
Chapter 20 Igneous activity later than the Old Red Sandstone

Introduction

The rocks considered in this chapter are a number of basic dykes, mostly in Ardgour but a few south-east of Loch Linnhe, and a volcanic neck in the valley of Allt Coire na Bà [NN 190 640], a mile and a half north of Kinlochleven. At least one of the dykes as well as the neck may safely be classed as Permian. The majority of the dykes are probably Tertiary.

The main distinction between Permian and Tertiary igneous rocks in Scotland is provided by the former's typical alkalinity and the latter's typical talc-alkalinity. This criterion was first applied by Harker (1918, *proc.* p. lxxxvii); and it groups most of the post-Old Red Sandstone alkaline intrusions of the West Highlands along with the Permian lavas of Exeter and Ayrshire and the famous Oslo complex of Norway. Harker's view is now generally accepted (*cf.* Richey 1939, p. 416; MacGregor 1949, p. 137), having received support both from field evidence and from determinations of helium content (Urry and Holmes 1941).

It must, however, be admitted that there is in the West Highlands sufficient overlap of character between supposed Permian and undoubted Tertiary intrusions to render the alkalinity separation unreliable in a number of individual cases. This naturally led to doubts for many years as to whether all the West Highland alkaline intrusions might not really be Tertiary variants, a view long supported, more particularly, by Flett. One of the chief reasons for rejecting this alternative is that the alkaline rocks of the mainland, wherever seen in contact with talc-alkaline, are cut by the latter.

Four field characteristics help to distinguish the supposed Permian and Tertiary intrusions from one another.

1. Most of the former are thoroughly basic or ultrabasic camptonites and monchiquites, and are very prone to develop pinkish feldspathic spots, or ocelli, containing needles of hornblende or flakes of biotite. Such ocelli are almost unknown among the undoubted Tertiary intrusions of like basicity. Admittedly somewhat similar developments occur among Tertiary quartz-dolerites, but these latter are distinguishable on other grounds. The employment of ocelli as a diagnostic feature was among the lessons taught by Clough to his colleagues (*cf.* Bailey and others 1924, chap. moor).
2. The supposed Permian dykes show a marked tendency to pustular or nodular weathering, much more so than do Tertiary associates.
3. In many districts direction helps to separate the dykes of the two suites, but this criterion fails round about Mull (including Sheet 53), where both sets tend to run roughly west-north-west.
4. To the north-west of Sheet 53, in the mining district of Strontian and in Ardnamurchan, Moidart and Arisaig, camptonitic dykes are often significantly associated with crushing and mineralisation. This feature was first recognised and carefully investigated by V. A. Eyles in 1921, in Ardnamurchan. It has since been found by the same worker and his colleagues to hold throughout the considerable area mentioned above (*Sum. Prog.* 1931, p. 64; 1932, p. 60; 1938, p. 72).

We have noted that the camptonite-monchiquite dykes are cut in many observed instances by Tertiary basalt dykes. On the other hand several camptonite dykes in the Ardnamurchan and Arisaig districts are known to cut small quartz-dolerite bosses assumed on other grounds to be of Permo-Carboniferous age (*Sum. Prog.* 1936, p. 80; MacGregor 1949, p. 140).

Although camptonite dykes are numerous in districts of the West Highlands which also retain extensive spreads of Trias, no contact of camptonite and Trias, either unconformable or intrusive, has rewarded careful search. In fact only one dyke that may be claimed as belonging to the Permian suite has been seen in this position, and it is there duly cut off by the Triassic unconformity. Richey has given the following account (1939, p. 418). "In one locality [of Morvern], a basic dyke was traced by Dr. J. B. Simpson up to the base of the Trias, and continued no farther. It was found clearly to be older than the basal bed of the Trias. This bed is a cornstone, and copious veins from it traverse both the underlying schists and the dyke. The latter resembles in rock-type the basalts that accompany the camptonites, but, it must be admitted, these basalts are themselves indistinguishable in composition from the undoubted Tertiary dykes of the neighbourhood".

Accordingly we must accept as a surprising fact that scarcely any of the supposed Permian suite found in pre-Triassic rocks extend to the Trias unconformity. This presumably points to an original sharp upward termination of the dykes. A possible explanation is that magmatic pressure was relieved wherever a dyke attained local access to the surface, either for itself or its gases. E. B. B.

Permian dykes and neck

Dyke at Meeting of Three Waters [NN 175 563], Glen Coe

A group of west-north-west dykes has been followed from Sgòr nam Fiannaidh [NN 137 584], along and across Glen Coe, and up and down the slopes of Buachaille Etive Beag [NN 192 548]. There is generally only one dyke, a few feet thick, in the group. Erosion of such a representative has been responsible for the straight gorge into which the River Coe turns at the Meeting of Three Waters [NN 175 563] (p. 139).

A specimen taken from this locality proves to be a somewhat decomposed rock of monchiquitic affinities ([S11913](#)) [NN 1678 5658]. The chief mineral is a pale purple augite. Strongly pleochroic biotite is abundant, as also is magnetite. Olivine is represented by pseudomorphs. Analcite occurs in big clear patches, allied to amygdales, as well as in the groundmass associated with chlorite and other decomposition products. There is more feldspar present than in typical monchiquites, but scarcely enough to warrant placing the rock with the camptonites.

The Glen Coe monchiquite cuts the Old Red Sandstone lavas, the Fault-Intrusion and the north-east dykes of the Etive Swarm. There can be no hesitation in referring it to the same epoch as the north-west camptonite dykes which Kynaston found traversing the Starav Granite in Sheet 45 (Geol.). H. B. M.

Mineralised dyke, Ardgour

In Sheet 53 a north-westerly dyke is shown entering the western margin of the sheet near Sgòrr Dhearg [NM 872 653], whence it passes through Garbh Bheinn and approaches Loch Linnhe at Inversanda Bay b[NM 940 595]. It is quite probable that the same fissure has been used by both Permian and Tertiary intrusions. At any rate the mineralised portion described below is almost certainly Permian.

The locality is easy to fix on the one-inch map. The dyke, as a whole, is shown as cutting an east-north-east felsite 1200 yd S. of E. of the summit of Garbh Bheinn, and then, a little further east, as sending off a couple of branches. This occurs at the head of a gully, which may be taken as a landmark in the field. For the next 80 yd the dyke is mineralised.

Fifty yards along the gully K.C. Dunham, in 1946, measured the following section with an inclination of 75°–80° N.E.:

Gneiss of S.W. foot-wall

Dyke: 6 in.–6 ft

Breccia with fragments of dyke and gneiss in a chalcedonic and carbonate matrix: 3 ft

Barytes vein with a little galena: 1 ft

Gneiss, impersistent, giving place downwards to white trap: 1 ft 6 in.

Dyke, not in condition of white trap: 3 ft 6 in.

Gneiss: 2–3 ft

Dyke: 4 ft

Gneiss: 3 ft

Dyke: 4 ft

Gneiss of N.E. hanging wall

A dyke specimen ([S10938](#)) [NM 9194 6181] proved to be a fine-grained olivine-basalt, much decomposed. E. B. B.

Coire na Bà Neck

A patch of red breccia is met with on the eastern slopes of the valley of Allt Coire na Bà [NN 190 640]. Its northern end is obscured by an extensive landslip, but the total length of the outcrop cannot much exceed a quarter of a mile, while the breadth is about 50 yd. The breccia contains rounded pebbles of quartzite as well as angular fragments of the same material. Small pieces of a peculiar fine-grained red sandstone have also been found, but no volcanic ejectamenta. The junction with the surrounding quartzite appears to be vertical and irregular, suggesting that the breccia occupies an explosion vent. In support of this view the breccia at one point has been invaded by a basic igneous rock now exposed in a small stream where it is full of xenoliths picked up from the breccia.

Even in the field the highly basic character of the intrusion is obvious, and small phenocrysts of olivine and augite can easily be recognised. Thin slices ([S12906](#)) [NN 1921 6438]; ([S12907](#)) [NN 1921 6438]; ([S14083](#)) [NN 1932 6460]; ([S14084](#)) [NN 1922 6443]; ([S14085](#)) [NN 1922 6443]; ([S14938](#)) [NN 1931 6460] show that felspar is absent, except in the vicinity of quartzite xenoliths ([S12906](#)) [NN 1921 6438]. A pale purple augite, occurring partly in little zoned phenocrysts, but more especially in a multitude of minute prisms, is the dominant mineral. Olivine is well formed and abundant, and sometimes fresh ([S14085](#)) [NN 1922 6443]. Biotite is an accessory. By far the most interesting feature of the rock is abundance of fresh nepheline ([S14083](#)) [NN 1932 6460], first recognised by Maufe. The nepheline occurs in relatively large crystals, enclosing the other constituents in poikilitic fashion. The Coire na Bà [NN 188 650] rock affords the finest example of a nepheline-basalt yet known in Britain. Unfortunately, in most of the specimens collected, the nepheline has decomposed, and the groundmass consists of chlorite and analcite. W. B. W.

Tertiary dykes

Ardgour

Dykes of basaltic or doleritic appearance in the field, and of a more or less west-north-westerly trend, are much more commonly met with on the north-west side of Loch Linnhe than on the south-east; and they become quite abundant in the vicinity of Glen Tarbert [NM 910 600] and further south. They cut the "granitic" rocks of the district and also the felsite dykes. As explained above some of them are probably Permian and others Tertiary; but separation of the two suites has as yet scarcely been attempted.

The majority of the dykes measure only a few feet across, but one important example, followed north-westwards past Garbh Bheinn [NM 905 622], measures about 100 ft for a distance of a mile; it here assumes, as might be expected, a thoroughly coarse doleritic texture. This broad dyke is probably Tertiary or Permo-Carboniferous, since the Permian dykes of the West Highlands are characteristically rather narrow. Further south-east the same fissure is occupied by the mineralised dyke described above under the Permian heading, so that it seems probable that it has been injected at two widely separate times. E. B. B.

South-east of Loch Linnhe

A small group of basic west-north-west dykes has been traced intermittently across the "granites" of Ben Nevis, through Allt Coire Giùbhsachan [NN 183 700], and over the slopes of Binnein Beag [NN 222 677]. In the latter position there are five parallel dykes with an average thickness of 4 ft apiece. Specimens from Ben Nevis ([S14430](#)) [NN 1382 7184] and Binnein Beag ([S12886](#)) [NN 2253 6704]; ([S12887](#)) [NN 2235 6711] agree in character. The dykes are fine-grained ophitic olivine-dolerites, or tholeiites, with faintly purple augite and a little intersertal material. They certainly belong to the Tertiary suite.

Another parallel group of dykes has been traced south-eastwards along Gleann Fhaolain [NN 150 520], where one of them follows the Glen Coe Fault and has been crushed by recurrence of movement along the old line of weakness. These dykes cut the north-east porphyrites. H. B. M.

A thin representative of the same group has been met with crossing the more easterly of the two streams that enter the River Etive half a mile east of Dalness. This thin dyke has been traced east-south-eastwards into a great slack that follows the same direction. A specimen ([S11482](#)) [NN 1797 5079] proved on examination to be too decomposed for accurate determination. C. T. C.