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## **Chapter 7 Basalt and mugearite lavas: outside pneumatolysis limit. Sheets 43, 51, and 52**

Only a brief anticipation of the separate memoirs dealing with the maps enumerated in the heading of this chapter is attempted in the following pages.

Speaking generally, one may say that cliffs and coast-sections afford numberless exposures of basalt-lavas with slaggy tops and subordinate slaggy bases. Sheet 43 is the best provided in the matter of cliff-sections, including those above the road leading along the south shore of Loch na Keal and southwards through Gribun.

Contemporaneous weathering of lava-tops is also well displayed in these three maps. Sometimes it has led merely to a rotted superficial layer, at other times it has been accompanied by accumulation of red bole.

Another characteristic of the district as a whole is the very widespread preservation of fresh olivine. As usual it can easily be recognized in hand-specimens with a lens, especially on a sunny day. It is scarcely necessary to add that rusty and spheroidal weathering are both prominent, and that pimple-weathering is not uncommon.

The whole assemblage of flows falls within the Plateau Group as defined in Chapter 5, and lies outside the Limit of Pneumatolysis drawn on (Plate 3). It must be remembered, however, that non-porphyrific, compact, olivine-poor basalts, of Central rather than Plateau Type, are well-represented among the earlier, often columnar, lavas of Sheet 43 (pp. 30, 94). E.B.B., E.M.A., J.E.B., G.V.W., G.A.B.

### **Sheet 43: The Western coasts of Mull, with Ulva, The Treshnish Isles, and Staffa**

Trap-featuring is nowhere better displayed than in Sheet 43. Particularly good examples are afforded in the part of the district north of Loch Tuath, in Ulva and Gometra, and in Bearraich, the mountainous termination of the Gribun Peninsula. A curious capriciousness may be noticed in this respect. While the Gribun Peninsula as a whole is characteristically terraced, there is a marked poverty of such features in that part of the district which centres about Creag nam Fitheach. As instances of flows with porphyritic felspar, such as occasionally occur in the Plateau Group, mention may be made of four lavas exposed in and around Allt an Fheòin draining into Loch Assapol.

The Leaf-Beds of Ardtun are of cardinal importance to the student of Mull lavas, since they date the early part of the sequence. Along with the basal sediments of the district, and a few imper-sistent coal-seams, they have already been described in Chapter 3 and their fossil-contents in Chapter 4.

### **Columnar basalts: Staffa and elsewhere**

The geological phenomenon which has attracted most attention to Sheet 43 in the past, apart perhaps from the Leaf-Beds of Ardtun, is the beautiful columnar structure exhibited by a small proportion of the lavas. All the examples known are referable with fair certainty to a low position in the Plateau Group, with a maximum development in the south-east corner of the map. A geographical as well as a time limit has been recognized. The columnar lavas of the south-east corner of Sheet 43 continue for some distance eastwards into Sheets 36 and 44 along the Carsaig cliffs, but otherwise no typical columnar basalt is known in Mull, except a solitary occurrence low down in the lava-sequence at Bloody Bay (Sheet 52, p. 118). In the following rather disconnected paragraphs, attention is directed to the various exposures met with in Sheet 43: E .B.B. E.M.A. J.E.R., G.A.B.

A continuation of the zone of columnar lavas which has been described in the cliffs above Carsaig Arches (Chapter 6) follows the southern coast to the east of Eas Dubh, and reappears in the Ardtun Peninsula.

In the gully formed by the more easterly of the two streams, which are shown in the one-inch Map to descend the cliffs above Aoineadh Beag, a single flow is seen have the following section:

	Ft.
Non-columnar zone, reddened at top	60
Zone with irregular curving columns	60
Zone with regular vertical columns	10

The lavas immediately above and below the intercalation of sediment which contains the Ardtun Leaf-Beds at the mouth of Loch Scridain are both strikingly columnar. The underlying member shows two zones of columns, with the upper zone merging into slag above. E.M.A.

In the Gribun Peninsula north of Loch Scridain, one realizes very clearly the restriction to a low horizon of the few typical columnar basalts that occur. They are exposed on both sides of the peninsula, more especially in the main river east of Tavool House, where they extend for 400 yds. inland from the sea, and again in the coastal cliffs reaching from Carraig Mhic Thòmais to the Wilderness. In the continuation of the cliffs just mentioned, they are not visible much east of Caisteil Sloc nam Ban; and, in keeping with this, are definitely seen to be absent from the Allt na Teangaidh section by the roadside above Bahneanach. E.B.B.

North of the Inch Kenneth anticline (p. 172), two columnar flows extend along the coast from Ulva Ferry to Torr Mòr. They occur practically at the bottom of the pile of lavas constituting Ulva, and presumably lie very near the base of the lava-group considered as a whole.

The columnar flow of Fingal's Cave, which has rendered Staffa famous, is also almost certainly on a low horizon. G.A.B.

A very fine columnar basalt forms the two islands of Rèidh Eilean and Stac Mhic Mhurchaidh on the west of Iona, and is possibly to be regarded as the last exposure of the Mull Plateau Basalts towards the south-west. The texture is, however, more doleritic than usual; and no definite proof has been obtained that the islands are not part of a sill. The columns, which appear to be fully a hundred feet in height in the case of Stac Mhic Mhurchaidh, are vertical and regular, and if they form part of a lava, this must have been of unusual thickness. E.M.A.

Even in this brief notice, it is necessary to discuss the origin of certain features of columnar jointing. Many, but not all, of the more conspicuously columnar lavas of Mull show three well defined zones: a lower zone of massive regular columns, a middle zone of closer-spaced wavy columns, an upper zone of slag. The phenomenon is illustrated at Staffa, the Wilderness, the river at Tavool, the Ardtun Peninsula, and the Carsaig cliffs. The line of demarcation between the two tiers of columns is, as a rule, very even and well-defined; although it is obvious on inspection that both tiers consist of one rock, and are merely differentiated by their jointing. The line between the upper zone of columns and the slag is often irregular, and there are numerous clear instances of an insensible passage from the one into the other. Of these, special mention may be made of those afforded by Staffa and the columnar basalt underlying the Ardtun Leaf-Beds, and also of some half dozen flows accessibly exposed at the base of the Wilderness cliff above Aird na h-Iolaire. E.B.B., E.M.A., G.A.B.

Scrope and Judd, as already noticed (p. 44), give good reason to believe that the close-spaced wavy columns have resulted from rapid irregular cooling of the upper surface (which may safely be ascribed largely to convection); and that the more massive and straight columns have developed through slow regular cooling of the lower surface. Professor Iddings, adopting much the same standpoint, argues that the spacing of the columns is controlled by rate of cooling, and their direction by a tendency to grow always at right angles to a retreating isothermal surface corresponding with a particular temperature. It may seem, at first sight, that the rate of the cooling responsible for the two tiers of columns has been the same in both cases, since often the two tiers are of about the same depth. But it must be remembered that the upper tier is covered with a thick layer of slag, and that this has, of course, retarded the initiation of its cooling and consequent jointing.

Professor Iddings strongly supports his thesis by pointing to a very striking phenomenon sometimes observable at the approach of two systems of columns, where the columns, instead of coalescing, bend abruptly into rough parallelism. Professor Iddings<sup>ref>T. P. Iddings, Igneous:Rocks, 1909, vol. i., Figs. 13–17, pp. 320–325.</ref></sup> draws his illustrations from America, and Mr. James<sup>ref>A. V. G. James, Factors producing Columnar Structure in Lavas and its Occurrence</sup>

near Melbourne, Australia, *Journ. Geol.*, vol. xxviii., 1920, Fig 13, p. 467. from Australia; (Figure 16) is a sketch by Mr. G. M. Sinclair from a photograph taken at Staffa, while the Frontispiece shows another, though more complicated, example furnished by the mainland of Mull. The explanation advanced by Professor Iddings is sufficiently illustrated in (Figure 16).

It must not be thought that final mutual avoidance is a general phenomenon of the approach of two systems of columns. It is the exception rather than the rule. The alternative is coalescence, resulting from an alignment of certain margins of the lesser columns and the disappearance of others. Here the weakness of neighbouring jointed basalt is evidently a controlling factor. Combined with this, is the relatively slow cooling from below. The form of the critical isothermal surface retreating rapidly and irregularly away from the top of the flow is in general little affected by loss of heat downwards even after joining with its counterpart below. Thus columns of the upper tier approach exceedingly close to columns of the lower tier without experiencing any tendency to deflection. The relative sluggishness of downward cooling is sufficiently evidenced by the course of the even boundary that commonly separates the two tiers of columns in lavas of this class, for the separation follows a plane at right angles to the columns of the lower tier. E.B.B.

Staffa has been mentioned several times. Its main constituent is the Fingal's Cave Lava. This lava is underlain by red ash exposed from Fingal's Cave along the greater part of the west coast; while in Meallan Fulann it passes under succeeding basaltic flows. The Fingal's Cave Lava is generally divisible into a lower zone of massive regular columns, a middle zone of narrow wavy columns, and a top zone largely of slag. The base of the lava is most conveniently reached from above at Port an Fhasgaidh where it is seen to be vesicular and brecciated. The two columnar zones are typically exposed at Fingal's Cave; and the visitor, as he approaches the cave along the causeway, has plenty of opportunity for seeing that there is no line of separation in the basalt thus variously jointed. The slaggy zone occupies the east coast for some 300 yds. south from Goat Cave. An interesting feature of this upper portion is the occurrence of masses of slag, often brecciated, which have been carried forward by still liquid lava, now in large measure columnar. Towards the top of the flow, columnar structure fails altogether. Several instances can be examined of passage from columnar basalt to slag; and vesicular structure often manifests itself within the limits of a well-defined column. At Goat Cave, thin ash and carbonaceous sediment separate the Fingal's Cave Lava from the chilled columnar base of an overlying flow. The actual top is again seen at sea-level north of Meallan Fulann. G.A.B.

## **Macculloch's Tree**

Another famous columnar lava of the district is that which flowed round and over Macculloch's Tree, otherwise known as the 'Fossil Tree of Burgh' (Frontispiece) The cast of the tree-trunk stands in a recess of the coastal cliff, 150 yds. north of the waterfall of Allt Airidh nan Caisteal (this is the most southerly of two neighbouring waterfalls, about 70 yds. apart, a little south of Rudha na h-Uamha). A visitor will find it most convenient to approach by boat from the Bunssan side, or by motor-boat from Iona. If he comes on foot., he is well-advised to start from the Tavool side. In any case it is essential that he should time his arrival for a falling half-tide.

The cast of this tree is seen in vertical section and looks like a pipe, nearly 5 ft. broad and about 40 ft. high, and largely filled with breccia consisting of lumps of 'white trap' and charred wood. The lower part of the pipe encloses a partially silicified semi-cylinder of wood glittering with quartz-crystals. The diameter of the cylinder is about 3 ft., and outside is a hollow where soft black coniferous wood (p. 77), a couple of inches thick, may be dug out with a hammer. In 111acculloch's day the wood continued as a coat around the silicified cylinder, but since then it has been ruthlessly stripped by curio-hunters until now it is no longer part of the spectacle—though the recollection of its former presence is a great stimulus to the observer. The pipe rises vertically in the heart of columnar basalt, and the columns as they approach it turn so as to meet it everywhere at right angles. The roots of the tree are not seen; but close at hand a carbonaceous mud, sometimes with a film of coal, is exposed beneath the lava; and under this there follows a prominent bed of red ash.

In the continuation of the same lava, 230 yds. north of the upstanding tree, is a cave with two entrances. In the overhanging northern face of the main entrance, there lies a gently inclined dicotyledonous tree (p. 81), 10 ft.. long and 6–8 inches thick, enclosed in a brecciated portion of the flow.

It is probable that the two trees mentioned are merely remnants of a forest. At any rate, the lower portion of the lava, has characteristics which suggest that it consolidated in an unusual environment. Magnificent exposures of this lower part of the flow are afforded by the cliffs of Rudha na h-Uamha. It is seen to rest regularly on top of the carbonaceous layer and ash already mentioned; but it is within itself wonderfully irregular, for it consists of a chaotic assemblage of columnar and brecciated basalt. The columnar basalt traverses the brecciated, or sweeps round great masses of it 40 or 50 ft. high. Everywhere the columns are at right angles to the junction-line of the two types, and thus most arresting combinations are produced, including rosettes and fringes.

What has been spoken of above as brecciated basalt is always more or less vesicular; but its solidity varies greatly, for sometimes this part of the complex flow is merely a vesicular basalt with little or no brecciation, whereas elsewhere it is an ash-like accumulation of fragments of different degrees of porosity, bound together by infiltrated calcite. One cannot strictly define the brecciated portion as basal. The columnar part of the complex is equally often found in contact with the underlying black mud, and in such a case shows distinct chilling—probably the mud was wet. There is, however, no chilled edge to the columnar part at the well-defined contacts of solid lava and breccia.

It is undeniable that the columnar basalt was in a sense intrusive into the brecciated. But the non-transgressive relation of the complex as a whole with reference to the underlying black mud—as seen for quarter of a mile—negatives the possibility that the intrusion took place under cover. The columnar basalt and the breccia together constitute a unit, and the breccia's character stamps the unit as superficial. The two trees, the one enveloped in solid, the other in breccia, afford confirmation of this view. Probably we have here a lava that poured into a forest, where its first advance gave rise to a series of explosions. The flow continued, and great masses of slag and breccia were caught up and involved in the irresistible flood.

To test this explanation a careful search was undertaken for other traces of the postulated forest. Apart from the two trees, only occasional fragments of wood could be found; but in places the non-columnar basalt encloses short ribbons of what looks like a carbonaceous distillate.

Two other localities may be mentioned in connexion with this wonderful lava. Between the two waterfalls already mentioned as a guide to the upright tree, one may see the massive columns of the lower part of the lava in regular disposition and overlain—Staffa fashion—by narrow wavy columns. In the cliff just north of the next little stream (200 yds. south of Allt Airidh nan Caisteal), the top of the flow is very accessible, and the minor columns can be examined merging upwards into slag.

### **Tavool Tree**

An inconspicuous, but readily accessible, analogue of Macculloch's Tree is exposed near the north shore of Loch Scridain in the bed of a little river, or stream, that enters the sea 500 yds. south-east of Tavool House. There is a foot-bridge near the mouth of this stream, and a beautiful waterfall a little farther up. Halfway between these two landmarks, the bed of the stream for 15 yds. shows a mass consisting largely of fragments of coniferous wood (p. 78); some of these are several inches long, and are intimately mixed up with vesicular basalt, locally altered to 'white trap'. The basalt belongs to the basal part of a strikingly columnar flow, with the double-tier type of jointing well-displayed in the waterfall. As the columns approach the mass of vegetable matter, they seem to tilt up away from it; but exposures are too restricted to give much information on this point.

The first exposure on the sea-shore, 400 yds. east of the mouth of the stream, shows a sill, with sapphire-bearing xenoliths (Chapter 24), and cutting with chilled base a basaltic breccia made of angular lumps of vesicular basalt, among which are many pieces of black wood. The breccia is rather more like an ash than a lava. Its position, judged by neighbouring exposures, is just at the base of the columnar flow seen in the stream. E.B.B.

### **Auto-Intrusion**

In the descriptions just given of the upper part of the Fingal's Cave Lava, and also of the lower part of the lava enveloping Macculloch's Tree, it will be noted that complex relations of slag and solid are recorded which may fitly be ascribed to

auto-intrusion. Still-fluid lava has evidently involved, entangled, and carried forward previously semi-consolidated portions. The numerous cliff-sections of the district frequently show phenomena of this kind. No finer example is known than that exposed in the cliffs of Little Colonsay at Port Nam Faochag. A thick mass of solid lava forming the cliffs east of the port suddenly gives place north-westwards to a banded complex of solid and slag looking at first sight. like a succession of flows.

More accessible coast-sections showing auto-intrusions occur in Mull at Lòn Reudle, at the mouth of Loch Tuath. The exact positions of two important examples are noted on the one-inch Map. In the more westerly exposure, comparatively solid black lava is well seen making a cliff-face and projecting as a tongue 4 yds. long into neighbouring slag. The tongue has concentric zones of amygdales parallel with its margin. The slag also shows a certain amount of banding conforming with the margin of the tongue, but in this case the conformity seems to have been imposed, and the banding of the slag is notably disturbed and broken. The junction of the two rocks, solid and slag, is well-defined, though there is no sign of marginal chilling. The contrast of the two has been accentuated by subsequent weathering which has reddened the slag and left the solid black.

The more easterly section shows a banded face of slag and solid, each band horizontal and roughly 6 ft. thick. In one very conspicuous case, a solid band is interrupted by a narrow vertical belt of slag apparently in continuity with the horizontal bands of slag above and below. The exposures are a little too high up the cliff to be actually hammered, but the phenomenon is so conspicuous that it deserves special mention. J.E.R.

### **Pipe-amygdales**

A few words may now be offered regarding a particularly interesting type of flow-banding illustrated by several examples within Sheet 43. The flow-banding is lenticular, and is characterized by the zonal arrangement of the amygdales. Each band has a basal zone with pipe-amygdales, a middle zone free of amygdales, and an upper zone with normal more or less spherical amygdales closely grouped. There may often be half a dozen such flow-bands seen in superposition, and they have as yet only been noticed in the upper parts of flows. Easily located examples are to be found:

1. In the cliff, Dùm Bhuirg, Loch Scridain.
2. At summit of the conspicuous landslip-hill (An Sithean), above the road 700 yds. N.E. of Balmeanach, Gribun.
3. Sailean Mòr, Gometra.
4. Roadside, 300 yds. E. of Kilninian Church, N. of Loch Tuath.
5. Shore, E. of Sloc an Neteogh, also north of Loch Tuath.

The last-named example is interesting on account of the diminutive thickness of the bands. E.B.B., J.E.R. G.A.B.

The conditions which led to the flow-banding under consideration were probably strictly superficial. The layers are distinctly separated from one another. There is, it is true, no clearly marked chilling at the surface of separation; but there is, on the other hand, no tendency for the round vesicles of the top of one band to extend upwards and mingle with the pipes of the next. Moreover, the contact seems in some cases definitely imperfect, for reddening can occasionally be observed (as for instance in the 4th example cited) along the junction-line of successive bands, suggesting that Tertiary soil-water found room to enter. It looks indeed as if each band were in a sense an individual surface-flow of miniature dimensions. A group of such bands indissolubly connected betokens intermittent advance of a lava, wave upon wave (p. 98). J.E.R.

### **Segregation veins**

Another point of general interest shown by a small proportion of the lavas of the district is the occurrence of inconspicuous pegmatitic or aplitic veins consisting of augite and felspar. Such veins are best displayed among the lavas of Gometra, where, for instance, numerous examples may be examined 300 yds. south of the 503 ft. summit. Another

easily found exposure is in the Dun Bhuirg cliff, Loch Scridain, already mentioned for its exhibition of flow-banding and pipe-amygdales. In this latter case, the pegmatitic veins, or strings, occur in what is almost certainly the massive downward continuation of the flow-banded portion above. The crystallization of the veins is coarse enough to be decipherable with the naked eye; and one can see minute augite-prisms embedded in a felspathic ground, or projecting into associated amygdales. The veins occur in lavas which retain their olivine fresh, and they do not seem to be accompanied by any notable signs of pneumatolysis. The microscopic appearances are dealt with in Chapter 10 E.B.B., G.A.B.

### **Sand infillings**

In the introductory remarks of Chapter 5, attention was drawn to two occurrences of cavities in the Tertiary lavas of Mull filled in with quartz-sand. One of these is in the main lava-escarpment of the Gribun Peninsula, where the stream from Fionna Mhàin leads down to Caisteil Sloc nam Ban. Climbing up beside the stream, one finds that the second lava encountered is a distinctly columnar doleritic basalt, easily identified since it figures prominently in the cliffs. Its massive columnar portion merges upwards into slag with a bright-red weathered top. Not far below this weathered surface, there are miniature caves choked with bedded millet-seed sand. E.B.B.

The other occurrence alluded to can be investigated in numerous exposures between Port Burg and Sloc an Neteogh, on the north shore of Loch Tuath. In this case again the bedding of the sandstone into the lava-cavities is quite clear, but the sand-grains are not wind-rounded. J.E.R.

### **Ulva Ferry**

Mention has already been-made of two columnar lavas seen near Ulva Ferry. Attention may now be directed to some other points of interest in this neighbourhood. At the ferry itself, only one columnar flow is exposed. It forms the Mull shore, and above it comes ash with a thick reddened top. The junction of the ash with the underlying columnar flow is concealed by raised beach; but the ash itself constitutes the lower part of the old coastal cliff above the road from near the School to Laggan Bay, and in the latter neighbourhood is well seen in stream-exposures. From this point on, it is cut out locally by a mugearite-plug constituting Na Torranan, but reappears in the road- and shore-sections of Camas an Lagain. Near the plug, the ash has what is, for Mull, a quite exceptional thickness, roughly about 30 ft. In Ulva, the same bed has been traced for some distance passing by Ulva House and the Church, but it is there only two or three feet thick, and is altered to red bole.

The Laggan ash is almost everywhere overlain by a platy mugearite. A good illustration of the relationship between the two is laid bare at the foot of the waterfall on the north shore of Camas an Lagain. The mugearite here rests with slaggy irregular base on the ash, and contains some exceptionally long pipe-amygdales springing up from its bottom layer. Individual pipes seem to measure some two or three feet in length. G.V.W.

## **Sheet 51: The north-west coast of Mull**

Trap-featuring is very general in that part of Mull included within the limits of Sheets 51, and is nowhere more impressed upon the observer than along the zig-zag course of the road leading from Dervaig eastwards towards Tobermory. There is also another and independent element in the scenery deserving attention in the half of the district lying north-east of Dervaig, for here a large proportion of the ridges and valleys are lineated north-west and south-east. As will be shown in Chapter 34, this is mainly due to the presence of a great belt of north-west dykes cutting the lavas of Quinish and Mishnish, and but sparingly represented in Mornish.

The most interesting single exposure of the district is to be found in the cliffs of Bloody Bay, at the eastern margin of the map, 500 yds. east-south-east of Ardmore Farm, and of easy access from above, or by boat from Tobermory. An old quarry is situated in the cliff-face at the top of a steep grassy slope leading down to the sea. It was opened in a sandstone for building the foundations and causeway of Rudha nan Gall Lighthouse (Sheet 52). The sandstone is red and carries local iron concretions. It is lying flat and shows bedding and false-bedding. Its grains are occasionally rounded. Its age is quite uncertain. The quarry-face is some 50 ft. high and 100 ft. long, and occasional exposures show

that the sandstone continues at about the same level for 200 yds. farther north to where (and again south of the quarry) a north-north-west fault brings lavas down to the sea-shore. The interest of the quarry from the present point of view is the manner in which it shows an eroded knoll of sandstone projecting up into manifestly unconformable lavas (Figure 17). There is no other instance known of obvious discordance at the base of the Mull Tertiary lavas. The sandstone where it comes in contact with the covering lava is notably hardened, and has developed a system of rude columnar joints extending inwards for a few inches. That one is not dealing with an intrusion-phenomenon seems clear, for the basalt concerned has no approach to a chilled edge and is associated with slaggy material. G.V.W.

For the rest, the geology of the lavas of Sheet 51 is a counterpart of much of Mull outside the Pneumatolysis Limit. There are no columnar lavas to attract attention, but the observer will find plenty to interest him in such matters as reddened tops. A good succession of basalt-flows with red weathered tops is seen in the ravined coastal cliff, north of the 200-ft. hill, east of Treshnish Point. Other good examples occur in the cliff above the road to Calgary pier, between the plantation and the stream that are shown on the one-inch Map. Another is afforded at the base of Dùn Leathan on the coast of Quinish. G.V.W.

A quite unusually thick red bole perhaps deserves special mention. It measures over 12 ft. in thickness, and is partly made up of lava rotted in *situ*. Though a conspicuous feature in the field owing to its dimensions and bright colour, it is not easy to locate on the map. The reader on consulting Sheet 51 will note that two streams are shown between Beinn Bhuidhe and Càrn Mòr. The more westerly of these two, 700 yds. north of where it crosses the map-margin, is joined on its west side by a tributary (omitted from the one-inch Map). The exposure of red bole occurs in a little gorge some 300 yds. up this tributary.

The thick red bole just referred to is overlain by a lava ([S20949](#)) [NM 383 499] of very compact texture exactly reproducing the characters of the compact non-porphyrific lavas of Central Mull described in Chapter 10. The lavas of Beinn Bhuidhe as a whole, it may be added, are persistently platy. Of course, platy joining is not uncommon among the Plateau Basalts, though in Sheet 51 as elsewhere it is subordinate to a rude blocky approach to columnar structure.

An example of a sparsely porphyritic lava forms a continuous scarp above the Dervaig-Salen road, 2½ miles south-east from Dervaig. As a rule, it need scarcely be added, the lavas of the district are free from obvious felspar-phenocrysts.

Sometimes the surface of basalt-lavas in Sheet 51, as in other parts of Mull outside the Pneumatolysis Limit., weather with a multitude of pimply excrescences. A good example may be examined below the road along Calgary Bay, at the foot of the cliff above the southern termination of the rocky foreshore half a mile south of Laine Sgeir. Here solid pimply-weathering basalt may be seen giving place laterally to vesicular basalt with large druses containing conspicuous crystals of analcite.

Just at the margin of Sheet 51, south from Treshnish Point, the observer may study a good example of massive interbanding of solid and slag within what appears to be limits of a single flow. The slaggy layers themselves exhibit banding on a small scale. J.E.R.

Contemporaneous pegmatitic veining of the lavas has been noted occasionally in this area as elsewhere in Mull. The veins are little segregatory felspathic patches including minute augite-prisms, and are accompanied by similarly constituted linings to amygdales. Examples occur on the northern ridge of Beinn na Cille, about three-quarters of a mile from the summit; others again in a gorge of Allt Mòr, due east of Calgary Castle, where pegmatitic crystallization is seen in an amygdaloidal portion of a banded lava. G.A.B.

## Sheet 52: Tobermory, Mull

The geology of the Tobermory district is quite typical of its kind, and is largely covered by the general remarks introducing the present chapter. Trap-featuring is well-displayed, and the tendency to a north-west and south-east lineation of ridge and hollow—already commented on in the case of Sheet 51—is clearly discernable near Tobermory and also along the hollow of Loch Frisa.

The prevalence of non-porphyrific basalt may be emphasized by mention of an exceptional flow with large felspar-phenocrysts which has been followed from Area 3 of Sheet 44 across the map-boundary to the source of Allt Ardnacross in Coire Aria. J.E.R.

Of columnar structure, only one really good example is known from the district. It occurs at the cliff-bottom 800 yds. east-south-east of the point where Glac Mhòr empties into Bloody Bay. The lava is of the triple-zoned variety. Its lower portion consists of massive vertical columns, its central portion of thinner wavy columns, and its top of typical slag with reddened surface. Its actual base is hidden by the sea.

Another, but less perfect, example of columnar structure is afforded by the Calve Island basalt, as must often have been noticed by passengers entering Tobermory Harbour by the main entrance. In agreement with what has been found in Sheet 43, both these columnar lavas are near the base of the lava-series.

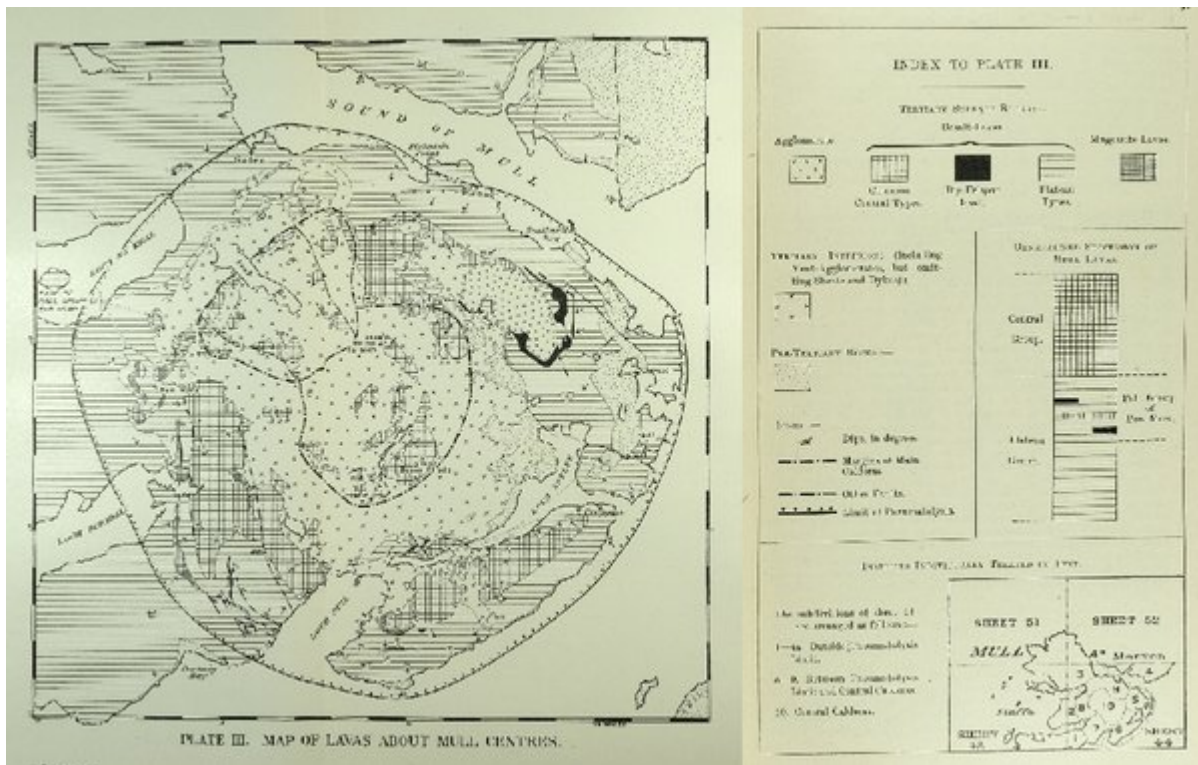
A very convenient path connects Tobermory with the Rudha nan Gall Lighthouse, and mention may be made of a few points of interest which can be seen along its course. Starting from Tobermory, one soon meets with several exposures of a lava showing more or less lenticular banding, with pipe-amygdales springing from the bases of individual bands. The appearances are rather puzzling, but they recall certain occurrences in Sheet 43, already dealt with in the earlier part of this chapter. Of more exceptional nature, and much more likely to escape attention, is a small group of pipe-amygdales, each pipe about 3 ft. in height. This is seen in the cliff-wall of the path some 400 yds. beyond the exposure of a 30 ft. basalt dyke, which goes out to sea at Rudha na Leip. Continuing along the path, one presently turns a corner that brings the Lighthouse into view. A hundred yards farther on, there is a particularly striking example of pegmatitic segregation-veins within a lava. The lava itself has undergone pronounced weathering giving rise to a rusty loam. The veins consist, as usual, of felspar and augite.

The pegmatitic veins so well seen near the Lighthouse are merely a sample of what can be found here and there throughout the district. Another easily located example is met with at the roadside half-way between the Poorhouse and the bridge over Tobermory River. G.V.W.

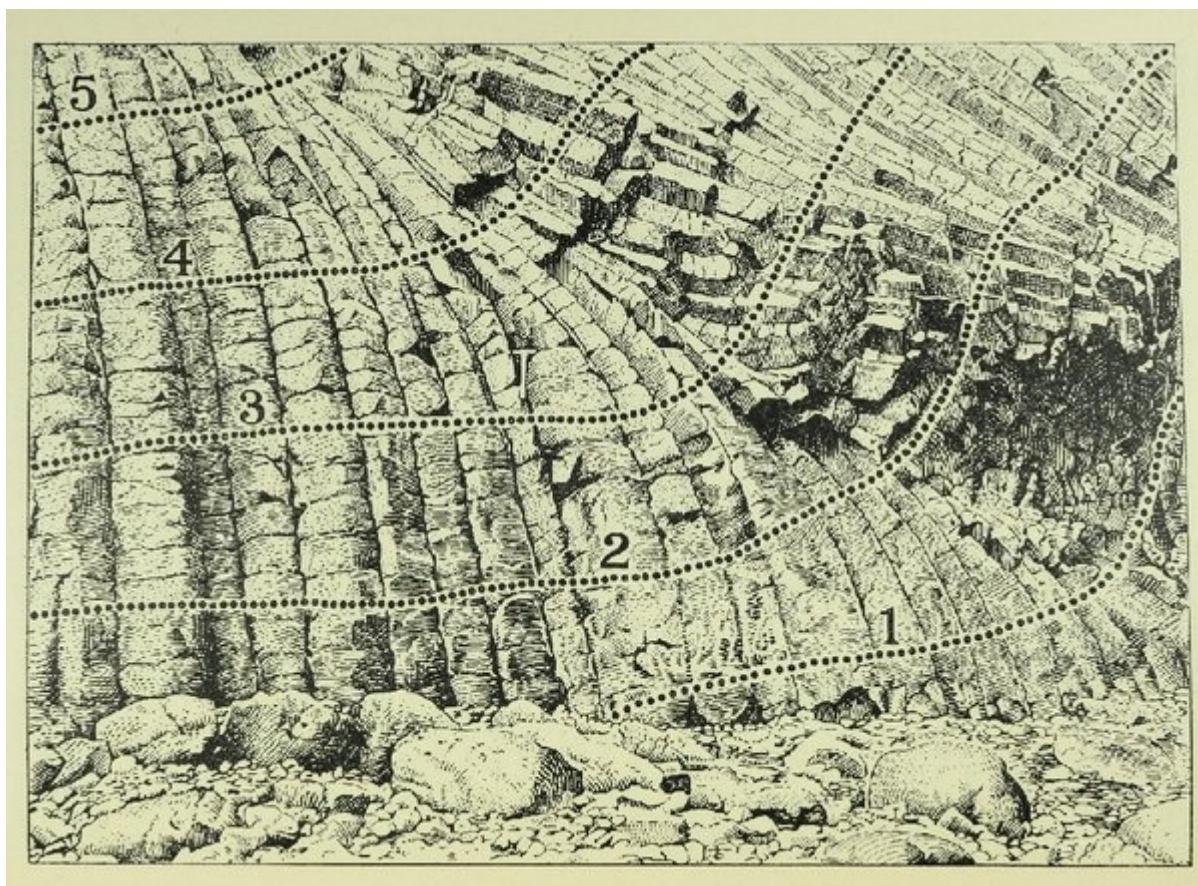
In describing Area 3 of Sheet 44 (Chapter 6), the coast-section on the Sound of Mull was specially referred to as affording a convenient introduction to the characteristics of Mull lavas outside the Pneumatolysis Limit. Its continuation across the southern boundary of Sheet 52 is equally useful. Reddened tops are abundantly exhibited. Typical instances occur on the little peninsula projecting into the bay into which the stream drains that passes by Aria Farm; and again where the map shows an islet surrounded at high tide just north of the mouth of Allt Ardnacross. Other features of interest within this stretch of coast are the banding of some of the lavas, for instance at Rudha Gorm and also about 200 yds. south of the mouth of Allt Ardnacross. The banding consists of an alternation of thin layers of compact and amygdaloidal basalt.

J.E.R.

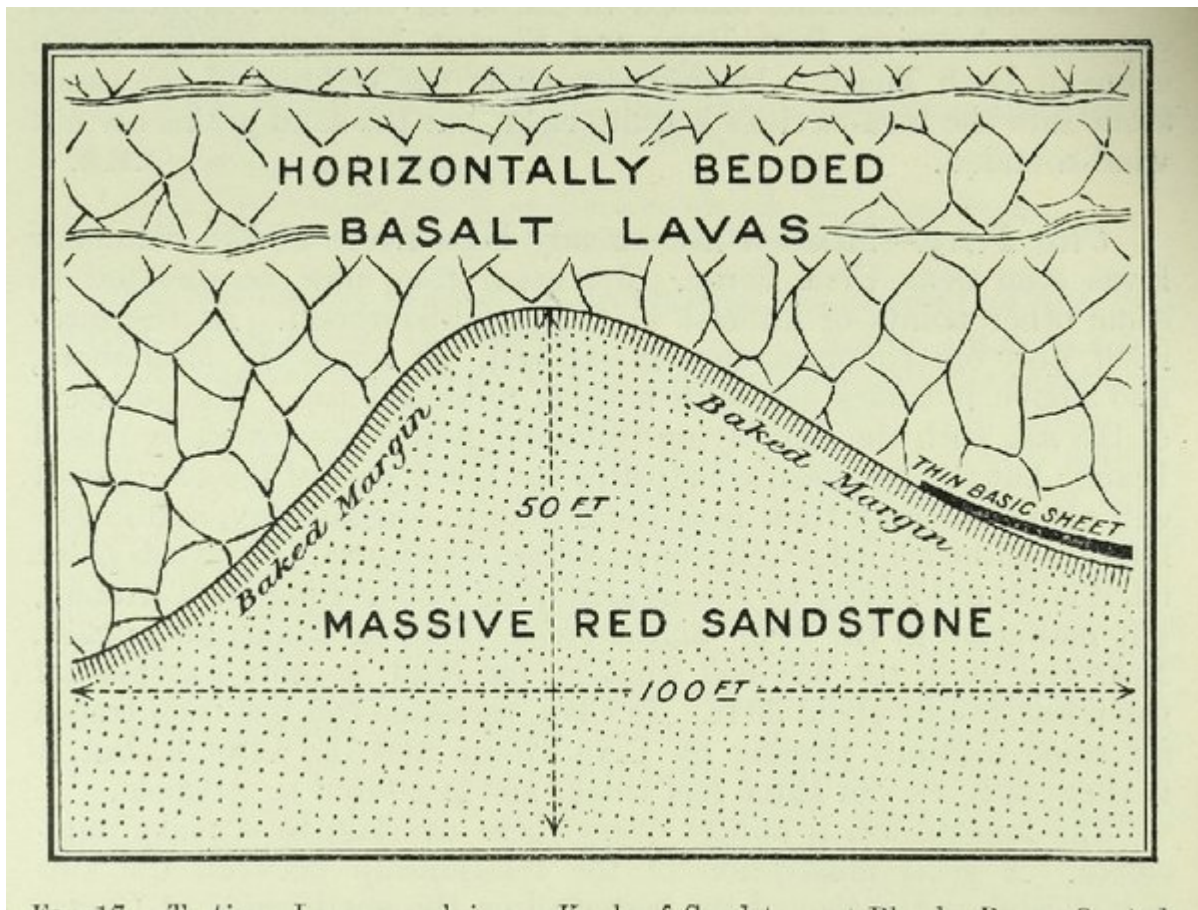




(Plate 3) Map showing the distribution of lava-types and the limit of pneumatolysis



(Figure 16) Columnar Jointing, North of Landing Stage, Staffa. The dotted lines, 1 to 5, indicate inferred successive positions of the critical isotherm, at right angles to which the columns have developed. (Modern beach-gravel shown at bottom of sketch)



(Figure 17) Tertiary Lavas overlying a Knob of Sandstone at Bloody Bay. Quoted from Summary of Progress for 1920, p. 37.