
Chapter 6 Basalt and mugearite lavas: outside pneumatolysis limit Sheet 44

Five areas, 1–4a of sheet 44 as outlined in the index map (p. 91), are considered in this chapter. They have much in common, and to avoid reiteration it may be stated that they all furnish good examples of trap-featuring, rusty present-day weathering, spheroidal exfoliation, and abundance of fresh olivine easily recognized in the field (see also (Table 10), p. 93). They also very commonly exhibit reddened tops due to contemporaneous weathering of Tertiary date, and most of the districts furnish good examples of red boles. A rather minor feature is a tendency to pimply surfaces as explained (p. 138).

The great majority of the lavas do not carry porphyritic feldspars, but various exceptions will be specially noted in the sequel.

Area 1, Sheet 44: Carsaig Bay to Loch Scridain

(Index map, p. 91).

What may be described from the scenic point of view as typical 'plateau country' extends from Glen Leidle and Carsaig to the western boundary of the map. Trap-features are more pronounced than east of Glen Leidle, but at the same time they are not caused by every lava. Except as regards its southern margin, the region is not one of marked relief.

The sequence is entirely basaltic. Very few of the flows are porphyritic, but one of this type may be traced for about half a mile to the south of Creag an Fheidh. Another occurs on the southern coast west of Tràigh Cadh' an Easa', at a height of about forty feet above the coal to which reference has been made in Chapter 3. It can be traced inland to Airdh Mhic Cribhain, and occurs again on the western slope of Beinn an Aoinidh, always in the same relation to the coal to which it forms an index. E.M.A.

The district is noteworthy for the spectacular exposures afforded in its southern coastal cliff, ranging up to 1000 feet in height. The difficulty the geologist finds is that much of what he looks at he cannot reach to hammer. He has to walk, or row, along the base of the cliff, or to examine it from above. Still what is seen can be compared with more accessible sections elsewhere in Mull, and thus interpreted with considerable confidence. The view here taken is that the cliffs consist essentially of a succession of basic lava-flows, interrupted occasionally by well-defined sills of basic and intermediate composition. In Chapter 5. it has already been pointed out that a very different interpretation of these cliffs has been advanced by Dr. Harker<ref>A. Harker in 'The Geology of the Seaboard of Mid Argyll; Mem. Geol. Surv., 1909, p. 79.</ref>: he recognizes as superficial flows only the more conspicuously amygdaloidal parts of the sequence, whereas the present authors regard these as often nothing more than slaggy tops and bottoms; and he holds that what are treated here as the massive interiors of successive lava flows are in reality sills of a quite later date. His account refers only to that portion of the district which extends into one-inch Sheet 36. In comparing the two descriptions it should be noted that the sills described by Dr. Harker are additional to the sills of basic and intermediate composition which are recognized in Chapter 23. of the present Memoir. The former are called olivine-dolerite by Dr. Harker, while the sills about which no question arises are generally tholeiite or andesite. At the same time, this difference should not be overstressed, for it happens that the majority of the more conspicuously columnar sheets of south-west Mull, classed by Dr. Harker as sills and by ourselves as lavas, are olivine-basalts of markedly tholeiitic affinity (Staffa Type, Chapter 10).

No instance has been noted by the present writers where the debatable olivine-bearing sheets (whether one call them dolerite or basalt does not affect the question) have compact non-vesicular tops. On the other hand, they do exceptionally show bases of this type. For instance, an interesting example of a massive sheet with variable basal character is exposed south-east of Creachan Mew. This sheet can be followed along the cliff-margin for over a quarter of a mile. Just west of the indentation of the cliff, which is determined by erosion along a fault running inland to Allt Cnoe nam Piob, it has the typical slaggy base of a lava; but 600 yards farther west, to the south of the more westerly of two small lochans shown on the map, it has a compact, and to a certain extent chilled, bottom-layer. Occasional chilling of lava-bases is, as already stated, a widespread, though very subordinate, feature of Mull geology.

A particularly convincing reason, for interpreting as lavas most of the inaccessible massive sheets of the part of the Carsaig cliffs, described by Dr. Harker, lies in the following facts. Reference will be made in the next chapter to the frequency with which the non-vesicular part of a columnar lava is divided along a definite plane into a lower zone with massive regular vertical columns, and an upper zone in which the columns are curved and relatively thin. The type-locality for this double-tier type of jointing is Staffa, where observations, which will presently be recorded, leave no doubt that one is dealing with a lava (p. 111); and there are many other instances—in the Gribun and Ardtun peninsulas. Of the numerous examples from the Mull area which have been examined at close quarters, there has been only one where the point was doubtful. In agreement with this, one finds that Scrope and Judd, the former building on his experience of the Auvergne, have developed a theoretical explanation (pp. 44, 109) which would not be in accordance with subterranean conditions of cooling. Now the basic sheets of the cliffs in the part referred to are largely columnar, and in some cases they reproduce the Staffa appearances precisely. On looking east across a narrow gully from the top of the cliff immediately above Carsaig Arches one sees the following sequence:

Layer of curving columns}

Layer of regular columns}

Slaggy layer.

Layer of curving columns}

Layer of regular columns}

Slaggy layer

Layer of curving columns}

Layer of regular columns}

The double columnar layers must be regarded as examples of the 'olivine-dolerite sheets' referred to, which there is thus strong reason to regard as interior or basal portions of lavas. The slaggy layers are probably in the main the tops of the two lower of the three lavas represented in this section—for experience teaches that slaggy bases are usually quite subordinate in thickness to slaggy tops. If this supposition be correct, the two lavas referred to are each formed of three layers of about equal thickness. E.B.B., E.M.A.

The term 'columnar' might be not unreasonably applied to many of the plateau basalts of Mull in which a columnar appearance is caused by the intersection of more or less rectangular systems of joints. It is possible that these are not ordinary joint-planes, but were formed by contraction on cooling. If so, they are related in origin to the joints bounding polygonal columns. In the description of this area, however, the term columnar is restricted to lavas in which the columns are polygonal. Columnar basalts in this sense extend along the southern cliff westwards from Carsaig Arches into Sheet 43. Above the Arches, they reach upwards to nearly 1000 feet from the bottom of the lava-group. This appears to be a maximum development. As a general rule in the Mull area, they underlie the great mass of non-columnar, or not-polygonally-columnar, members; and near Gribun (see p. 108) are confined within a much shorter distance from the base.

Judging from what is seen on the southern cliffs, fifty feet may be taken as an average thickness of an individual flow; One or two cases can be seen where a lava attains a hundred feet; and one, at the bottom of the cliff at Tràigh Cadh' an Easa', appears to be over 180 feet in thickness.

A very constant feature in this district, as in others outside the Pneumatolysis Limit, is the more or less pronounced reddening by ferric oxide of the tops of the lavas. This reddening appears to have been produced on the weathered surface of each flow before the superposition of the next in order; it affects only a small thickness of the lava, except where it has worked its way downwards along cracks and joint-planes. It is due to incipient production of laterite, checked before it proceeded to any great extent by the protection afforded by succeeding flows. E.M.A. Reference has been made in Chapter 3. to certain intercalations of sediment and associated ash near the base of the lava-sequence. Of these, the deposit exposed in the cliffs between Carraig Mhòr and An Dùnan, east of Carsaig, is the most noteworthy. It varies from 10 to 20 ft. in thickness, and consists in the main of a breccia. of pale green to buff-coloured fragments of fine-grained vesicular basalt. The interstices are filled with black sedimentary material, and the whole contains a good deal of calcium

carbonate both as a filling to the vesicles and dispersed through the rock. (B.L.)

Between the southern cliffs and Loch Scridain, conditions are not good for observing such intercalations, and in only one case has a thin band of tuff been detected.

In the southern part of the district, there is a very gentle rise of the lavas to the east, which, though hardly perceptible in the featuring, brings the base of the assemblage from below sea-level at Carsaig Arches to about 300 ft. above sea-level at Carsaig.

E.M.A.

Area 2, Sheet 44: Loch Scridain to Loch Na Keal

(Index map, p. 91).

The lavas on the north side of Loch Scridain are of the same general character as those on the south. Trap-featuring is rather more pronounced. Red-weathered tops are again found, and are sometimes overlain by a foot or more of red bole, in the deposition of which water may have played a part. An easily located example of such a bole occurs beneath a porphyritic flow on Aird Kilfinichen, a little above high-water mark on the south coast of this peninsula. Another place where a geologist is sure to find red tops and boles is among the exposures afforded by the many small streams descending into Gleann Doire Duhhaig, on the north side of Coire Bheinn. E.M.A., J.E.E.

While the majority of the lavas of the area are non-porphyritic, a well-defined porphyritic zone, consisting sometimes of one, sometimes of two flows, is traceable on both sides of Kilfinichen Bay. The field-characters leave no doubt as to the contemporaneous nature of these porphyritic lavas; for instance, the little stream east of Dùn Scobuill, just inside Sheet 43 across the border of Area 2, furnishes an excellent exposure of a thick slaggy top belonging to the upper of the two flows—the only one to extend so far west. The porphyritic elements are fairly abundant felspar-phenocrysts, usually rather more than a quarter of an inch long, but exceptionally reaching 3 inches. These Kilfinichen lavas have not been coloured on the one-inch Map (Sheets 43, 44) as Big-Felspar Basalts, since their porphyritic character is not sufficiently conspicuous. At the same time, they furnish an excellent example of the intercalation of porphyritic lavas in the lower part of the Plateau Group. Their outcrop has been traced from Aird Kilfinichen, where there are two flows of the type, for a mile up the north-east side of the valley a little above the road. They have been picked up again on the other side of the valley, and here the upper flow makes a conspicuous scarp and shelf above Seabank Villa. Beyond Tioran, only this upper flow persists, and it has been traced almost a mile into Sheet 43. Its outcrop at its farthest west exposures crosses the Tioran-Tavool Road.

Attention may be directed to interesting examples of what seems to be auto-intrusion within a lava. The Abhuinn Bail' a' Mhuilinn flows over bare rock, and in dry weather exposes an exceptionally clear section for some distance above its junction with Allt a' Mhuchaidh and, again, at a point a little farther upstream. Amygdaloidal lava is exposed cut by irregular, but distinct, amygdaloidal intrusions ([S18507](#)) [NM 4841 2958] by ([S18508](#)) [NM 4842 2955], and ([S18509](#)) [NM 4806 2996] by ([S18510](#)) [NM 4806 2996] of similar type. The intrusions have chilled edges so that if, as seems possible, they are portions of the lava forced from below into an already consolidated crust, this latter must have been fairly cool at the time. Observations of the coastal cliffs of Sheet 43 have furnished many examples of various types of auto-intrusion described later (Chapter 7). E.M.A.

On Coirc Bheinn, the highest mountain of the district, there is an interesting outlier of lavas with scolecite, albite, and epidote in their amygdales. The cavities thus filled are larger than is general among the lavas of the neighbourhood. Scolecite-bearing lavas, on much the same geological position occur in the Ben More country (Area 8), where they have attracted considerable attention. The Coirc Bheinn examples seem to deserve further investigation, since they seem to fall outside the Pneumatolysis Limit of (Plate 3) (p. 91), whereas their Ben More analogues are well inside.

J.E.R.

Area 3, Sheet 44: Glen Aros District, Loch Na Deal to Sound Of Mull

(Index map, p. 91).

Almost all the lavas are non-porphyrific olivine-rich basalts—thoroughly typical of the plateau country in general. An exception is a flow with conspicuous felspar-phenocrysts which forms a strong crag on the western top of Meall na Caorach, and has been traced from this point in a north-westerly direction into Sheet 52. Another exception is a mugearite shown on the map at Tom a' Chrochaire, and in a small isolated crop a mile farther west. This mugearite is a very platy rock. Near the south-western end of its main exposure, it is seen resting irregularly, with slightly chilled base, on a red bole overlying amygdaloidal basalt; while its top is probably in places brecciated—at any rate mugearite-breccia underlies the most westerly of the associated basalt-outliers. Even within the limits of its outcrop, the mugearite is seen to be imper-sistent; and it is probably quite distinct from, and earlier than, the Ben More flow of similar type.

Along the coast north of Salen, a gentle dip in the south-east direction brings successive lava-flows to the surface at long intervals; and no better section is known in Mull for illustrating the thin vesicular base, the thick massive interior, and the thick slaggy top so characteristic of individual lava-streams. The evidence is particularly clear, since in a majority of cases the slaggy top of each flow is found to have been reddened, and very often to have been covered with red bole, before the outpouring of the next lava of the sequence. A few notes regarding this illuminating coast-section may be of service:

- South of Sgiath Ruadh, red bole is seen filtered down into cracks in reddened amygdaloidal lava.
- At Port an Tobire, a reddened top is exposed in which the amygdales are grouped in bunches—quite a common arrangement.
- For about a mile north of Rudha Àrd Ealasaid, the lavas are distinctly platy.
- At the north end of the bay, 400 yards S. E. of Kintallen, there are good exposures of a reddened lava-top with overlying bole.
- Opposite Kintallen, a banded lava occurs in which there are marked alternations of vesicular and solid layers. J.E.E.

Leaving the Sound of Mull one may glance for a moment at exposures at Rudha Mòr on Loch na Keal. Here, pimply-weathering basalt is seen—a type of basalt which, as already stated (p. 100), is rather characteristic of the plateau country as a whole, outside the Limit of Pneumatolysis; and close by is an instance of contemporaneous pegmatitic veining such as is more fully described in Chapter 7. E.B.B.

Area 4, Sheet 44: Loch Aline, Morven

Index map, p. 91

The Loch Aline district is more accessible from Oban and the south than any other part of the plateau region outside the Limit of Pneumatolysis. Fortunately it serves as a very good example of its kind. The rusty weathering cliffs rising above Inninmore Bay have been known to draw from the passing tourist the remark " there must be iron in those rocks." Moreover trap-featuring is displayed to special advantage through contrast arising from juxtaposition of lavas with gneisses along the wonderful Inninmore Fault ((Figure 26), p. 182).

Cliff- and shore-sections are easily reached from the steamer-pier. They show, as is usual, that the majority of the flows are massive in their centres and become amygdaloidal and brecciated towards their tops and bottoms. The amygdaloidal band at the top of any particular flow is always thicker than at the bottom, and is often marked by purple and red staining. There is a capital exposure of a brecciated base at the head of the little bay east of Rudha Dearg, three quarters of a mile west of the pier; and a reddened scoriaceous top is well seen along the shore east of the same. Just at the entrance to Loch Aline, on the western shore about 200 yards south of the ferry, massive basalt with a foot of slightly vesicular rock at its base can be seen resting on a reddened scoriaceous top. Such examples might be multiplied indefinitely. In the precipitous northern face of Glais Bheinn, east of the loch, seven distinct thin red layers have been counted in the basalt-sequence.

A tendency to rude columnar jointing is quite common, but there is no example of a definitely columnar lava. Sometimes, the dominant structure is platy jointing parallel to the plane of flow.

As elsewhere in the plateau country outside the Pneumatolysis Limit, spheroidal weathering is widespread and conspicuous.

A point of great interest is an appearance suggestive of thinning of the lava-group northwards away from Mull. On the west side of Loch Aline, the lowest lavas seem to be dying out northwards, and to be overlapped by upper members of the sequence, which thus come down on to the floor of Cretaceous sediments. In Glais Bheinn, too, there would seem to be only some 500 ft. in the northern escarpment as opposed to 1100 or 1200 ft. in the southern slope—but just possibly here the northern sequence may be curtailed by a fault concealed beneath talus. G.W.L.

Area 4A, Sheet 44: Fishnish, Mull

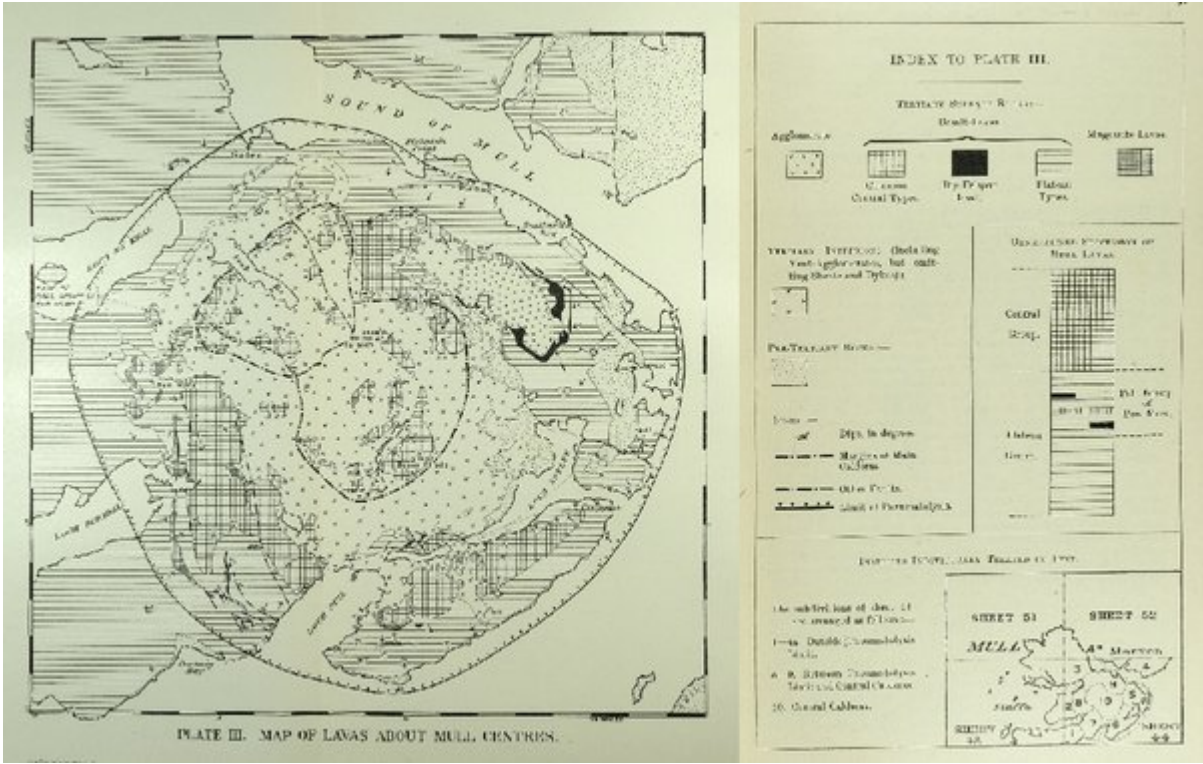
The Sound separates Fishnish from Area. 4 in Morven, but the Pneumatolysis Limit divides it even more markedly from its geographical continuation (Area 9) in Mull. Only the lowest of the Plateau Basalts are met with; and some of them are rather doleritic in texture. The north coast of the peninsula shows a succession of massive bands with slaggy tops and less-marked vesicular bases—typical lava-streams. The massive bands weather rusty at their surfaces, and on fracture show specks of fresh olivine.

Easily reached by road from Salen or Craginure, the district furnishes an excellent starting point from which to investigate the reality of the Pneumatolysis Limit. E.B.B.

TABLE X.—SYNOPSIS OF MULL BASALTS MICROSCOPICALLY EXAMINED FROM 1-INCH MAP, SHEET 44.

District.	Ornament employed in Pl. III.	Number of Slides Examined.		Number of Slides with—	
		Plateau Types.	Central Types.	Olivine fresh.	Olivine all decomposed.
Area 1	Plateau	16	1	15	2
„ 2	Plateau	8	1	4	5
„ 3	Plateau	6	Nil.	5	1
„ 4	Plateau	8	Nil.	8	Nil.
„ 4a	Plateau	4	Nil.	2	2
„ 5	{ Central Plateau	Nil. 60	1 1	Nil. Nil.	Nil. 60
„ 6	{ Central Plateau	2 38	36 6	Nil. Nil.	3 42
„ 7	{ Central Plateau	2 17	21 1	Nil. Nil.	5 18
„ 8	{ Central Plateau	1 107	5 5	Nil. Nil.	1 112
„ 9	{ Central Plateau	Nil. 52	2 8	Nil. Nil.	Nil. 62
„ 10	Central	Nil.	74	Nil.	33
Sheet 44 (inclusive).	{ Central Plateau	5 316	139 23

(Table 10) Synopsis of Mull basalts microscopically examined from 1-inch map, Sheet 44



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

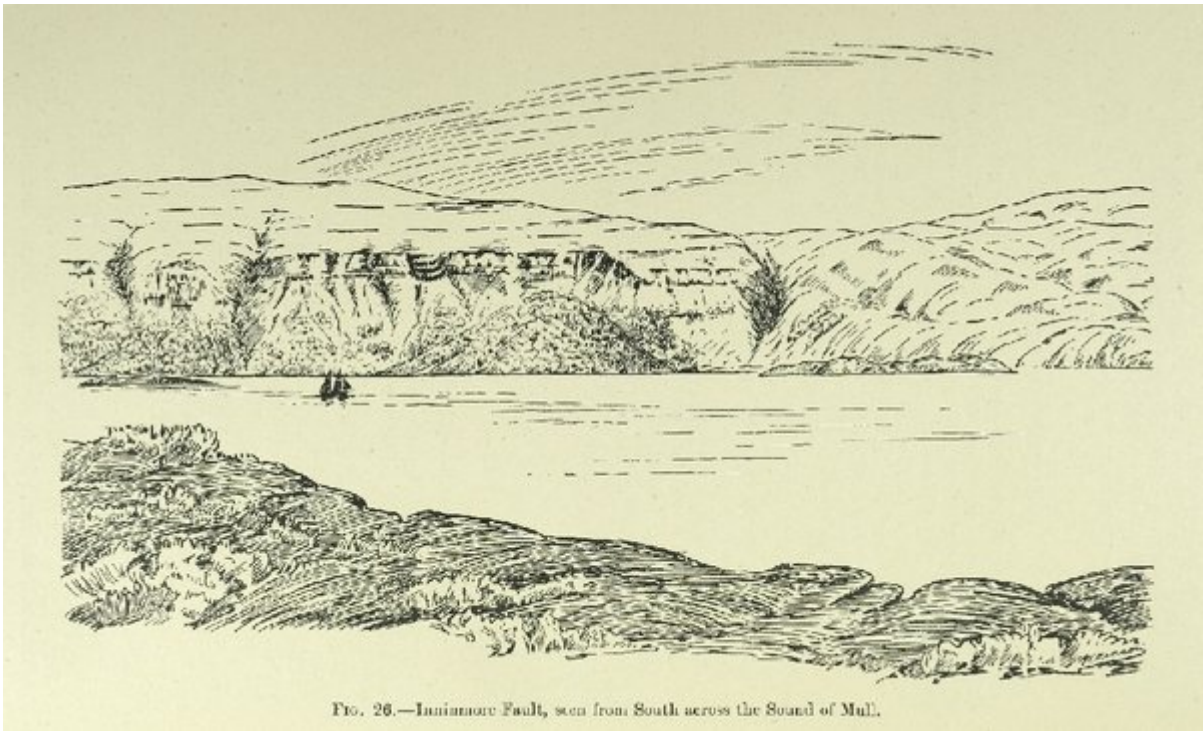


FIG. 26.—Inninmore Fault, seen from South across the Sound of Mull.

(Figure 26) Inninmore Fault, seen from South across the Sound of Mull.