary is locally more complex in Sheet 45, and is margined by a fringe of "granitic" tongues; but these may be compared with the more irregular parts of the Fault-Intrusion of Glen Coe. Moreover the close marginal association with the Meall Odhar partial ring-dyke and with the Allt Buidhe partial ring-fault emphasises the probability of a subterranean cauldron interpretation. The Allt Buidhe Fault is presumably a concentric flanking dislocation tending to enlarge the scope of the Cruachan subterranean cauldron by downthrow towards its centre.

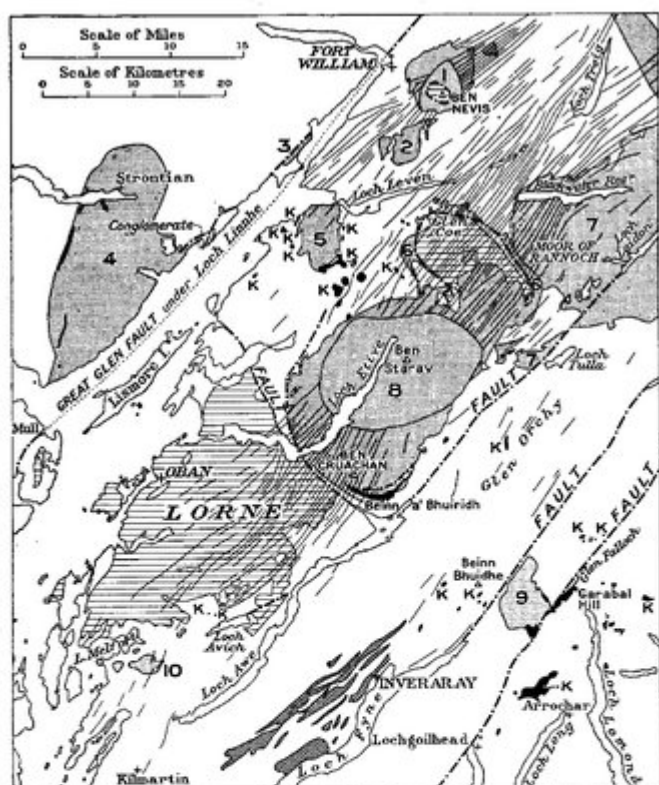
When we wrote our 1909 account we also pointed to strong supporting evidence supplied by Kynaston's mapping and description of partial ring-structures at Beinn a' Bhuidh [NN 093 283] at the south-east corner of the Cruachan Pluton (Figure 18). The district lies wholly in Sheet 45 (Geol.) and is therefore not suitable for treatment in the present memoir. Readers are referred to Anderson's relatively recent paper, full of new information based on close field study (1937a, pp. 517–527). His corrections and amplifications have greatly strengthened in principle the inferences we had based upon previously available information.

The Meall Odhar Granite of the type outcrop is a typical example of a ring-dyke. Like most of its kind it is partial in the sense that it is merely arcuate in plan and does not complete a closed curve. It is quite uncertain whether it opened up a single fissure, or occupied a space between two parallel fissures left vacant through contemporaneous foundering of an intervening strip of country-rock.

The similar granite of Stob Gaibhre [NN 063 467], continuing south into Sheet 45, has been interpreted by Anderson as a gently inclined sheet, probably in large measure fed by the Meall Odhar ring-dyke. According to this reading it represents an early stage in the filling of a subterranean cauldron, where subsidence of the floor made of Cruachan "Granite" was soon brought to a halt.

That the Starav Granite likewise marks the site of a subterranean cauldron is rendered probable from the verticality of its margins. The core of Cruachan "Granite" which it replaces must either have gone up or down; that the movement was downwards seems likely from the analogy of the Glen Coe subsidence lying at so short a distance to the north.

The foliation of some of the dykes in the neighbourhood of the Starav Granite may be ascribed to the movements which accompanied the introduction of the latter. Other mechanical aspects of the Etive Dyke-Swarm will be considered in chapter 16. E. B. B.



**VOLCANIC ROCKS:** Ben Nevis, Glen Coe, Lorne

**BASALT, ANDESITE, RHYOLITE**

**DYKES:** Mostly of Nevis and Etive Swarms.

**PORPHYRITE, MICRODIORITE, LAMPROPHYRE, PORPHYRY.**

**INCLINED SHEETS:** Loch Fyne.

**QUARTZ-PORPHYRY.**

**ULTRA-ACID, ACID and INTERMEDIATE PLUTONS.**

**GRANITE, QUARTZ-DIORITE:** 1 Ben Nevis; 2 Mullach nan Coirean; 3 Loch Linnhe; 4 Strontian; 5 Ballachulish; 6 Glen Coe; 7 Rannoch; 8 Etive; 9 Garabhal; 10 Loch Meallort.

**BASIC and ULTRA-BASIC PLUTONS, including a few giant xenoliths**

**APPINITE, MONZONITIC AUGITE-DIORITE, ETC., including K-KENTALLINITE.**

FIG. 18. Map of igneous rocks of South-West Highlands referred to Lower Old Red Sandstone Period

(Figure 18) Map of igneous rocks of South-West Highlands referred to Lower Old Red Sandstone Period.



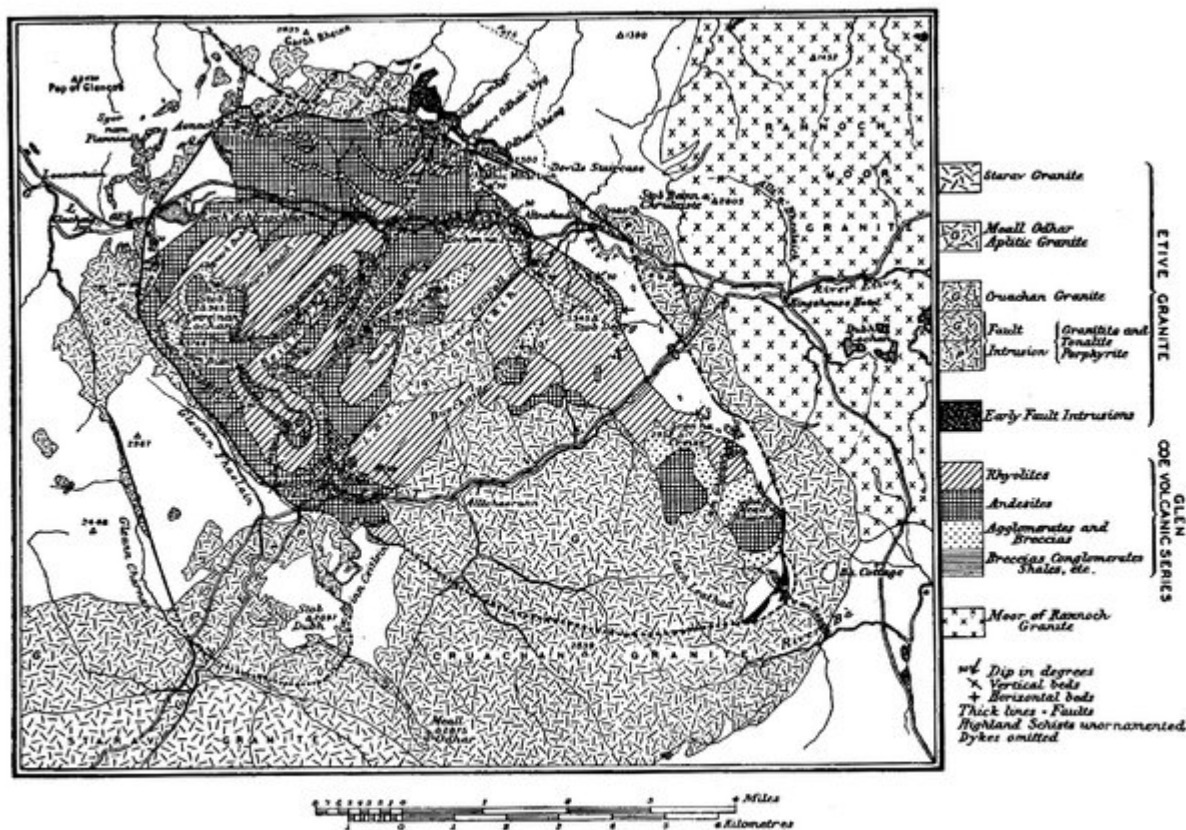
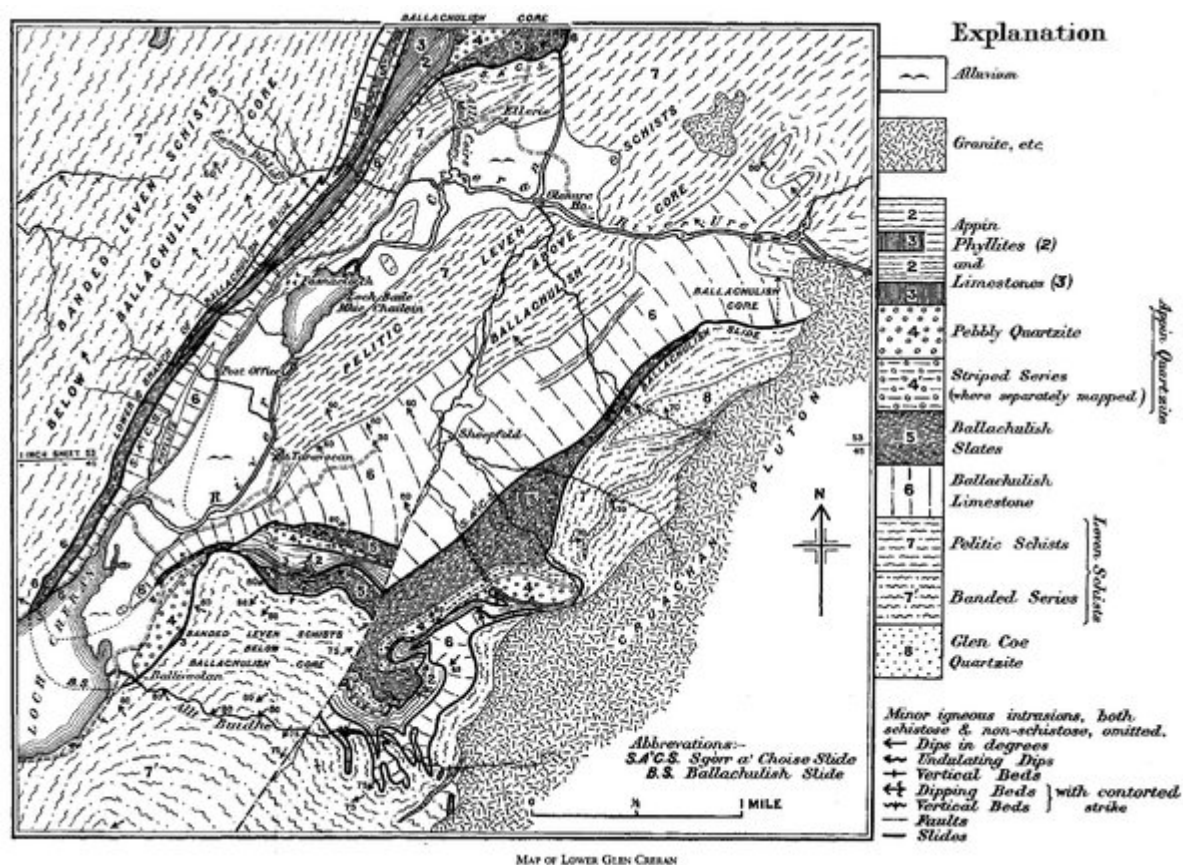
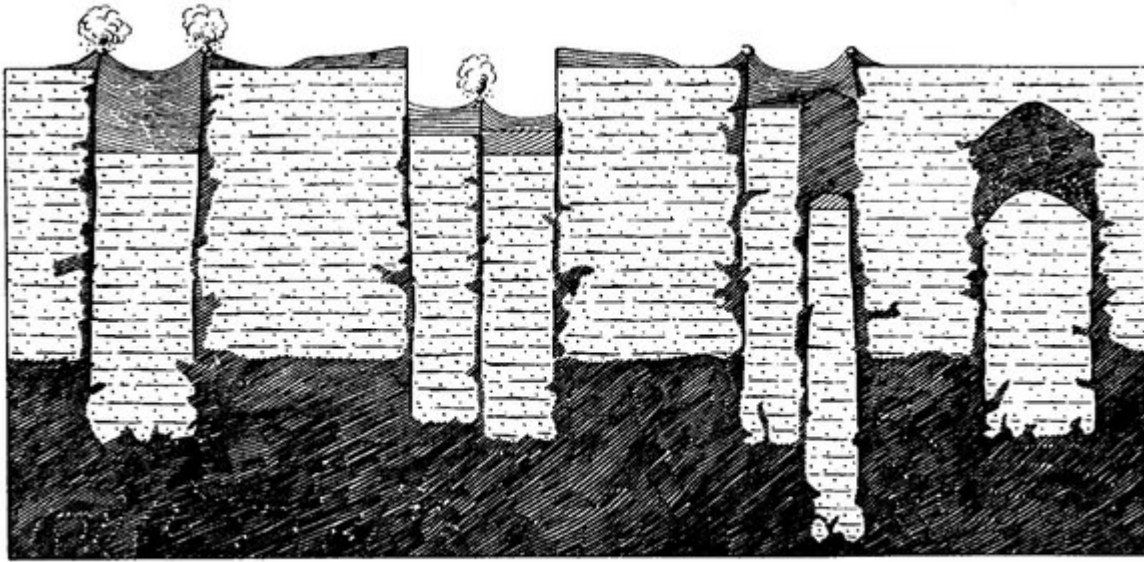


FIG. 19. Map of the Cauldron-Subsidence of Glen Coe and associated igneous phenomena  
For new road see Fig. 22

(Figure 19) Map of the Cauldron-Subsidence of Glen Coe and associated igneous phenomena. For new road see (Figure 22).



(Plate 4) Map Of Lower Glen Creran.



**FIG. 30.** Diagram of subaerial and subterranean cauldron-subsidences accompanied by volcanic and plutonic accumulations of igneous rocks

*(Figure 30) Diagram of subaerial and subterranean cauldron-subsidences accompanied by volcanic and plutonic accumulations of igneous rocks.*