

mittent in its outbursts, and cooling under widely different conditions, affecting the attraction or repulsion of its mineral constituents. The whole of these Lizard rocks bear the impress of this later mechanical and chemical change, but the broader features due to these original and subsequent causes should, I think, be distinctly separated and clearly recognized.

VII.—PRELIMINARY NOTES ON SOME OCCURRENCES OF TACHYLYTE IN MULL.

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THE following notes have been compiled in order that, pending the publication of the results of microscopic and chemical examination of the specimens collected, geologists visiting the island may have an accurate localization of the dykes and intrusive sheets bearing glassy selvages observed by the writer and Mr. J. Lomas, A.N.S.S., during a recent visit to Mull. The list includes, for the sake of completeness, three occurrences of tachylyte which have already been described, viz.:—Sorne and Gribun¹ and Ardtun.²

The writer has not visited Sorne, but found the tachylyte at Ardtun, and re-discovered that at Gribun, in May, 1887. The last two exhibited certain peculiarities which appear to have hitherto escaped notice, and will be alluded to in the sequel. It is probable that some of the examples will prove upon examination to be more acid than the true tachylytes.

In the table which follows, the word "country" is employed as a convenient term to indicate the rock through which a dyke or intrusive sheet passes, or, briefly, in the miner's sense.

Many dykes which once possessed glassy selvages have undergone a process of decomposition, which, while removing all trace of actual glass, yet, leaves characteristic appearances which are quite unmistakable, though difficult to describe. Among the 200 or 300 dykes examined in Mull, a very large proportion are in this condition.

The tachylyte is occasionally very local in its distribution, and may be present only in small, widely-separated patches.

As a general rule it is thickest on the outsides of the curves of sinuous dykes (*e.g.* A. 12).

The character of the "country" appears to have influenced the formation of glassy selvages, hard and compact rock being a better conductor of heat than loose decomposed or vesicular material has favoured their production. This has been observed in numerous instances of which A. 12 may be taken as the most conclusive. The dyke can be traced across the junction of a sheet of compact basalt with an underlying highly vesicular rock, and thence on into the compact rock again, and it can be seen that in the compact rock the tachylyte is $\frac{1}{2}$ in. thick, while in the softer rock it is reduced to a mere film. Occasionally, in following up a dyke the tachylyte

¹ Judd and Cole, Q.J.G.S., vol. xxxix.

² Cole, Q.J.G.S., vol. xlv.

No.	POSITION.	BEARING (Magnetic).	CHARACTER OF DYKE OR SHEET.	CHARACTER OF TACHYLITE.	CHARACTER OF "COUNTRY."	REMARKS.
S. 1.	About 200 yards S.W. of Pier at Salen, Mull.		Intrusive sheet, ? thickness. Vesicular in median part.	Greenish to black. About $\frac{1}{2}$ in. thick.	Mostly compact, but varying with position of sheet.	The sheet is quarried for road metal near the road.
S. 2.	Port Mòr, Ardmòr, Salen. Behind Port Mor House.	General.*	Dyke 4 feet thick, fine-grained pyritous basalt.	$\frac{1}{2}$ in. thick. Black. Soft (?)	Compact felsite.	The specimens are as a rule very soft, and therefore I mark this as doubtful.
S. 3.	Port Beann near "y" of "Salen Bay," on 1 in. map.	N. 4° W.	Small string parallel to a large dyke.	A thin and local film. Black and lustrous.	Compact.	
S. 4.	About 20 yards E. of old cottage, Rudh 'a Ghnail, Salen.	Nearly due N.	Dyke 3 ft. 6 in. wide. Fine transverse columns.	$\frac{1}{2}$ in. thick. Greenish. Soft (?)	Compact.	
S. 5.	20 yards E. of S. 4.	N. 18° W.	Dyke about 5 ft. wide. Sinuous with strong rhomboidal jointing.	Thin, with dull lustre, and very local.	Highly amygdaloidal.	There are layers of infiltration matter between selva and "country."
S. 6.	E. of Salen Pier—runs under eastern corner of waiting room.	Runs between Beinn na h'Uaigh and Beinn Chreag-ach.	Dyke with many parallel strings.	$\frac{1}{2}$ in. thick, but thicker in angles. Black and lustrous.	Compact, with porphyritic felspars.	
S. 7.	7 feet E. of S. 5, of which it is probably a branch connected by a small bridge-like intrusive sheet.	Same as S. 5.	Dyke 2 ft. 5 in. wide.	$\frac{1}{2}$ in. thick. Black to green.	Same as S. 5.	There are clear traces of an intrusive sheet adhering to the "country" between S. 5. and S. 7.
K. 1.	Loch na Keal, western end of first field W. of Kellon Wood and on shore opposite.	Dip 20° to W.	Intrusive sheet of columnar basalt 18 in. to 2 feet thick with tachylite top and bottom.	Black, lustrous, upwards of $\frac{1}{2}$ in. thick.	Compact amygdaloidal basalt.	The columns are used as a parapet to road beside Kellon Wood.
K. 2.	N. side of Loch na Keal to W. of "16,"	N. 17° W.	Dyke 5 ft. 9 in. wide.	Black, lustrous. $\frac{1}{2}$ in. thick.	Amygdaloidal basalt.	
K. 3.	Intersected by K. 2.	N. 29° W.	Dyke 14 in. wide.	Black, lustrous.	"	
K. 4.	30 yards E. of K. 2.	Parallel to K. 2.	Dyke 8 in. wide.	"	"	
L.P.	Where telegraph wires cross road 300 yards beyond second milestone from Tobar-mory to Loch Feallach.	Parallel to Sound of Mull.	Dyke of magma basalt with pyrites in joint-planes. Columnar and platy.	Black. Perfect vitreous lustre.	"	Near the road the "country" is rotten, and the tachylite is soft, but further in the "country" is hard and the tachylite good.

T. 1.	Tobermory Burn—below top fall, just opposite a bye-road.	N. 7° W.	Dyke with columnar jointing. Magma basalt with a little augite.	Black, lustrous.	Compact basalt.	Found by Butler & Kendall May 1887. A small kernel of tachylyte occurred within the dyke about 6 in. from selva.
T. 2.	About 10 yards below T. 1.	N. 5° W.	Dyke about 8 in. wide.	Thin and local.	"	
T. 3.	About 2 yards below T. 2.	N. 5° W.	Dyke 9 in. wide.	Lustrous, black.	"	
Rn. G.	Rudha nan Gael. Cliff just behind Coastguard Station.		Dyke 3 ft. 6 in. wide. Magma basalt with porphyritic labradorite.	Nearly ½ in. thick.	Hard amygdaloidal basalt.	Found by Butler & Kendall, May 1887. Block on the shore fallen from dyke visible in cliff.
E. 1.	W. side of Erray Burn (between lighthouse and Bloody Bay).	Parallel with Sound of Mull.	Dyke about 3 ft. wide. Coarse grained basalt with minute amygdulites and eroded labradorite crystals 2 in. long.	Lustrous, black. About ½ in. thick.	Rather decomposed columnar basalt.	Found by Butler & Kendall, May 1887.
E. 2.	E. side of Erray Burn.	"	Dyke of fine-grained basalt 8 feet wide.	Much decomposed. Black, with resinous lustre. Firmly adherent to dyke.	"	
G. A.	Glen Aros, ¼ mile above bridge and 100 yards E. of cutting showing speroidally weathered basalt.	N. 5° W.	Dyke of pale green rock with minute amygdulites and some large mica crystals. 20 in.	Very dark green. 2½ in. thick, passing into sperulitic structure internally.	Basalt dyke in spheroidally weathered basalt.	This appears to be a case of "dyke-in-dyke."
A. B.	Aros Bridge, just behind 1st road on road to Tobermory.	N. 2° W.	Dyke of porphyritic basalt, 7 feet wide. Much broken up.	Very thin and local. Black lustrous.	Compact basalt.	The average direction would probably prove about N. 5° W.
A. 1.	Immediately behind Aros Hotel and passing E. window.	N. 20° W.	Dyke of magma basalt, 5 feet thick.	Greenish to jet black. ½ in. thick.	Compact basalt.	
A. 2.	Seaward side of Aros Hotel.	Towards Heinn Chreagach.	Sinuuous dyke 20 in. wide. In places very amygdaloidal.	Black and lustrous, coating the dyke in broad patches where the "country" is worn away.	Coarse amygdaloidal basalt.	The strings contain large felspar crystals.
A. 3.	Aros Hotel just N. of creek where boats are drawn up.	N.W.	Many small string-dykes, parallel to a large one. The strings are about 1 in. wide and are vesicular down middle.	Very thin.	Coarse basalt.	
A. 4.	Shore N. of Aros Hotel, 70 yards S. of 2nd wall.	N. 37½° W.	Dyke 15 in. thick.	Thin, lustrous.		
A. 5.	At 2nd wall N. of Aros Hotel.	Strikes large island in Sound. N. 15° W.	Dyke 4 feet wide. Porphyritic basalt.	Black and lustrous. Thin, local.	Compact basalt.	The dyke runs like a wall for a long distance. The tachylyte is best seen on E. side a few yards from the wall.

* Probably about N. 5° W.

No.	POSITION.	BEARING (Magnetic).	CHARACTER OF DYKE OR SHEET.	CHARACTER OF TACHYLITE.	CHARACTER OF "COUNTRY."	REMARKS.
A. 6.	200 yards N. of A. 5, and 50 yards N. of a wall with wire fence.	N. 26° W.	Dyke with many branches to the S. 8 feet wide at Max.	Black, lustrous. On one branch which thins to nothing, it occurs on both ends of columns. Very thin.	Compact basalt, much shattered.	
A. 7.	A little N. and seaward of A. 6.	N. 25° W.	Dyke 4 feet wide of coarse vesicular basalt. Breaks to Northward into 8 branches.		"	
A. 8.	Nearly parallel to A. 9, and displaces it by crossing.	Strikes for Beinn Bheanach.	Dyke 4 feet wide. Fine-grained basalt weathering sharply.		Compact basalt.	
A. 9.	Allt na Criche; crosses 1st fence N. of cottage.	N. 35° W.	Dyke 8 feet thick. Weathers into rounded masses. Coarser than A. 8.	Bright lustre.	Compact amygdaloidal basalt.	This dyke can be traced to the road from Salen to Tobermory, about 100 yds. S. of milestone "Sal. 3."
A. 10.	Crosses next stone wall to N. of A. 9.	N. 10° W.	Dyke 2 feet wide.	Black, lustrous. Strings of tachylite penetrate the "country."	Very tough amygdaloidal basalt.	
A. 11.	Between A. 10 and next wire fence to N.	N. 5° W.	Dyke 8 feet wide. Basalt with very large feldspars.	Black, lustrous.	Rotten amygdaloidal basalt.	
A. 12.	Strikes short, a few yards beyond wire fence N. of A. 11.	N. 23° W.	Dyke 3 ft. in wide with parallel composed entirely of tachylite.	Black, lustrous. ½ in. thick. Thickest on convex side of bends in dyke.	Compact, somewhat amygdaloidal, resting on decomposed highly amygdaloidal basalt.	The wire fence alluded to runs up to road "Sal. 3." from A. 12. Where the dyke is in contact with the amygdaloidal rock, the tachylite is very thin.
A. 13.	30 yards N. of A. 12.	Parallel to A. 12.	Dyke 1 foot wide thinning right out to southward.	Greenish to black. Lustrous.	Compact amygdaloidal basalt.	Note.—The dykes A. 1 to A. 13 are given in regular sequence along the shore from S. to N.
A. 14.	N. shore of Port nam Fuit-sichan 20 yards W. of bye road to Tobermory.	N. 25° W.	Dyke 5 feet wide. Rifurcates and re-unites. Very coarse and vesicular in median portion.	Thin, black, and lustrous.	Coarse compact amygdaloidal basalt, with lustrous brown crystals.	
A. 15.	Apparently cut by A. 14 to seaward.		Dyke 3 feet wide.	Thin.	"	
A. X.	On road from Salen to Tobermory beyond second milestone and 20 yards from turning to Ledmore Loch Frisa.	N. 15° W.	Dyke 5 feet wide.	Black, lustrous.		
T.R. 1.	On same road where the 400 contour-line crosses between 3rd and 4th milestone from Tobermory.	N. 15° W.	Dyke.	Black lustrous; about ½ in. thick.		The specimens obtained <i>in situ</i> were poor though unmistakable, but on the wall intersecting the dyke were fine examples.

T.R. 2.	On same road, a little nearer to Tobermory than 3rd milestone.	N. 20° W.	Dyke. Contains large felspars like those in A. 11 and E.B. 1.	4 in. thick. Greenish. Includes large felspars.	In-	Compact basalt.	Dyke and "country" are worked for road-metal.
T.R. 3.	On same road, a few yards from gate "Upper Drumin."	N. 5° W.	Intrusive sheet exposed from some distance in roadside. Marked platy jointing.	Thin. Black to greenish. Very local.	Very compact and adherent to dyke. Hard and compact.		The specimens were found after repeated searches close to the intersection of a large dyke. We were led to re-examine by finding a block with tachylite on the Survey cairn on the level stretch of road nearer to Salen.
K.R. 1.	On summit of road from Salen to Killichronan.						
K.R. 2.	A few yards W. of K.R. 1, where intrusive sheet dips under talus, and before its exposure to W.	General bearing.	Small dyke 2-5 inch wide.	Local. Greenish to black.		Compact basalt.	
C.M. 1.	Creag Mhòr, S. side of Loch na Keal. About letter "r" in "Creag" 1 in. map.		Probably from intrusive sheet about 1 foot thick. Fine-grained basalt with iron pyrites. Columnar.	Black, lustrous.		Compact, coarse-grained basalt.	A dyke and at the least six intrusive sheets are visible in the cliffs. The specimens were from fallen blocks.
C.M. 2.	Fallen block at 1st bridge from Creag Mhòr towards Gribun.			Black, lustrous.	"		
G.	Pass of Gribun about letter "a" in "Balmeanach" on 1 in. map, and 100 yards S. of gate.	? about N. 40° W.	Dyke 3-8 in. wide. Bifurcates and re-unites.	Black and highly lustrous. Max. 1 in. thick. Runs into the vesicles in "country."	Rotten, pulverulent, and amygdaloidal, but for a foot on each side of the dyke very hard and compact.		Described by Judd and Cole, Q.J.G.S. vol. xxxix. Rediscovered by Butler and Kendall, May, 1887.
T.	Torrens, Loch Scridain.			Black and lustrous.			The specimen was found by Mr. F. H. Butler, May, 1887, upon a wall to W. of Torrens. Time would not permit of its being traced to its source.
A.B.	Ardthn Brae.		Intrusive sheet.	Black, highly lustrous. Max. 5 in. thick. Runs down between columns of underlying basalt for a distance of 4 feet.	To N. compact non-vesicular, and to S. amygdaloidal basalt.		Described by Cole, Q.J.G.S. vol. xlv. Discovered independently by Duke of Argyll (?), Mr. Koob, Mr. Cole, and Butler and Kendall (May, 1887).
B.C.	Summit of Beinn Chreagach, near S. side.		Intrusive sheet 10 in. thick.	Greenish. Dull lustrous.	Very coarse gabbro.		The rock has rather the appearance of an intermediate rock.
	Sorne, 3 miles N.W. of Tobermory.		Dyke.	1 inch thick.			Described by Judd & Cole, Q.J.G.S. loc. cit.

gives place to a black or greenish substance having a hardness of about 2.

Several cases have been noted in which small strings have been given off consisting wholly of tachylite, for example strings descend from the Ardtun intrusive sheet between the columns of the basalt "country" to a distance of, at the least, four feet.

A good test for intrusive sheets when the stratigraphical evidence is inconclusive has long been a desideratum, and it may be that certain peculiarities in those observed in Mull may prove really diagnostic when a sufficient number of examples have been examined to justify generalisation.

The Ardmòr intrusive sheet (S. 1) was recognized as such in the first instance by the extraordinary sharpness of the plate-like columns and subsequently the determination was confirmed by the discovery of the tachylite selvages. This sheet is amygdaloidal *in the middle* and the same peculiarity is presented by other intrusive sheets, and also by many dykes (*e.g.* G. A.) in Mull, while, as is well known, lava-streams are vesicular top and bottom.

In conclusion, the writer desires to express his conviction that, when Mull comes to be fully surveyed, dykes with tachylite selvages will be numbered by hundreds, or, it may be, even by thousands.

Note by Bernard Hobson, Esq., B.Sc.—On the coast, between tide-marks, to East of the "principal ravine" of Mr. Starkie Gardner, at Ard Tun, are two intrusive sheets, each about one foot thick, one above the other, with only 2 or 3 inches between them. They are intruded into the basalt, and each sheet bears a thick selvage of tachylite both above and below, the mass of the sheet being characterized by large spherulites, clearly visible to the naked eye, especially when the rock is wet. The sheets are irregularly columnar and their surfaces where exposed by erosion of the "country," present a striking appearance owing to their brilliant glassy blackness.

VIII.—NOTES ON THE "*MONIAN SYSTEM*" OF PROFESSOR BLAKE.

By CH. CALLAWAY, D.Sc., F.G.S.

AS Professor Blake, in his elaborate paper in the Quarterly Journal of the Geological Society for August last, makes frequent reference to my work in Anglesey, I may perhaps be permitted a brief comment. I do not intend to enter upon an elaborate controversy, since I prefer, now that the two views of the district have been published, that those interested in the matter should visit the ground, and judge for themselves. Nevertheless, it is well that the salient points of agreement and difference between the two readings should be placed in a clear light.

On the fundamental question—the Archæan age of the bulk of the Anglesey crystallines and altered slates—Prof. Blake is at one with Dr. Hicks, Prof. Bonney, and myself; but he differs from those geologists who place a part of our Archæan in the Ordovician, and