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Figures

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(Front cover) The geology of Ardnamurchan, North-west Mull and Coll.

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(Figure 19) Section across Ben Hiant.

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(Figure 23) Map of Outer Cone-sheets of Centre 2, shore south of Kilchoan.

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(Figure 27) Section across Tertiary Intrusive Complex of Ardnamurchan. Index-letters for ring-dykes are explained in (Table 7), pp. 201–202.

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(Figure 29) Hypersthene-gabbro. A. (S23625) [NM 4499 6364] × 20. Hypersthene-gabbro. Large crystals of olivine fringed with hypersthene and embedded In a matrix of basic plagioclase felspar. B. (S22376) [NM 4195 6705] × 20. Olivine-free variety of the Hypersthene-gabbro showing ophitic relations of hypersthene and labradorite.

(Figure 30) Acidification of Hypersthene-gabbro. A. (S21522) [NM 4716 6440] × 20. Acidified gabbro. The section shows partly resorbed augite, plagioclase felspars albitized and edged with alkali-felspar, and some iron-ore, in a copious granophyric matrix. B. (S22274) [NM 4416 6942] × 20. Granulitic mass presumably produced by the complete

assimilation of gabbro material by acid magma. The rock contains a green strongly pleochroic augite, similar to that encountered in the Camphouse Augitediorite (p. 153, (Figure 17)).

(Figure 31) Granulitic masses associated with basic ring-dykes.. A. (S22658) [NM 4986 6764] × 20. Granulitic gabbro, at margin of Great Eucrite south-west of Meall nan Con. A completely recrystallized rock composed of augite, clear plagioclase, and abundant iron-ore. All the constituents tend to have a granulitic development. B (S23620) [NM 4223 6631] × 20. Granulitic gabbro of allivalitic composition, enclosed by Hypersthene-gabbro. It is composed of granulitic olivine, basic plagioclase felspar, and iron-ore. The rock has been completely recrystallized and has developed a faint banding.

(Figure 32) A (S24490 B) [NM 4805 6478] × 20. Sapphire-spinel rock xenolithic in the Hypersthene-gabbro. The section shows well-formed crystals of corundum and an almost opaque spinellid in a chloritic base. B (S24440) [NM 4283 6815] × 20. Spinel-magnetite rock occurring as streaks in the Quartz-dolerite of Sgùrr nam Meann. The section shows well-shaped crystals of dark-green spinel containing skeletal growths of magnetite, set in a matrix largely composed of magnetite. Certain bands contain a basic plagioclase felspar of which a little is visible in the lower portion of the section.

(Figure 33) Granophyre of Grigadale and Quartz-dolerite of SgUrr nam Meann. A. (S22820) [NM 437 664] × 20. Grigadale Granophyre. Crystals of plagioclase edged with turbid alkali felspar, partially resorbed augites of gabbro origin, and occasional patches of iron-ore, in a granophyric matrix of alkali felspar and quartz. B. (S22409) [NM 432 662] × 20. Quartz-dolerite of Sgùrr nam Meann. The section shows a large crystal of hypersthene, with partially recrystallized augite and iron-ore, in a matrix of plagioclase felspar that has been invaded by acid material and locally albitized.

(Figure 34) Quartz-dolerite net-veined by granophyre, Sgùrr nam Meann Ring-dyke, on shore south-west of Sgitrr nam Meann. Drawn from Geological Survey Photograph, No. C. 2773.

(Figure 35) Intrusive Junctions, seen in 20-ft. cliff west of Beinn na Seilg. Hypersthene-gabbro Ring-dyke, banded ornament. Quartz-dolerite Ring-dyke, light stipple. Inner Cone-sheet, heavy stipple.

(Figure 36) View of the western side of Beinn na Seilg. a, Hypersthene-gabbro. c, Quartz-gabbro of Garbh-dhail. e, Quartz-dolerite of Sgitrr nam Meann. f, Eucrite of Beinn nan Ord. g′, Quartz-gabbro of Beinn na Selig. Broken lines indicate margins of ring-dykes (not shown in foreground).

(Figure 37) Map of portion of Ring-dyke Complex of Centre 2, north of Beinn nan Ord. Note. Localities of a serial collection of rock-specimens are indicated by black dots numbered 1–21 (see pp. 268–270, 274, 275).

(Figure 38) Eucrite of Beinn wan Ord. A. (S22397) [NM 432 662] × 20. Irregularly bounded and broken crystals of olivine with some augite in a felspathic matrix. Ordinary light. B. (S22397) [NM 432 662] × 20. The same field between crossed nicols, showing the shattered character of the matrix. Subsequent metamorphism attended by recrystallization has, to a certain extent, reduced the original intensity of the cataclastic structures.

(Figure 39) Section from Meall an Tarmachain to Glas Bheinn, north of Kilchoan. 1, Moine Schists. 2, Trias. 3, Lower Lias (limestone and shale). 4, Tertiary basalt lavas. 5, Vent-agglomerate (Centre 1). 6, Porphyritic Dolerite of Glas Bheinn (Centre 1). 7, Outer Cone-sheets of Centre 2. 8, Cone-sheets (Centre 3). 9, Quartz-felsite dyke. A, Quartz-gabbro Ring-dyke (Centre 3). E, Great Eucrite Ring-dyke (Centre 3).

(Figure 40) View of Meall nan Con and Meall Meadhoin from north.Dotted line indicates junction of Meall nan Con Screen, forming ridge to left, with Great Eucrite Ring-dyke, forming Meall Meadhoin and foreground. Drawn from Geological Survey Photograph No. C. 2818.

(Figure 41) View of crags on west side of Meall nan Con.Broken line indicates junction of granulitized rocks of Meall nan Con Screen with Great Eucrite Ring-dyke, that forms vertically-jointed crag overlooking loch.Drawn from Geological Survey Photograph No. C. 2817.

(Figure 42) Great Eucrite. A. (S22675) [NM 4680 6659] × 20. Eucrite, typical of the Great Eucrite of Centre 3. The section shows olivine with slight marginal development of secondary magnetite, and plagioclase that varies in composition from basic labradorite to bytownite. B. (S22355) [NM 4422 6816] × 20. Same type with well-developed reaction border between olivine and felspar. The reaction border consists of dendroid magnetite and hypersthene.

(Figure 43) Olivine-spinel-granulite. A. (S26671) [NM 5024 6681] × 20. The rock consists of rounded grains of olivine and an almost opaque dark-green spinellid in a matrix of basic plagioclase felspar. B. (S26671) [NM 5024 6681] × 20. Another portion of the same section, with the same magnification, showing the large plates of biotite that occasionally replace felspar as the matrix of the other constituents.

(Figure 44) Intrusive Junction of Quartz-gabbro of Meall an Tarmachain (left) with Outer Eucrite, south-east side of Meall an Tarmachain. Drawn from Geological Survey Photograph No. C. 2812.

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(Figure 47) Diagrammatic section across Sìthean Mòr Ring-dyke.

(Figure 48) Tonalite and Quartz-monzonite.A. (S21248) [NM 4735 6873] × 20. Tonalite. Biotite, hornblende, and augite with plagioclase felspar, perthite, and quartz. Magnetite and apatite are abundant accessories. The alkali-felspar is mainly turbid. – B. (S21247) [NM 4699 6843] × 20. Quartz-monzonite. The section shows a large plate of biotite, with subordinate augite, abundant elongate crystals of oligoclase-andesine felspar, in an apatite-rich turbid base of albite-perthite and quartz.

(Figure 49) Tertiary Dykes of the South-West Highlands. Only about one dyke in every ten or fifteen in shown. Quoted from Tertiary Mull Memoir, 1924, (Figure 60), p357.

(Figure 50) Map of Tertiary Dykes, Ardnamurchan.

(Figure 51) Map showing relations of dykes and cone-sheets, on shore west of Sròn Bheag. pM, 4-ft. porphyritic basalt dyke. I, cone-sheets of quartz-dolerite (Talaidh type). M, 5-ft. Non-porphyritic dyke of quartz-dolerite (Talaidh type). xM, xenolithic portion of M. H.W.M., high-water mark.

(Figure 52) Dyke rocks. A. (S24472) [NM 5605 6101] × 20. Pitchstone with porphyritic felspars and pyroxene in a glassy base rendered almost opaque by skeletal growths of magnetite. The porphyritic felspars exhibit a highly characteristic spongy development and are penetrated by the ground-mass. B. (S22425) [NM 4721 6297] × 63. Amygdale from dolerite dyke showing zone of small idiomorphic garnets between turbid perthite and colourless prehnite.

(Figure 53) General glaciation of district, and some raised-beach phenomena. Quoted from Tertiary Mull Memoir, 1924, (Figure 65), p. 395.

(Figure 54) View of Kilchoan Bay, from the east, showing Pre-Glacial Marine Rock-notch at 140 ft. along west side of bay. Drawn from Geological Survey Photograph No. C2821.

Plates

(Plate 1) A. View of Ben Hiant, Ardnamurchan, from west. Main mass of this rocky hill is Ben Hiant Intrusion (see (Figure 19), p. 160). Maclean's Nose to right is agglomerate. Junction of these rocks extends from shore up well-marked hollow, seen on photograph above Mingary Castle (see also Plate 1, B). Stallachan Dubha is formed of outlying portion of Ben Hiant Intrusion. Scarp-features in middle distance are due to cone-sheets. Mingary Castle stands on a craignurite sill. Promontory beyond is Rudha a' Mhìle ((Figure 25), p. 177). Geological Survey Photograph, No. C2829. B. Marginal

Scarp of Ben Want Intrusion, seen from south-east. The view is taken from west of Stallachan Dubha (see Plate 1, A and Explanation). The Ben Hiant Intrusion is closely jointed. Vent-agglomerate forming foreground contains two large masses of big-felspar basalt (p. 126), one in centre of view, the other to the left. Geological Survey Photograph, No. C2850 .

(Plate 2) Index map of Teriary intrusive complexes of Centre 1, 2, and 3 Ardnamurchan.

(Plate 3) A. View of Maclean's Nose, Ardnamurchan, from east. Cliffs extend up to 800 ft. above sea-level, and are formed of vent-agglomerate with flatly interbedded tuffs. On extreme right of scree, buttress of basalt lava marks a vertical wall of the vent. Exposure of vent-wall (Moine Schist) again occurs on shore near point of Nose (see p. 124). Geological Survey Photograph, No. C2859. B. Agglomerate Cliff of Maclean's Nose. In foreground, flat bed of tuff (below hammer) with agglomerate above and below. The view is taken from near extreme right of Plate 3, A, looking towards the Nose. Geological Survey Photograph, No. C2848.

(Plate 4) Quartz-dolerite cone-sheets along shore south of Kilchoan, Ardnamurchan. The cone-sheets are inclined away from the camera, and show well-developed cross-jointing. (See (Figure 23), p. 174.) Geological Survey Photograph, No. C2826.

(Plate 5) Geology of Ardnamurchan. Index Map of ring-dykes of Centres 2 and 3, Ardnamurchan. (Mem. Geol. Surv.)

(Plate 6) Panorama of Great Eucrite and Interior Complex of Ring-dykes of Centre 3, Ardnamurchan, from north-east, with Meall an Tarmachain and Beinn na Seilg in distance. Outer ring of hills and dark foreground mark the outcrop of the Great Eucrite. Low inner ring surrounding central knob of Quartz-monzonite is the Fluxion Biotite-gabbro of Glendrian. The distance from Meall Meadhoin across the Interior Complex to Meall Sanna is three miles. Drawn from Geological Survey Photographs Nos. C2806, C2807, C2808, C2809.

(Plate 7) Tertiary Gabbro Topography, Ardnamurchan. View looking south from Achosnich across Ring-dyke Complex of Centre 2. Beinn na Seilg and Beinn nan Ord are formed mainly of eucrite. Intervening valley is eroded along north-south crush-lines. Dubh Chreag and other distant hills are hypersthene-gabbro. Lower ground between Beinn na Seilg and crofts in foreground (Achosnich) is mainly quartz-gabbro. Geological Survey Photograph, No. C2785.

(Plate 8) Map of Teriary Igneous Complex of Ardnamurchan.

Tables

(Table 1) Analyses.

(Table 2) Non-porphyritic Central Magma-Type (see (Figure 6)).

(Table 3) Sub-acid and Acid Magma-Types (see (Figure 6)).

(Table 4) Porphyritic Central Magma-Type (see (Figure 7)).

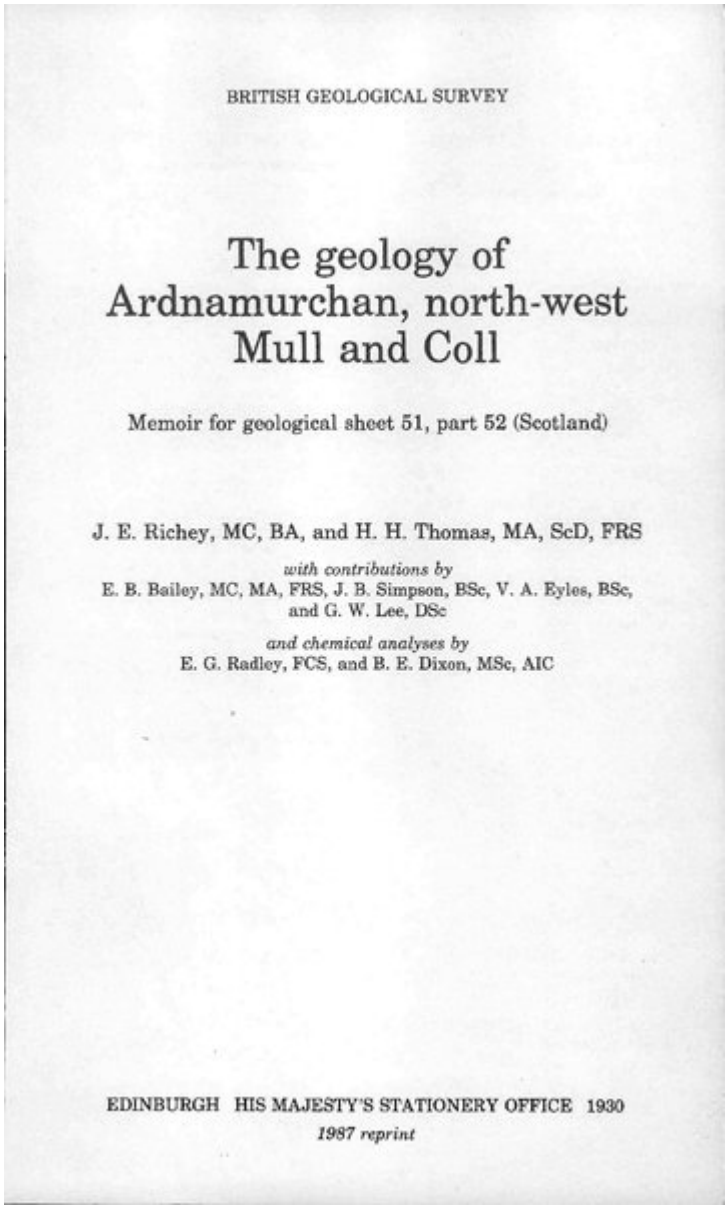
(Table 5) Tonalite and Quartz-monzonite Magma Series (see (Figure 8)).

(Table 6) Data concerning cone-sheets, Ardnamurchan.

(Table 7) Ring-dykes of Centres 2 and 3.

(Table 8) Data concerning Mull Dyke-swarm.

(Table 9) Analyses of Raasay Ironstone.



BRITISH GEOLOGICAL SURVEY

The geology of Ardnamurchan, north-west Mull and Coll

Memoir for geological sheet 51, part 52 (Scotland)

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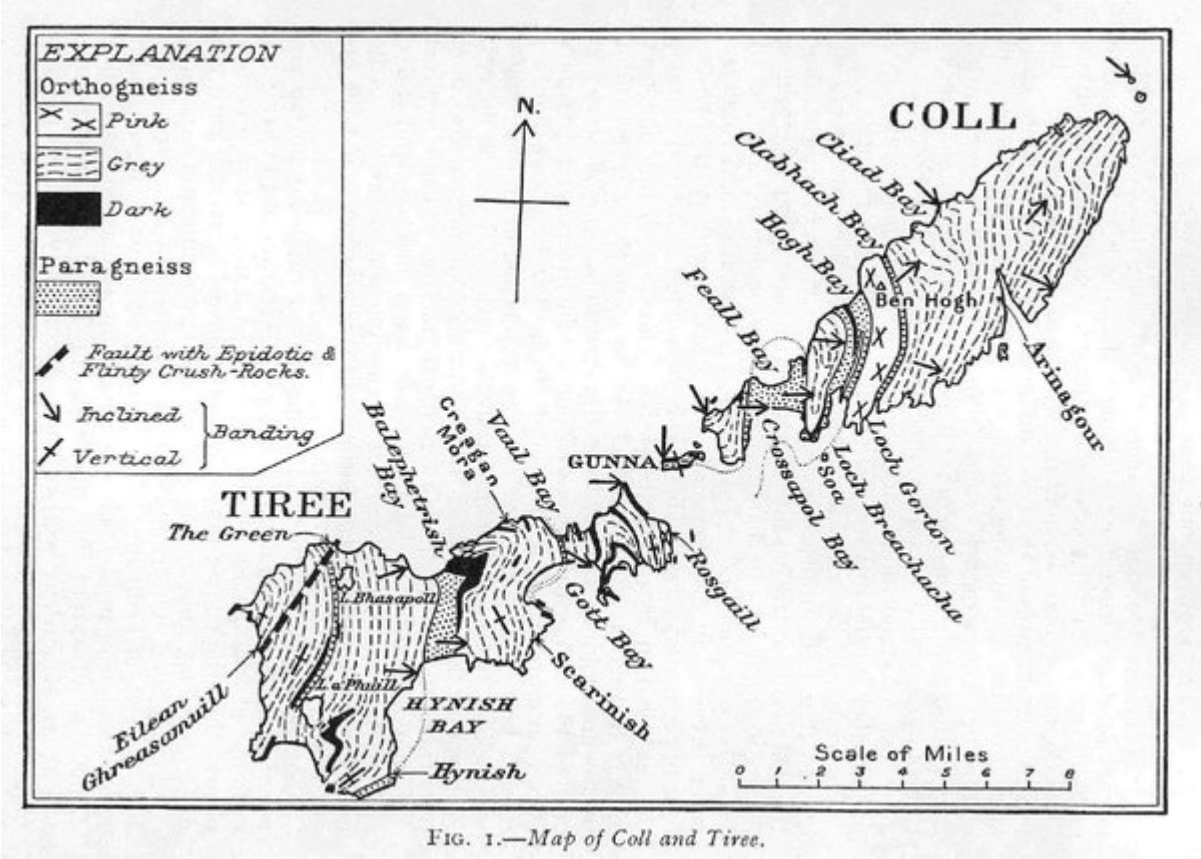

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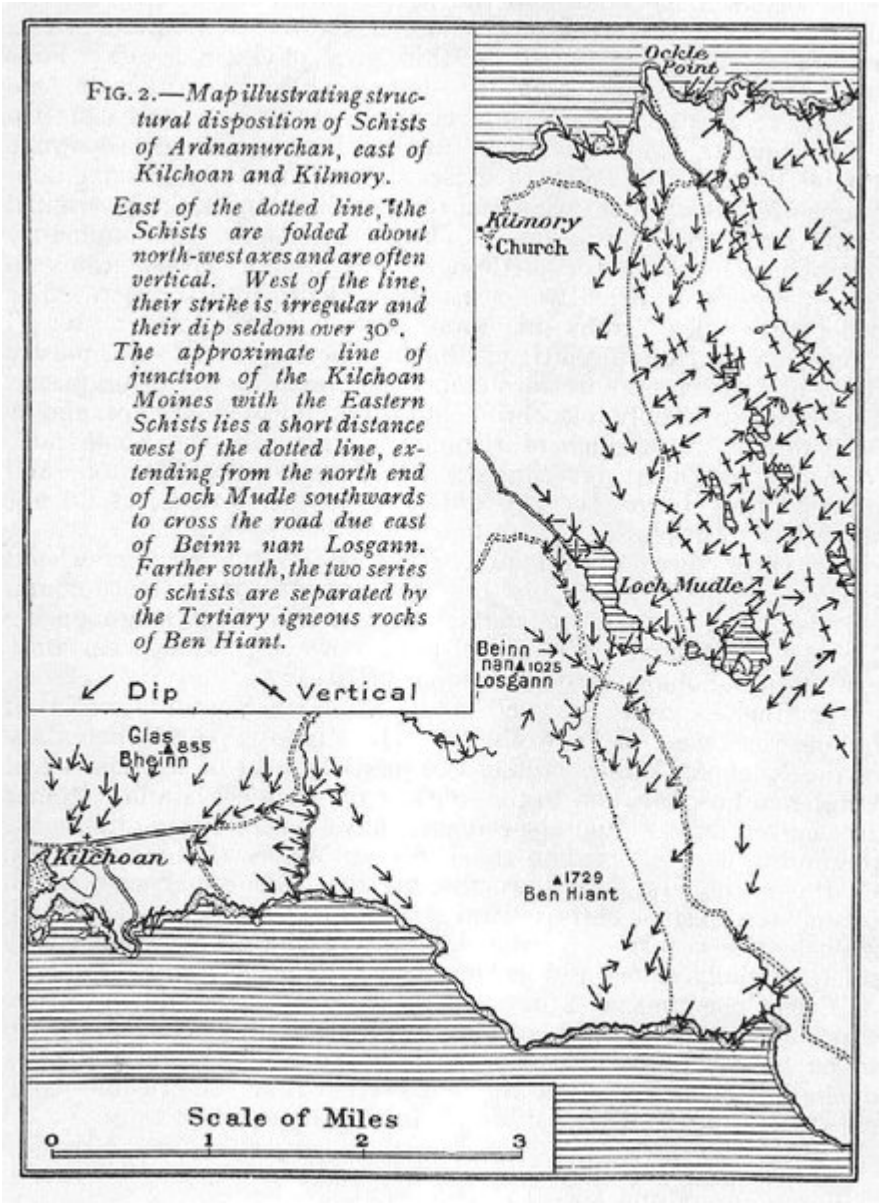

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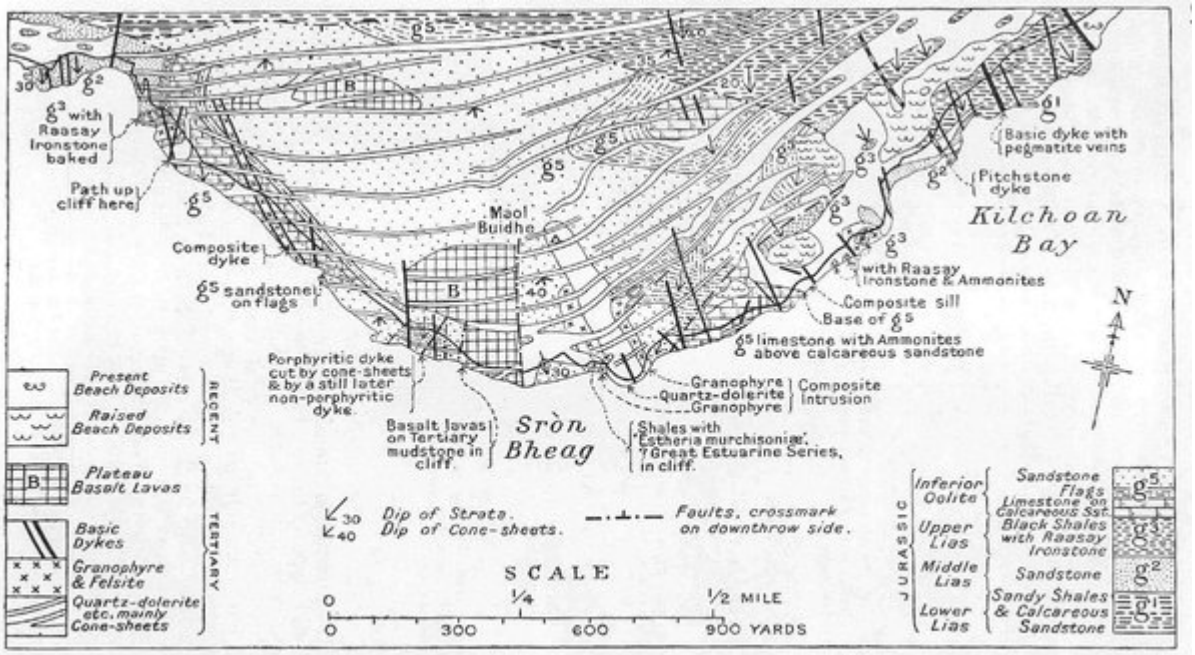

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NOTE.—Tertiary cone-sheets are mainly represented diagrammatically.

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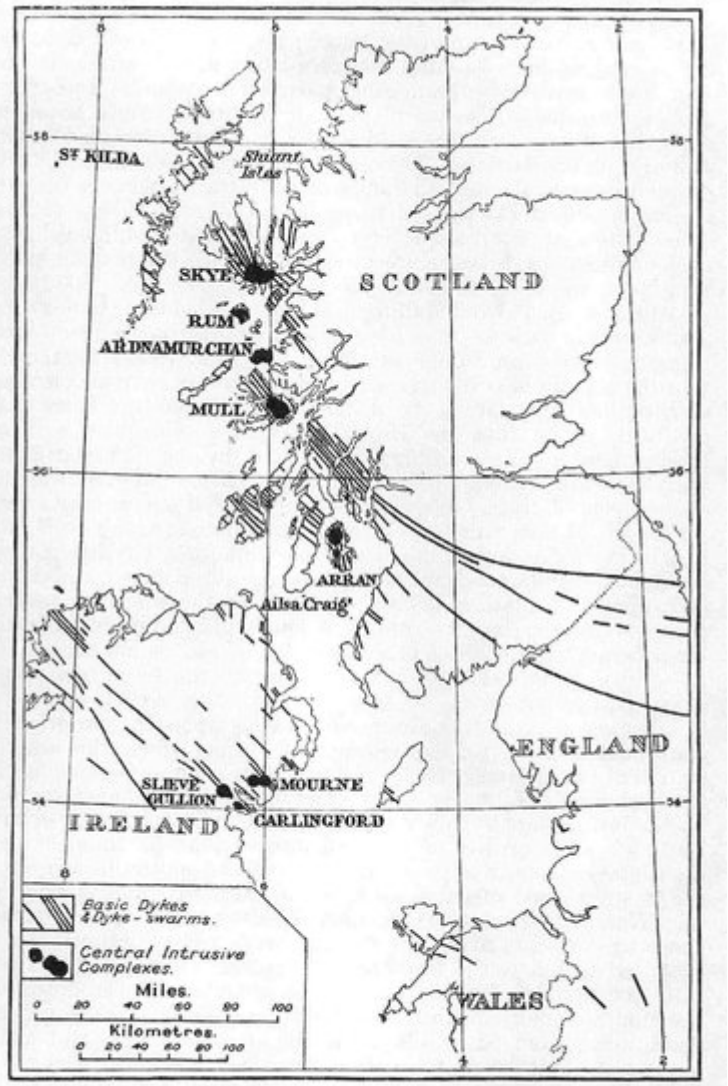

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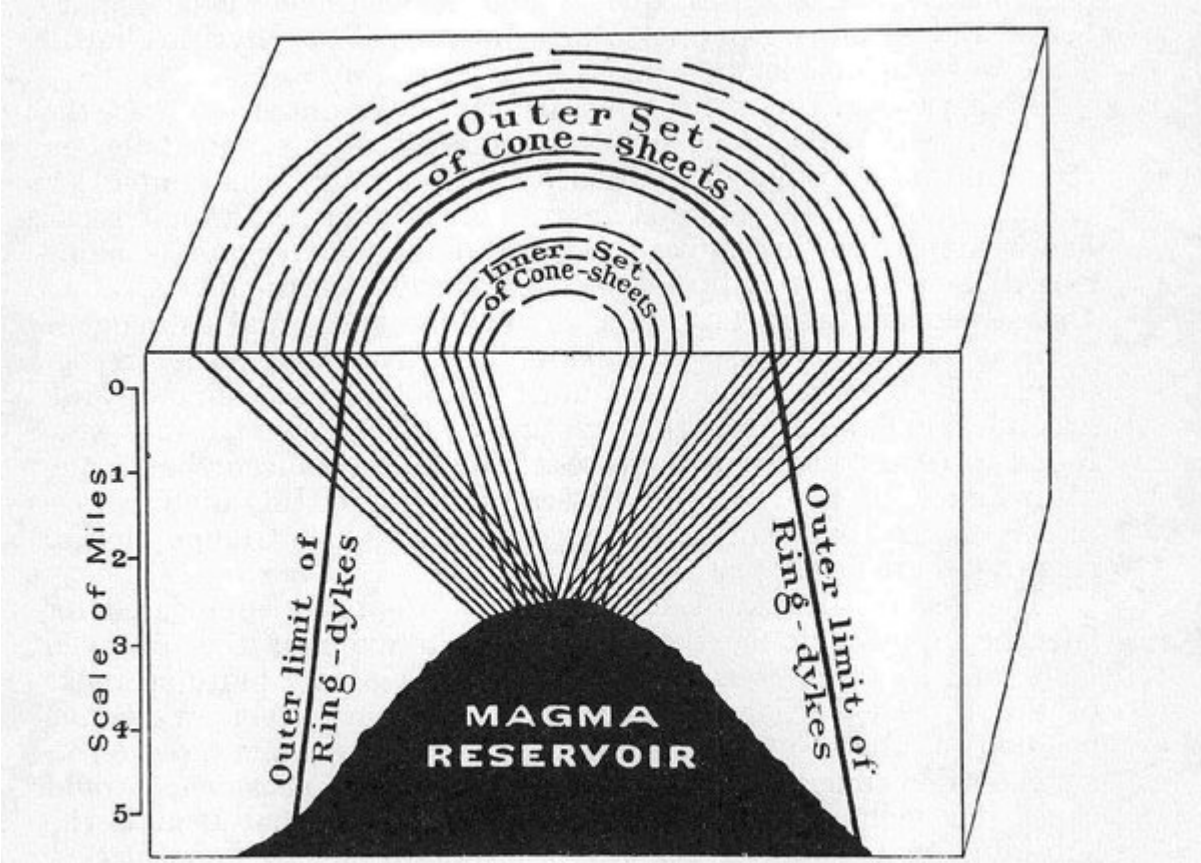

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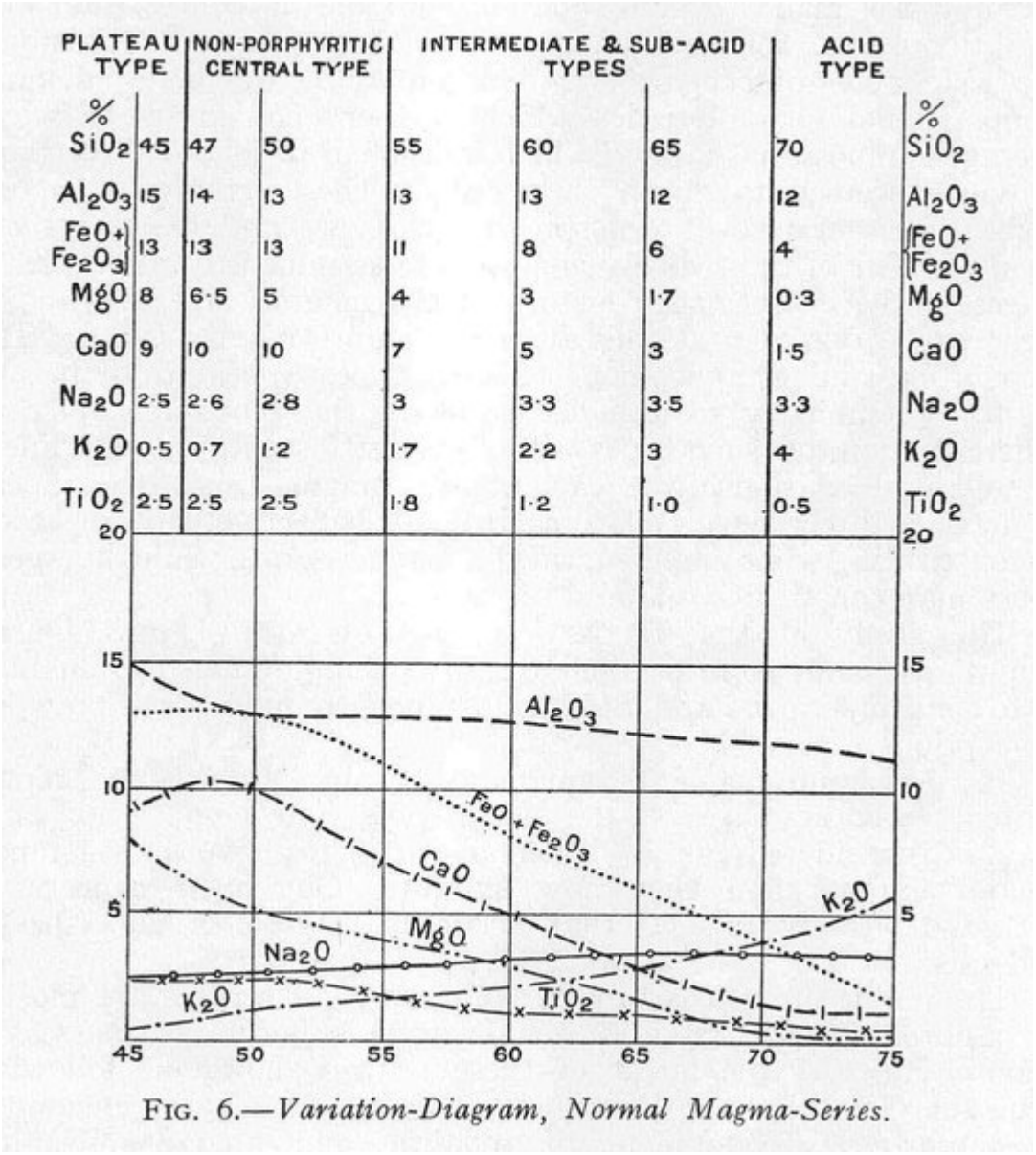

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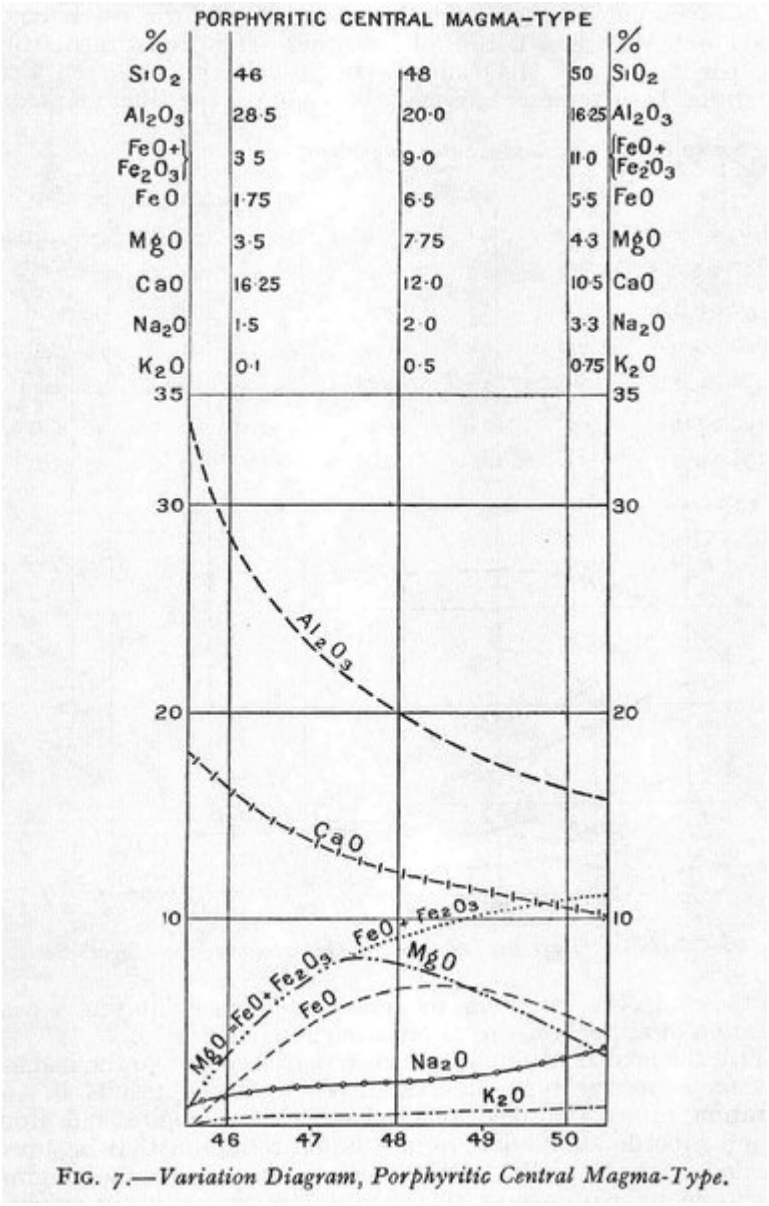

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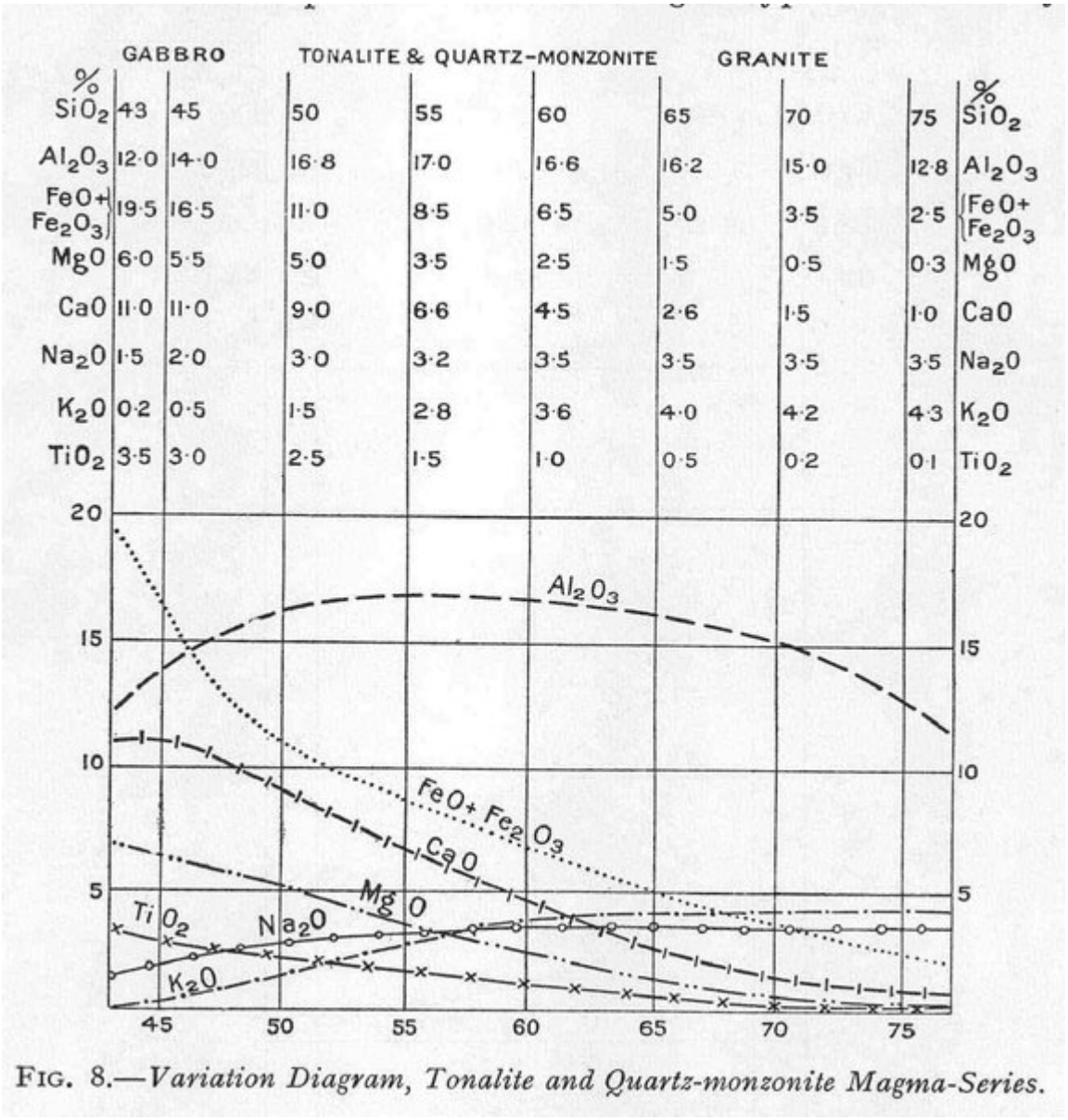

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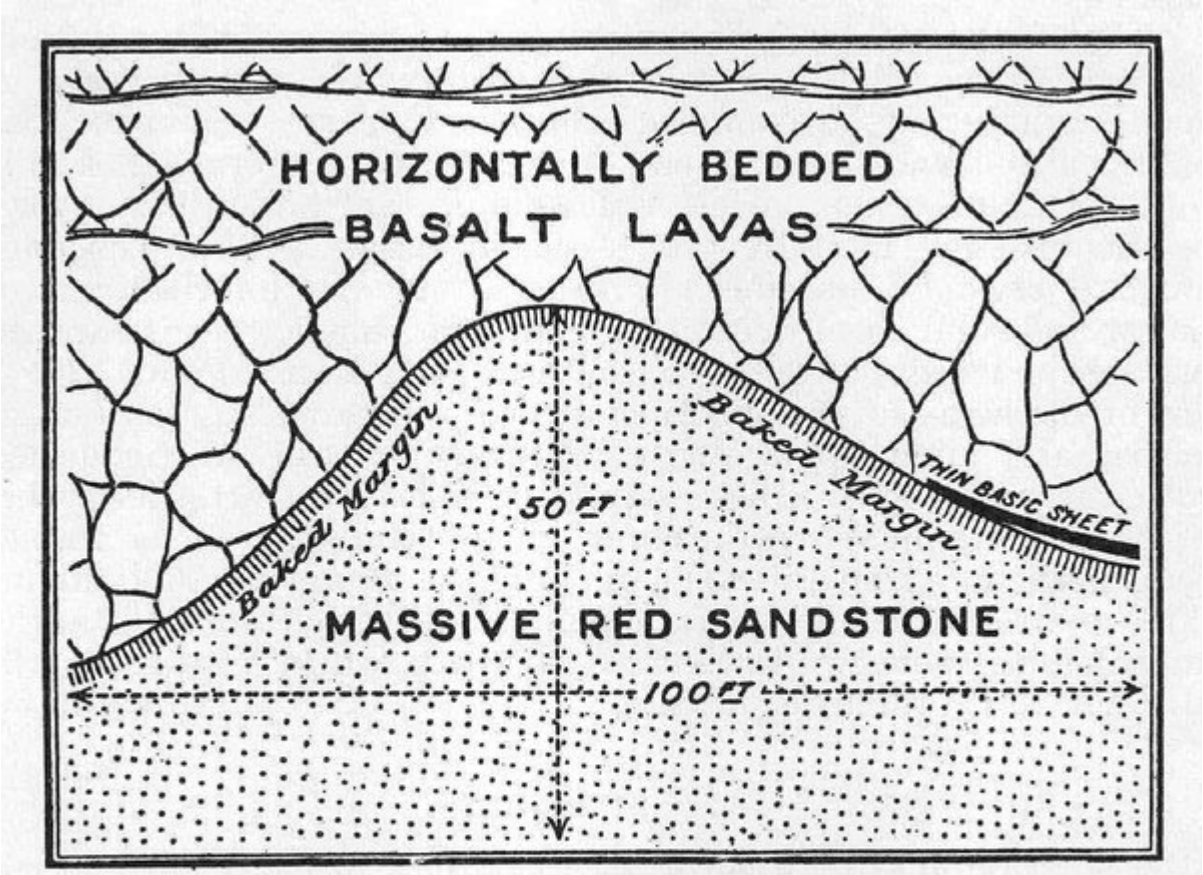

FIG. 9.—*Tertiary basalt lavas overlying a knob of sandstone at Bloody Bay, Northern Mull.*

Quoted from ' Summary of Progress for 1920,' p. 37.

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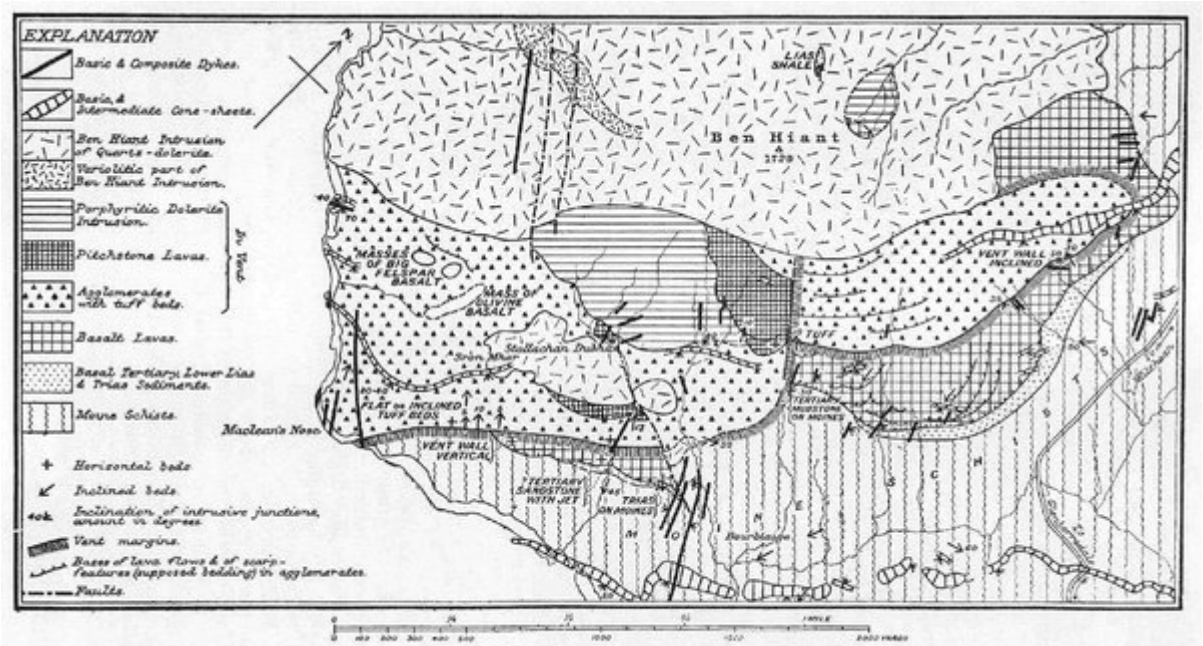

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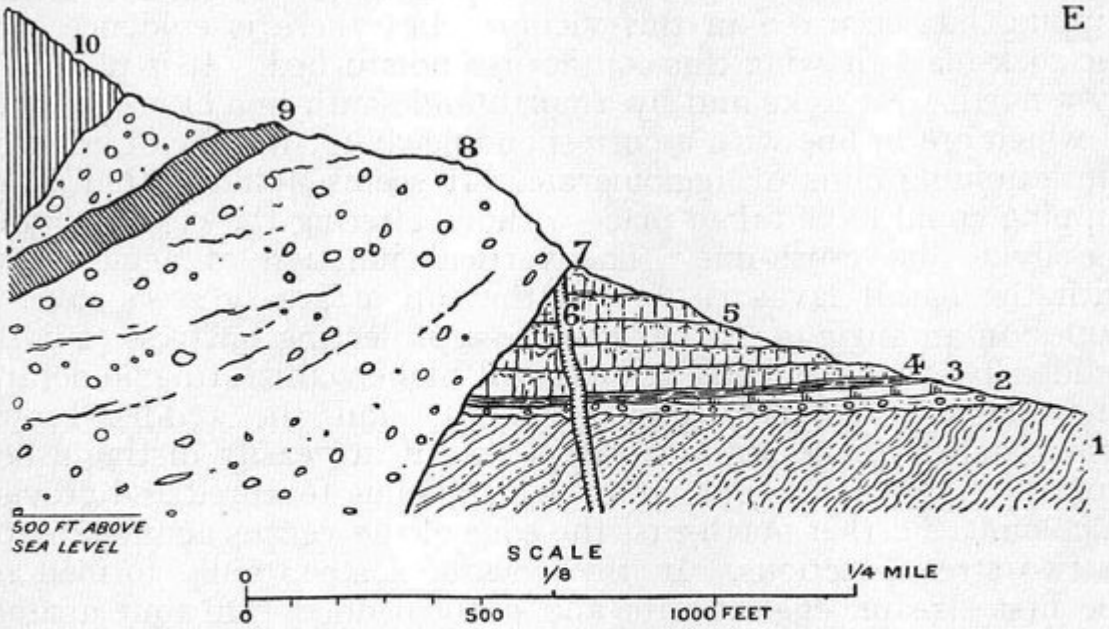


FIG. 11.—*Section of North-east Vent of Ben Hiant.*

1, *Moine Schists.* 2, *Trias.* 3, *Lower Lias limestone.* 4, *Basal Tertiary mudstone.* 5, *Tertiary basalt lavas.* 6, *Pre-vent composite dyke.* 7, *Edge of vent.* 8, *Vent-agglomerate.* 9, *Quartz-dolerite cone-sheet.* 10, *Ben Hiant Intrusion of quartz-dolerite.*

(Figure 11) Section of North-east Vent of Ben Hiant.1, Moine Schists. 2, Trims. 3, Lower Lias limestone. 4, Basal Tertiary mudstone. 5, Tertiary basalt lavas. 6, Pre-vent composite dyke. 7, Edge of vent. 8, Vent-agglomerate. 9, Quartz-dolerite cone-sheet. 10, Ben Hiant Intrusion of quartz-dolerite.

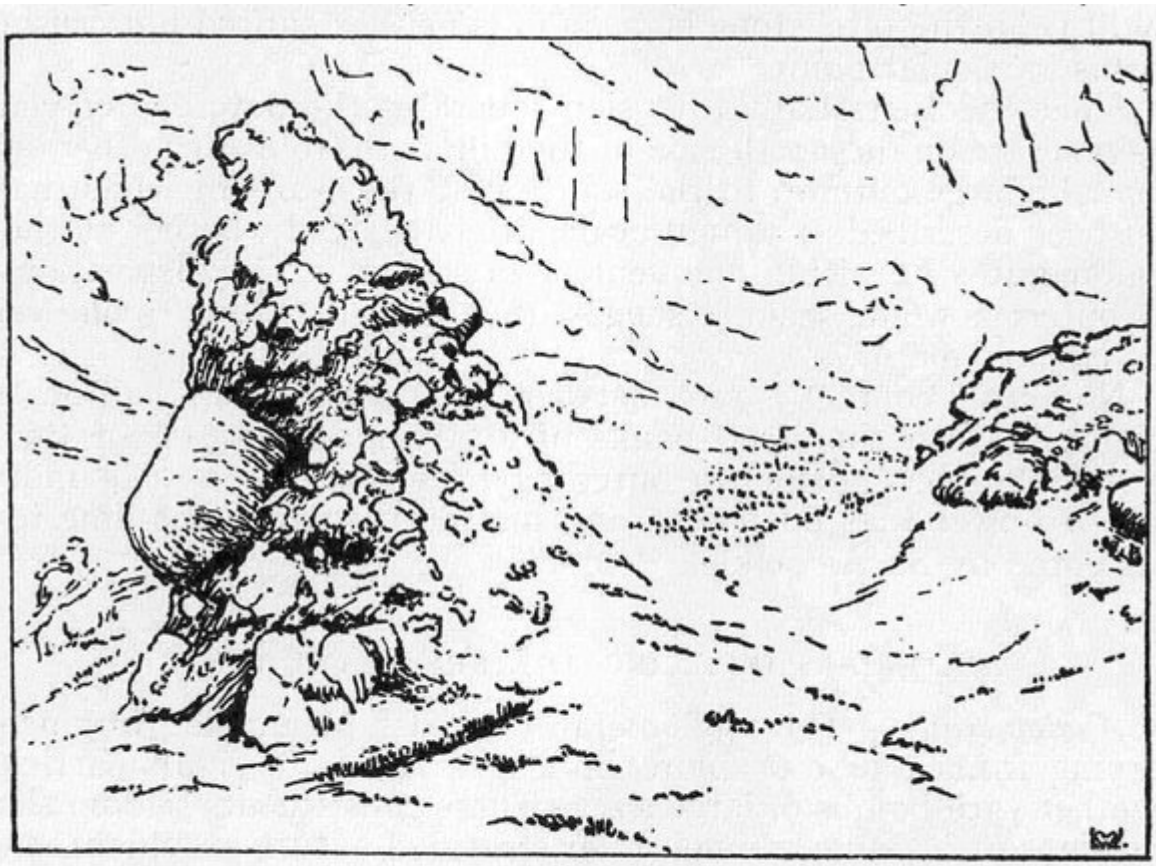


FIG. 12.—*Vent-agglomerate with large blocks of big-felspar basalt, near Maclean's Nose, Ben Hiant.*

Drawn from Geological Survey Photograph No. C. 2843.

(Figure 12) Vent-agglomerate with large blocks of big-felspar basalt, near Maclean's Nose, Ben Hiant. Drawn from Geological Survey Photograph No. C. 2843.

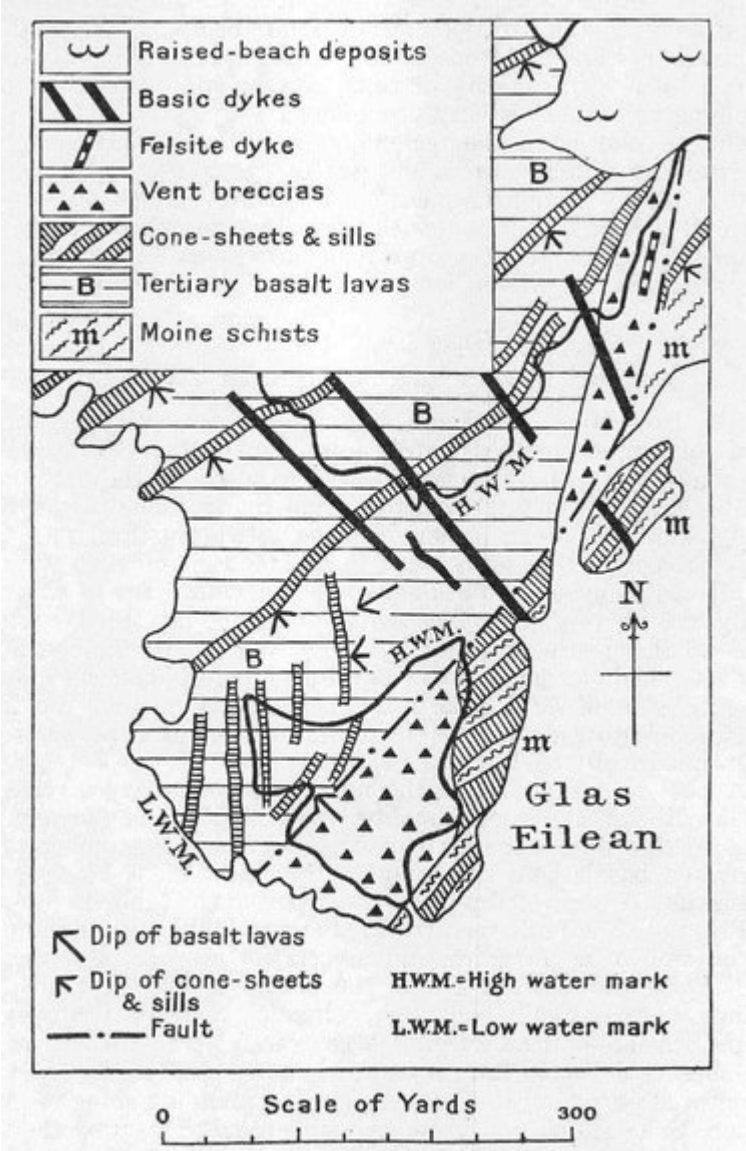


FIG. 13.—*Map of Glas Eilean Vent, south of Kilchoan.*

(Figure 13) Map of Glas Eilean Vent, south of Kilchoan.

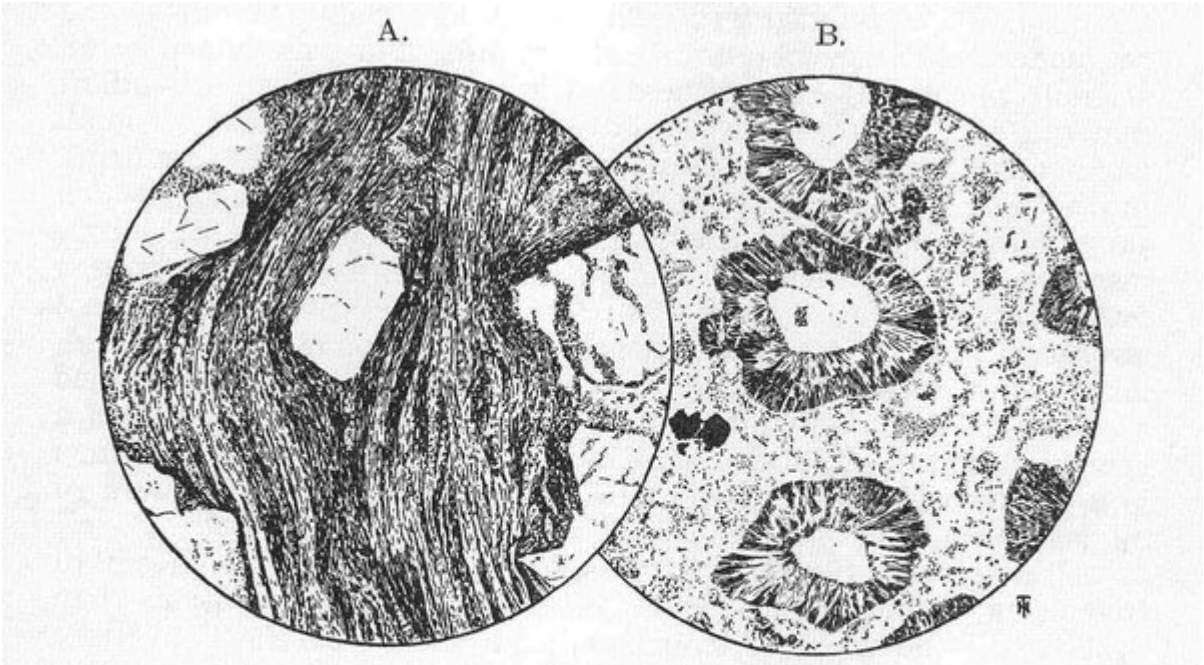


FIG. 14.—*Acid types from the Vents.*

A. (21446)×20. *Rhyolite with well-developed fluxion-structure, from the Agglomerate of Maclean's Nose, Ben Hiant.*
B. (23599)×20. *Spherulitic Quartz-rhyolite from East of Achateny Water. Showing phenocrysts of quartz surrounded by spherulitic growths of quartz and alkali-felspar, in a devitrified felsitic matrix.*

(Figure 14) Acid types from the Vents. A (S21446) [NM 5328 6183] &mu 20. Rhyolite with well-developed fluxion-structure, from the Agglomerate of Maclean's Nose, Ben Hiant. B (S23599) [NM 520 706] × 20. Spherulitic Quartz-rhyolite from East of Achateny Water. Showing phenocrysts of quartz surrounded by spherulitic growths of quartz and alkali felspar, in a devitrified felsitic matrix.

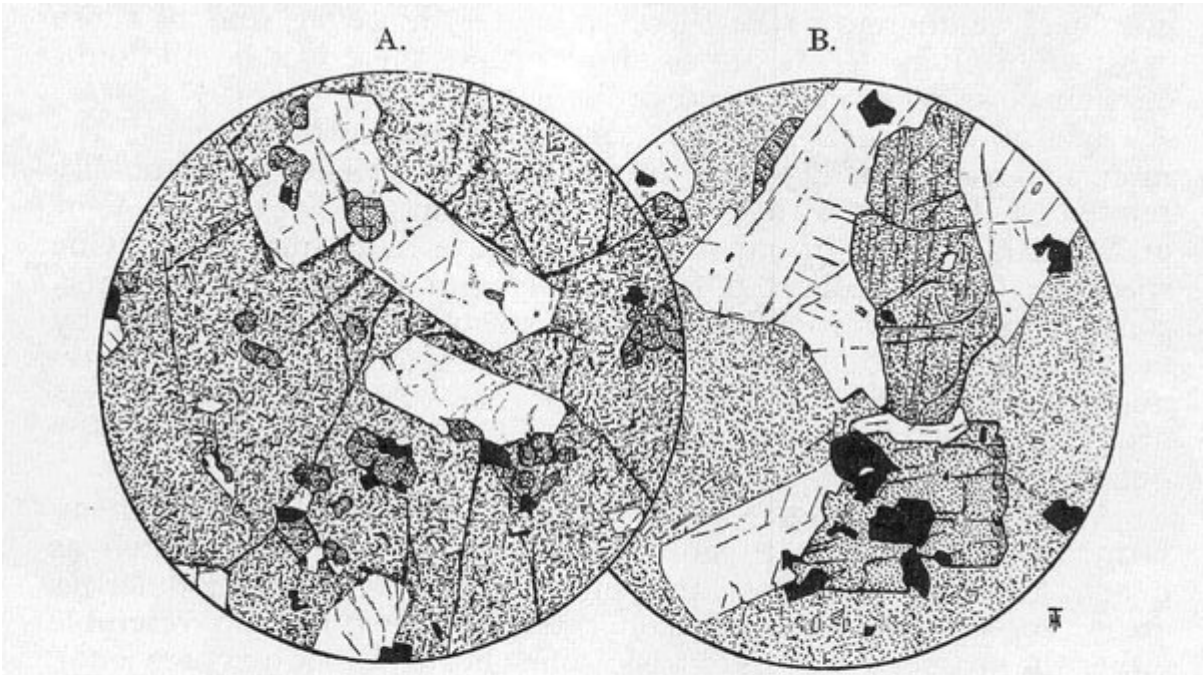


FIG. 15.—*Pitchstones of Ben Hiant.*

A. (21255)×20. *Normal type. Porphyritic plagioclase and small crystals of enstatite-augite in a glassy base charged with crystallites.*
B. (21458)×20. *Glomeroporphyritic group of hypersthene, augite, and plagioclase felspar in a brown glassy base.*

(Figure 15) Pitchstones of Ben Hiant. A. (S21255) [NM 540 622] × 20. Normal type. Porphyritic plagioclase and small crystals of enstatite-augite in a glassy base charged with crystallites. B. (S21458) [NM 5426 6272] × 20. Glomeroporphyritic group of hypersthene, augite, and plagioclase felspar in a brown glassy base.

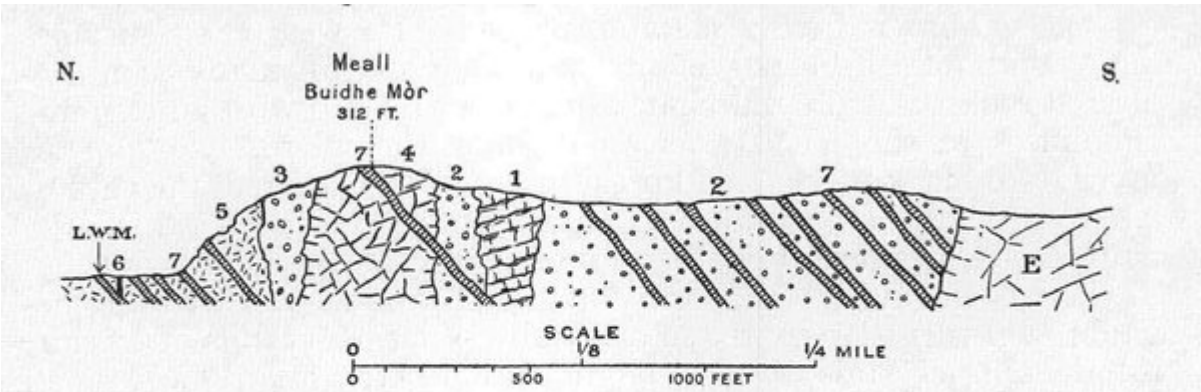


FIG. 16.—*Section, west of Faskadale Bay.*

1. *Basalt lava in vent.* 2, *Vent-agglomerate.* 3, *Screen of vent-agglomerate separating intrusions* 4 *and* 5. 4, *Gabbro of Centre* 1. 5, *Granophyre of Centre* 1. 6, *Basic E.N.E. dyke, seen to cut some cone-sheets and to be cut by others.* 7, *Cone-sheets of Centre* 2. E, *Great Eucrite Ring-dyke of Centre* 3. L.W.M., *Low-water Mark.*

(Figure 16) Section, west of Faskadale Bay. 1. Basalt lava in vent. 2. Vent-agglomerate. 3. Screen of vent-agglomerate separating intrusions 4 and 5. 4. Gabbro of Centre 1. 5. Granophyre of Centre 1. 6. Basic E.N.E. dyke, seen to cut some cone-sheets and to be cut by others. 7. Cone-sheets of Centre 2. E, Great Eucrite Ring-dyke of Centre 3. L.W.M., Low-water Mark.

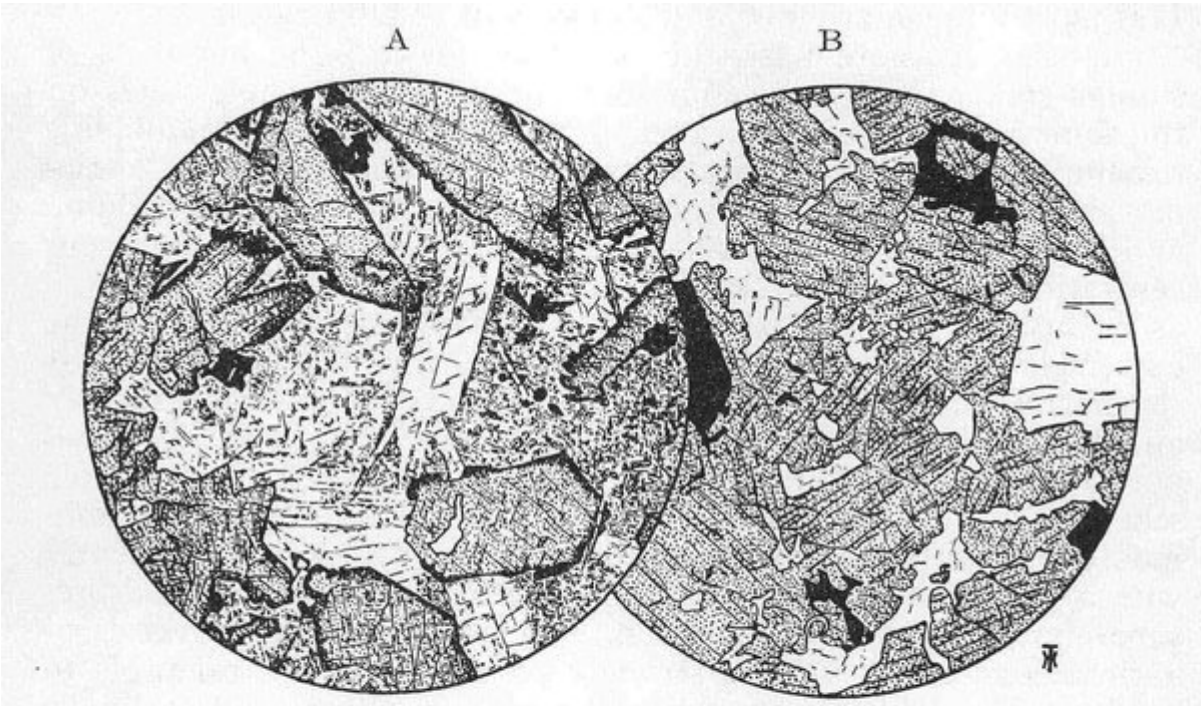


FIG. 17.—*Augite-diorite of Camphouse.*

A. (22226) × 6. *Felspathic variety. Idiomorphic crystals of augite with deep-brown or grass-green margins, partially albitized labradorite and perthitic orthoclase rich in apatite.*

B. (21512) × 20. *Portion of same mass showing a less alkaline and more doleritic facies.*

(Figure 17) Augite-diorite of Camphouse. A. (S22226) [NM 5207 6433] × 6. Felspathic variety. Idiomorphic crystals of augite with deep-brown or grass-green margins, partially albitized labradorite and perthitic orthoclase rich in apatite. B. (S21512) [NM 5207 6433] × 20. Portion of same mass showing a less alkaline and more doleritic facies.

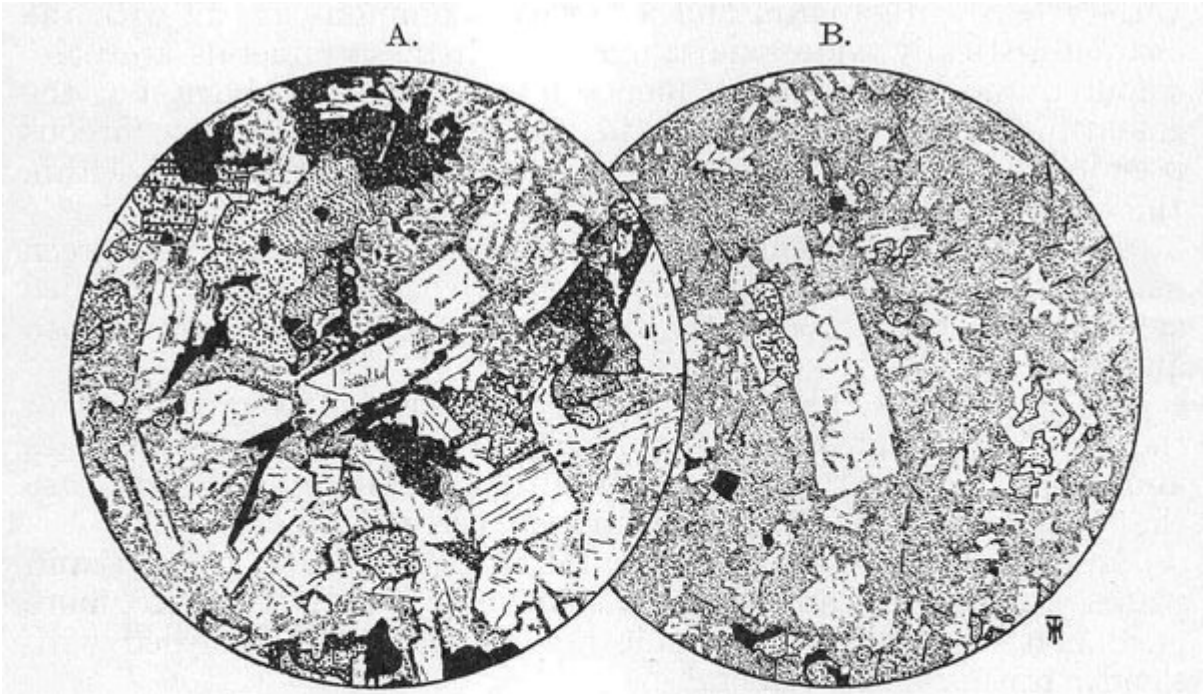


FIG. 18.—*Composite Intrusion of Beinn an Leathaid.*

A. (23463) × 20. *Lower basic portion of intrusion. The rock is composed of well-shaped crystals of zoned labradorite-andesine felspar, aluminous and non-aluminous augite, and a little hornblende in a matrix of alkali-felspar and quartz.*

B. (23459) × 34. *Acid upper portion of the intrusion. The section shows phenocrysts of acid-plagioclase felspar with subordinate ferromagnesian minerals in a fine-textured base that appears mainly to represent devitrified glass.*

(Figure 18) Composite Intrusion of Beinn an Leathaid. A. (S23463) [NM 5203 6772] × 20. Lower basic portion of intrusion. The rock is composed of well-shaped crystals of zoned labradorite-andesine felspar, aluminous and non-aluminous augite, and a little hornblende in a matrix of alkali felspar and quartz. B. (S23459) [NM 5190 6767] $_X$ 34. Acid upper portion of the intrusion. The section shows phenocrysts of acid-plagioclase felspar with subordinate ferromagnesian minerals in a fine-textured base that appears mainly to represent devitrified glass.

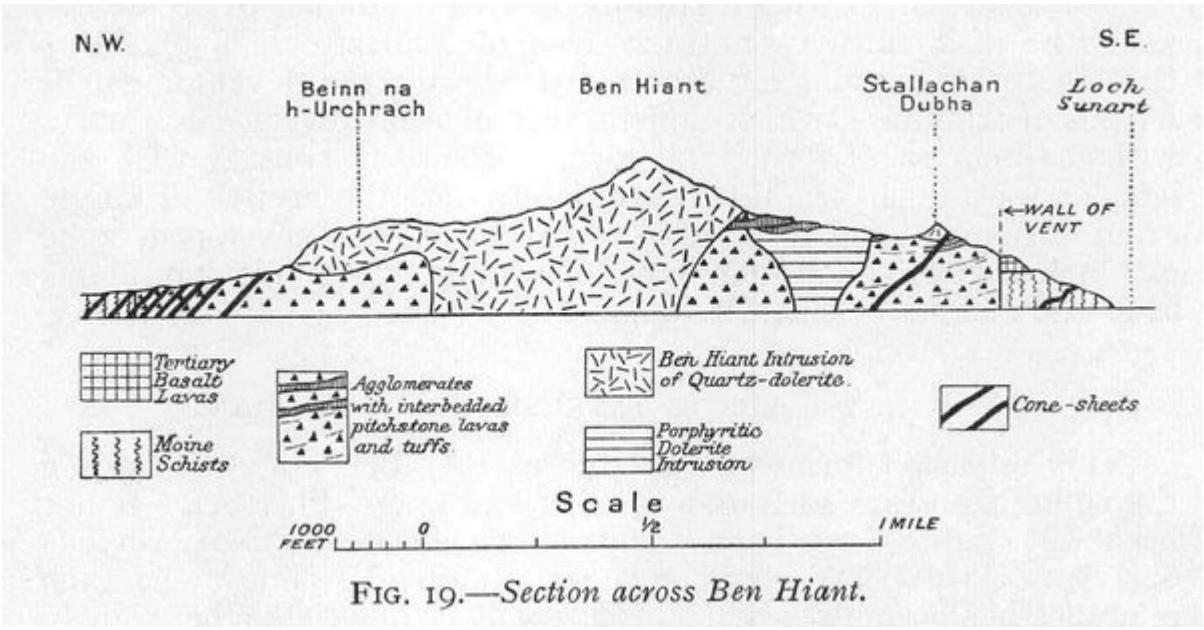


FIG. 19.—*Section across Ben Hiant.*

(Figure 19) Section across Ben Hiant.

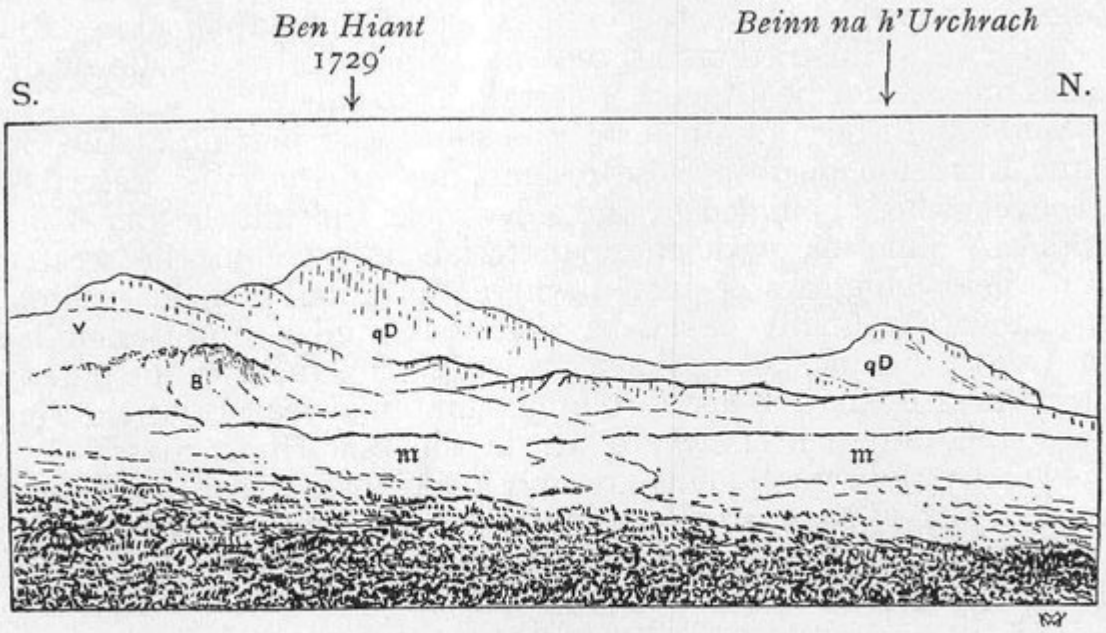


FIG. 20.—*View of Ben Hiant from east.*

m, *Moine Schists.* B, *Tertiary basalt lava.* V, *Vent-agglomerate.* qD, *Ben Hiant Intrusion.*

(Figure 20) View of Ben Hiant from east, in, Moine Schists. B, Tertiary basalt lava. V, Vent-agglomerate. qD, Ben Hiant Intrusion.

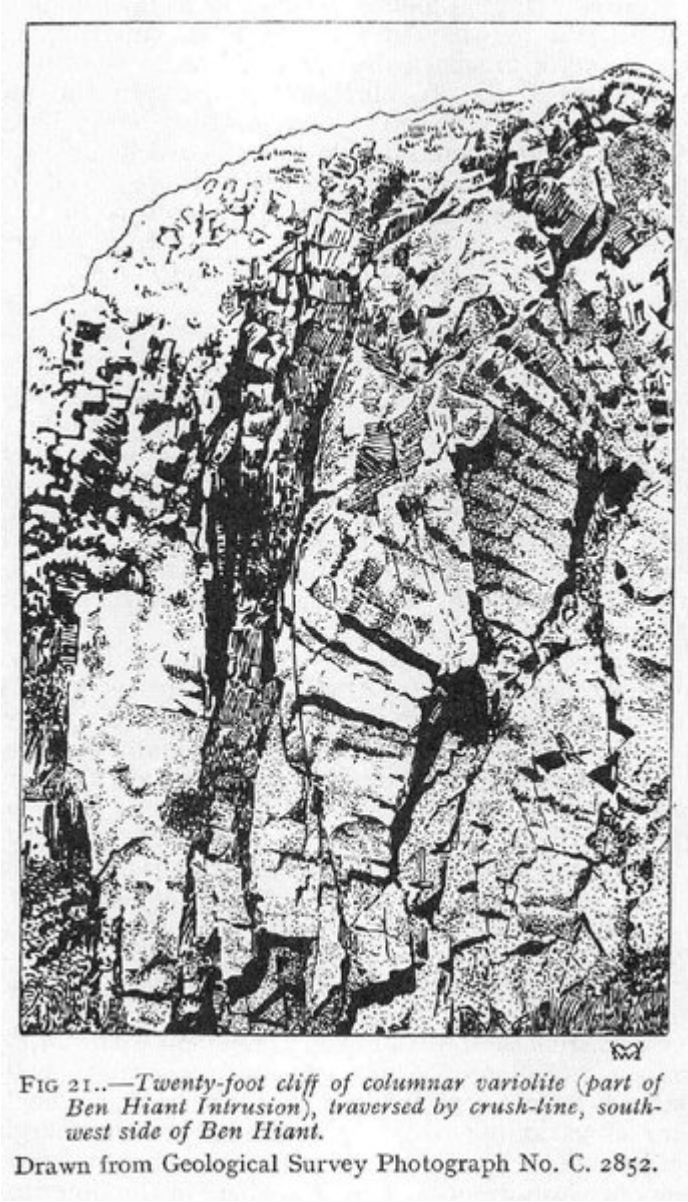


FIG 21..—*Twenty-foot cliff of columnar variolite (part of Ben Hiant Intrusion), traversed by crush-line, southwest side of Ben Hiant.*
Drawn from Geological Survey Photograph No. C. 2852.

(Figure 21) Twenty-foot cliff of columnar variolite (part of Ben Hiant Intrusion), traversed by crush-line, southwest side of Ben Hiant. Drawn from Geological Survey Photograph No. C. 2852.

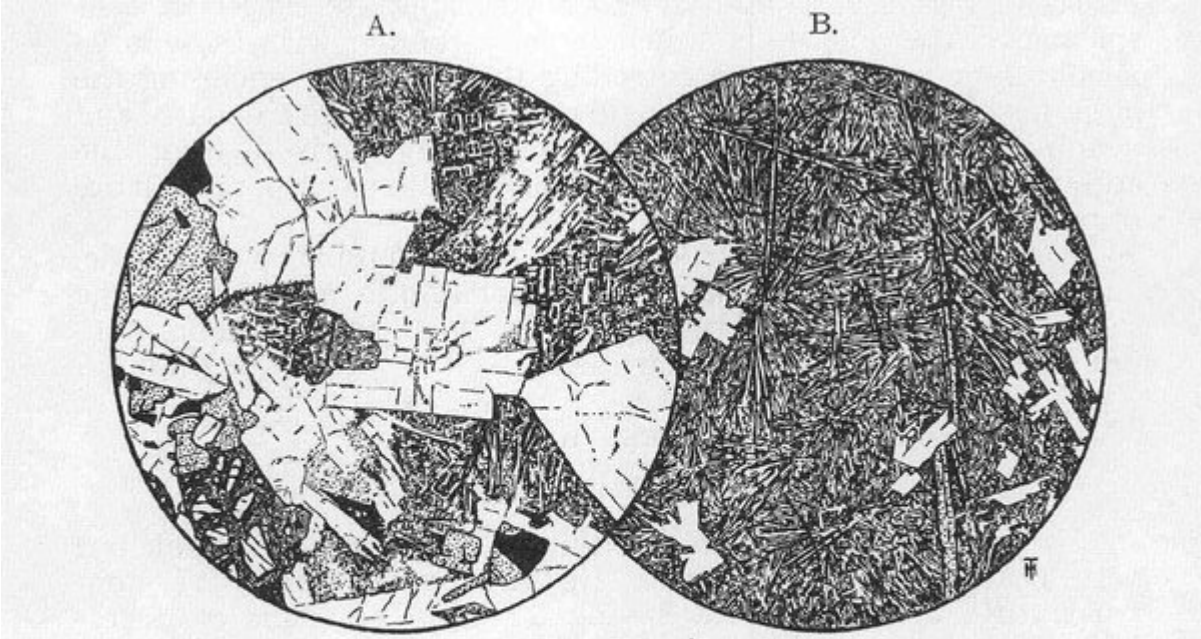


FIG. 22.—*Ben Hiant Intrusion.*

A. (22296) × 20. *Quartz-dolerite. The section shows partly decomposed olivine, labradorite felspar, augite, and ilmenite in a matrix of skeletal felspars, acicular augite, quartz and iron-ore.*

B. (24235) × 20. *Variolite. Small phenocrysts of labradorite felspar in a base consisting of blade-like crystals of yellowish-brown augite, long rods of magnetite, and a fine feathery crystallization of oligoclase-andesine felspar.*

(Figure 22) Ben Hiant Intrusion. A. (S22296) [NM 5325 6252] × 20. Quartz-dolerite. The section shows partly decomposed olivine, labradorite felspar, augite, and ilmenite in a matrix of skeletal felspars, acicular augite, quartz and iron-ore. B. (S24235) [NM 531 630] × 20. Variolite. Small phenocrysts of labradorite felspar in a base consisting of blade-like crystals of yellowish-brown augite, long rods of magnetite, and a fine feathery crystallization of oligoclase-andesine felspar.

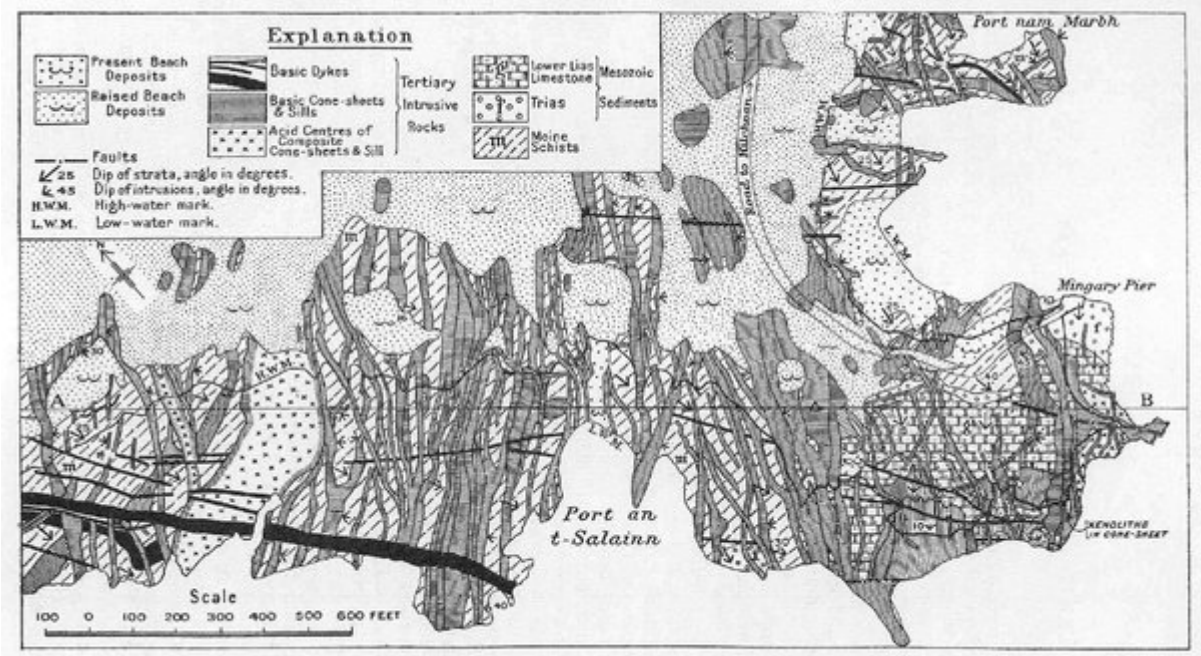


FIG. 23.—*Map of Outer Cone-sheets of Centre 2, shore south of Kilchoan.*

(Figure 23) Map of Outer Cone-sheets of Centre 2, shore south of Kilchoan.

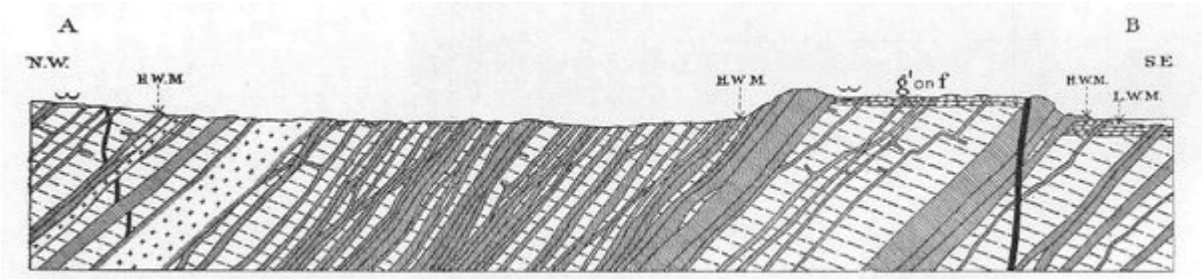


FIG. 24.—*Section along line A–B of Fig. 23.*

(Figure 24) Section along line A-B of (Figure 23) (Map of Outer Cone-sheets of Centre 2, shore south of Kilchoan).

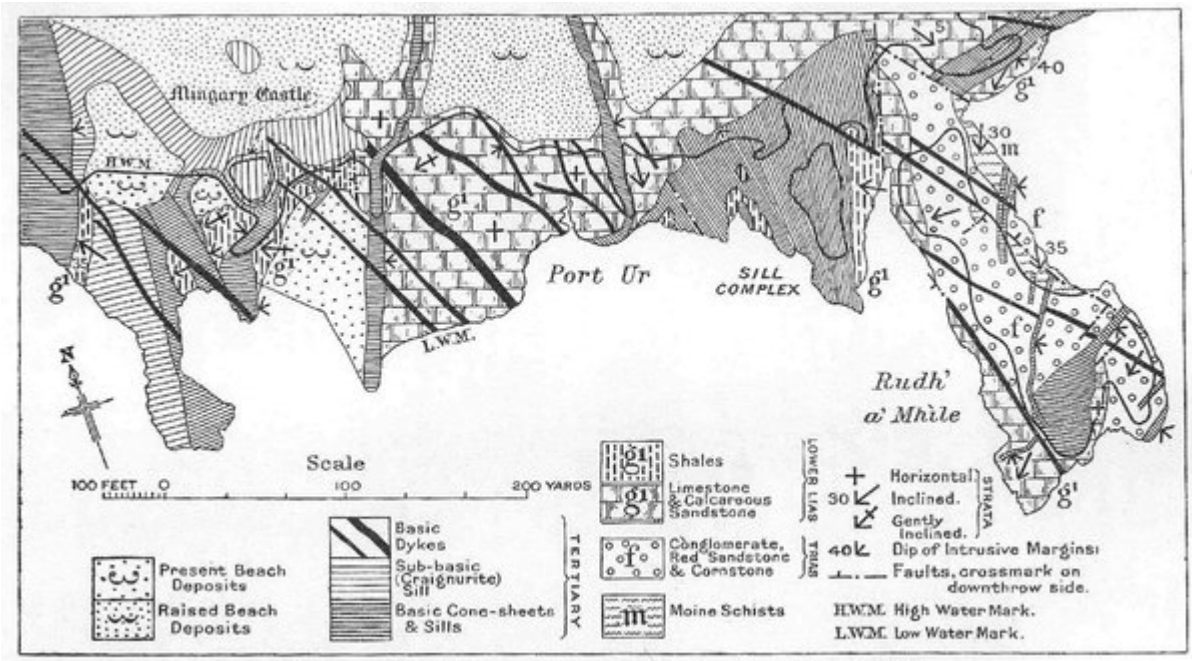


FIG. 25.—*Map of shore near Mingary Castle, east-south-east of Kilchoan.*

(Figure 25) Map of shore near Mingary Castle, east-south-east of Kilchoan.

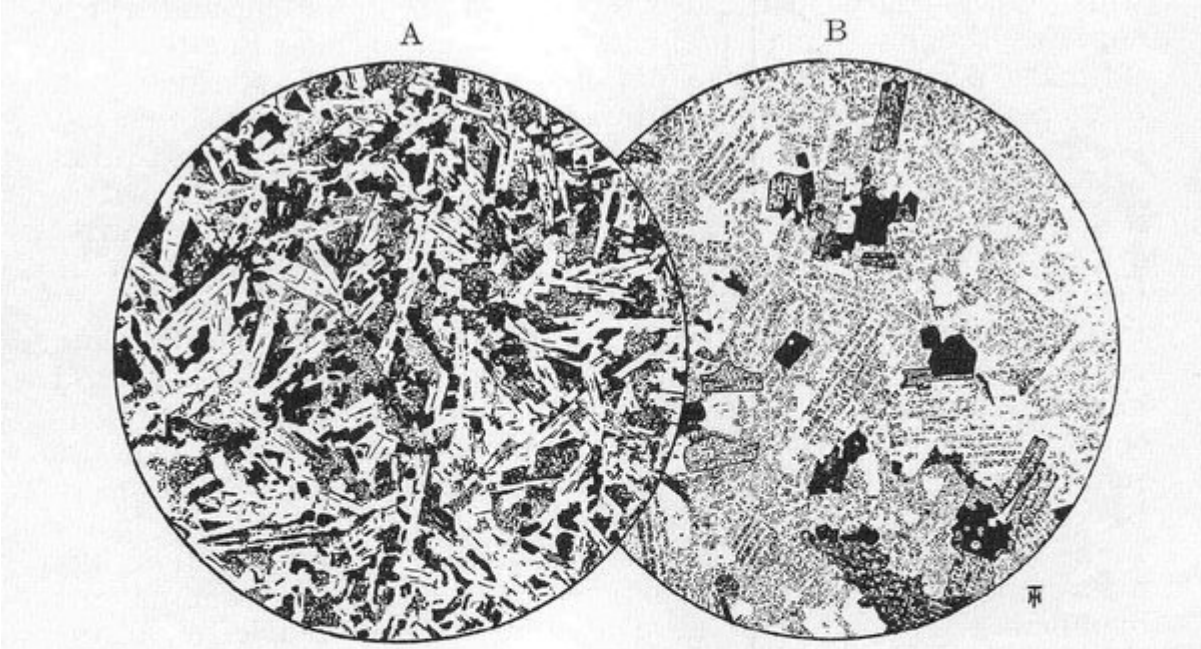


FIG. 26.—*Composite Intrusion of Sròn Bheag.*

A. (21825A) ×20. *Basic central portion of intrusion originally a quartz-dolerite of Talaidh type. Now modified by the intrusion of acid material and the consequent development of biotite. The rock retains its doleritic texture (see below).*

B. (21827) ×20. *Acid portion of the same mass consisting mainly of alkali-felspar, both soda and potash varieties, quartz, and fairly large crystals of fox-red biotite.*

(Figure 26) Composite Intrusion of Sròn Bheag A. (S21825A) [NM 4657 6228] × 20. Basic central portion of intrusion originally a quartz-dolerite of Talaidh type. Now modified by the intrusion of acid material and the consequent development of biotite. The rock retains its doleritic texture (see below). B. (S21827) [NM 4652 6227] × 20. Acid portion of the same mass consisting mainly of alkali-felspar, both soda and potash varieties, quartz, and fairly large crystals of fox-red biotite.

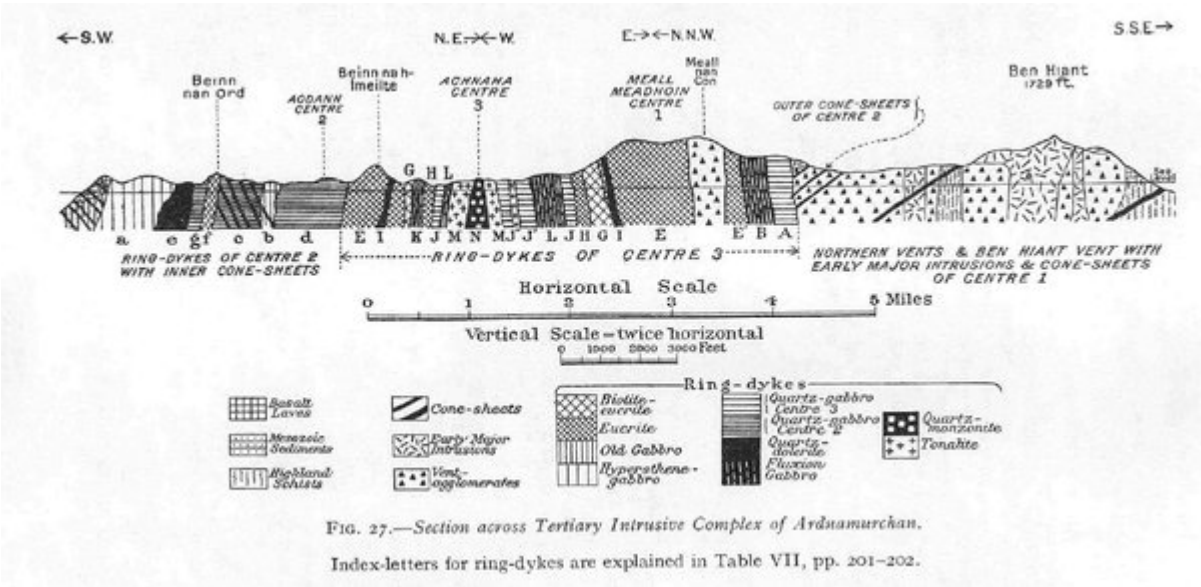


FIG. 27.—*Section across Tertiary Intrusive Complex of Ardnamurchan.*

Index-letters for ring-dykes are explained in Table VII, pp. 201–202.

(Figure 27) Section across Tertiary Intrusive Complex of Ardnamurchan. Index-letters for ring-dykes are explained in (Table 7), pp. 201–202.

TABLE VII

RING-DYKES OF CENTRES 2 AND 3

Index Letter on Map, Pl. V.	Symbol on Memoir-Map.	Rock-type and Designation.	Relative Ages, as determined by contact relationships (pp. 206–8)	
			Younger than	Older than
		EARLIER COMPLEX, CENTRE 2.		
		Older than Inner Cone-sheets.		
a	rE	Hypersthene-gabbro of Ardnamurchan Point ...	—	c, e, A, C, E.
b	oE	Old Gabbro of Lochan an Aodainn	—	c, c′, d, A.
c	qE	Quartz-gabbro of Garbh-dhail	b.	c′, f, A.
c′	G	Granophyre of Grigadale	c, b.	? c″.
c″	qE	Older Quartz-gabbro of Beinn Bhuidhe	? c′.	h.
d	qE	Quartz-gabbro of Aodann	b.	j, E.
e	gD	Quartz-dolerite of Sgòrr nam Meann	a.	g.
		Younger than Inner Cone-sheets.		
f	uE	Eucrite of Beinn nan Ord	c.	g, h, A.
g	qE	Quartz-gabbro of Loch Caorach	e, f.	—
g′	qE	Quartz-gabbro of Beinn na Seilg	e, ? f.	—
h	qE	Younger Quartz-gabbro of Beinn Bhuidhe	e″, f.	—
i	fE	Fluxion Gabbro of Portmairk	—	? E
j	G	Felsite, south of Aodann ...	d.	—

RING-DYKES OF CENTRES 2 AND 3

Index Letter on Map, Pl. V.	Symbol on Memoir-Map.	Rock-type and Designation.	Relative Ages, as determined by contact relationships (pp. 206–8)	
			Younger than	Older than
		LATER COMPLEX, CENTRE 3.		
A	qE	Quartz-gabbro of Faskadale	a, b, c, f.	E.
B	fE	Fluxion Gabbro of Faskadale	—	? E′
C	eD	Gabbro of Ploeaig ...	a.	E.
C′	eD	Gabbro, south-east of Rudha Groulin	—	E.
D	eD	Porphyritic Gabbro of Meall nan Con screen ...	—	E, E′.
E	uE	Great Eucrite	a, d, h, A, C, C′, D.	F, I, K.
E′	uE	Outer Eucrite	? B, D.	? E, F.
F	qE	Quartz-gabbro of Meall an Tarmachain summit ...	E, E′	—
F′	qE	Quartz-gabbro, south side of Meall an Tarmachain	—	—
G	bE	Biotite-eucrite	—	I.
H	uE	Inner Eucrite	—	—
I	gD	Quartz-dolerite, veined with granophyre ...	E, G.	—
J, J′, J″	qE	Quartz-biotite-gabbro ...	—	? L, M.
K	fE	Fluxion Biotite-gabbro of Sithean Mòr	E.	—
L	fE	Fluxion Biotite-gabbro of Glendrian	? J and J″.	M.
M	tH	Tonalite	J′, J″, L.	N.
N	qH	Quartz-monzonite ...	M.	—

(Table 7) Ring-dykes of Centres 2 and 3.

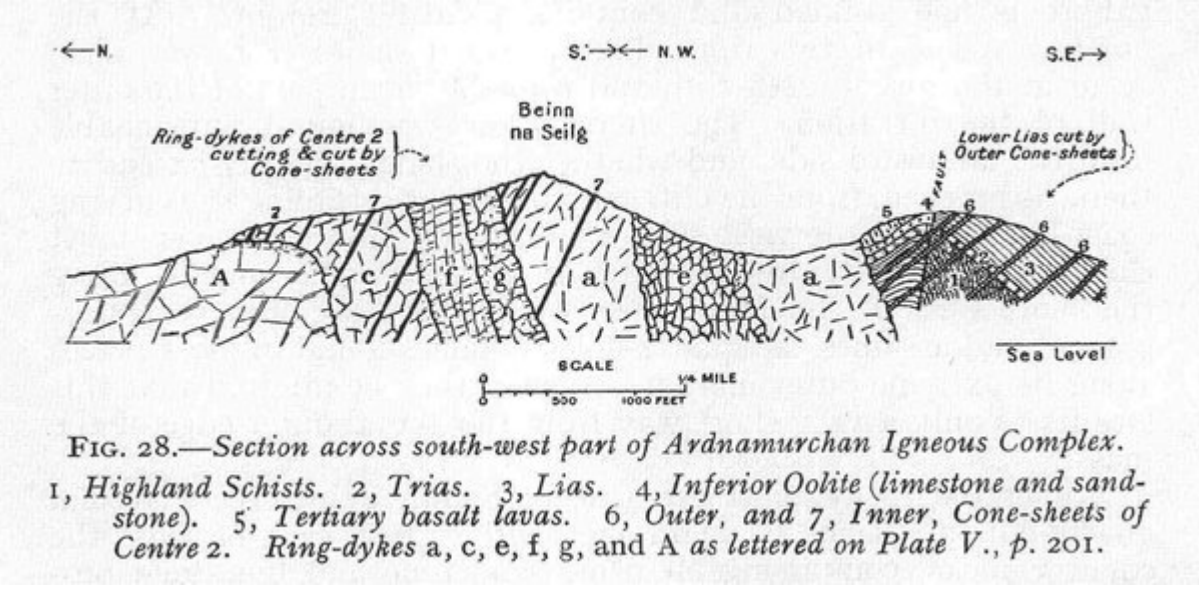
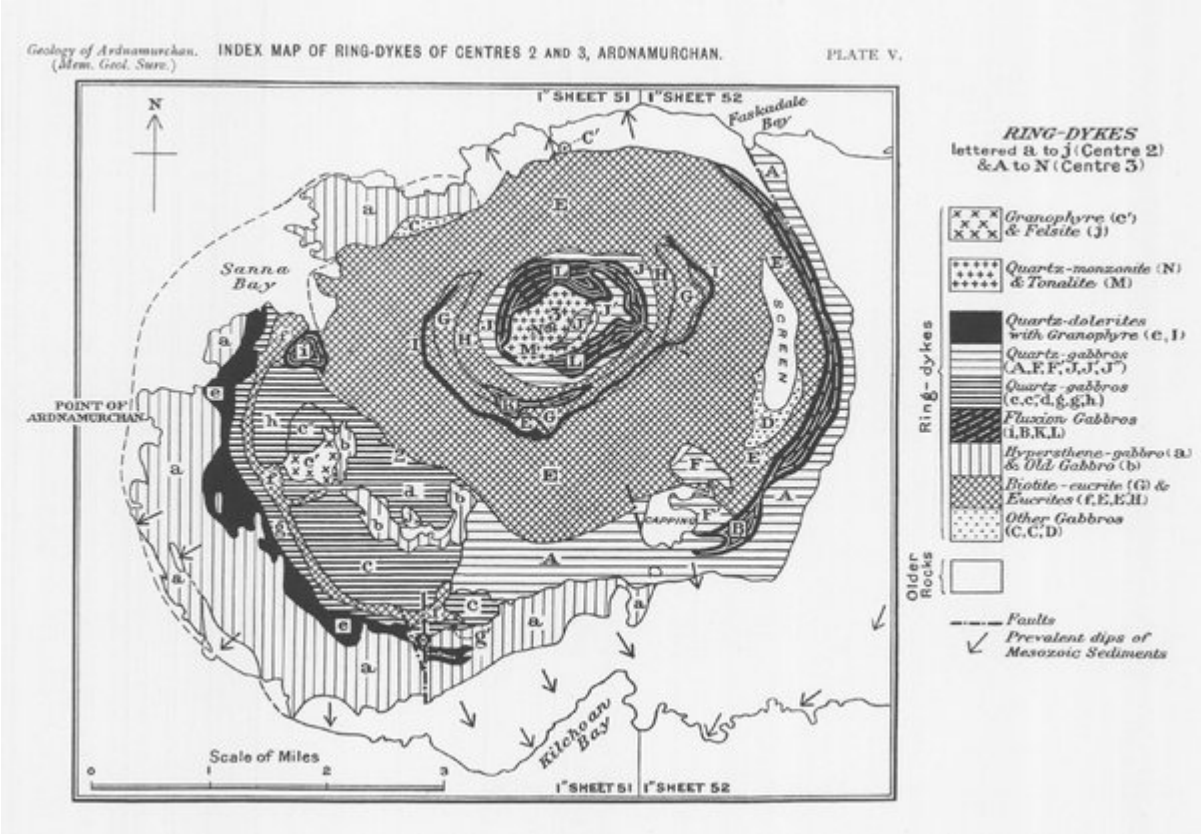


FIG. 28.—*Section across south-west part of Ardnamurchan Igneous Complex.*
1, *Highland Schists.* 2, *Trias.* 3, *Lias.* 4, *Inferior Oolite (limestone and sandstone).* 5, *Tertiary basalt lavas.* 6, *Outer, and* 7, *Inner, Cone-sheets of Centre* 2. *Ring-dykes* a, c, e, f, g, and A *as lettered on Plate V., p.* 201.

(Figure 28) Section across south-west part of Ardnamurchan Igneous Complex. 1, Highland Schists. 2, Trias. 3, Lias. 4, Inferior Oolite (limestone and sandstone). 5, Tertiary basalt lavas. 6, Outer, and 7, Inner, Cone-sheets of Centre 2. Ring-dykes a, c, e, f, g, and A as lettered on (Plate 5)., p. 201.



(Plate 5) Geology of Ardnamurchan. Index Map of ring-dykes of Centres 2 and 3, Ardnamurchan. (Mem. Geol. Surv.)

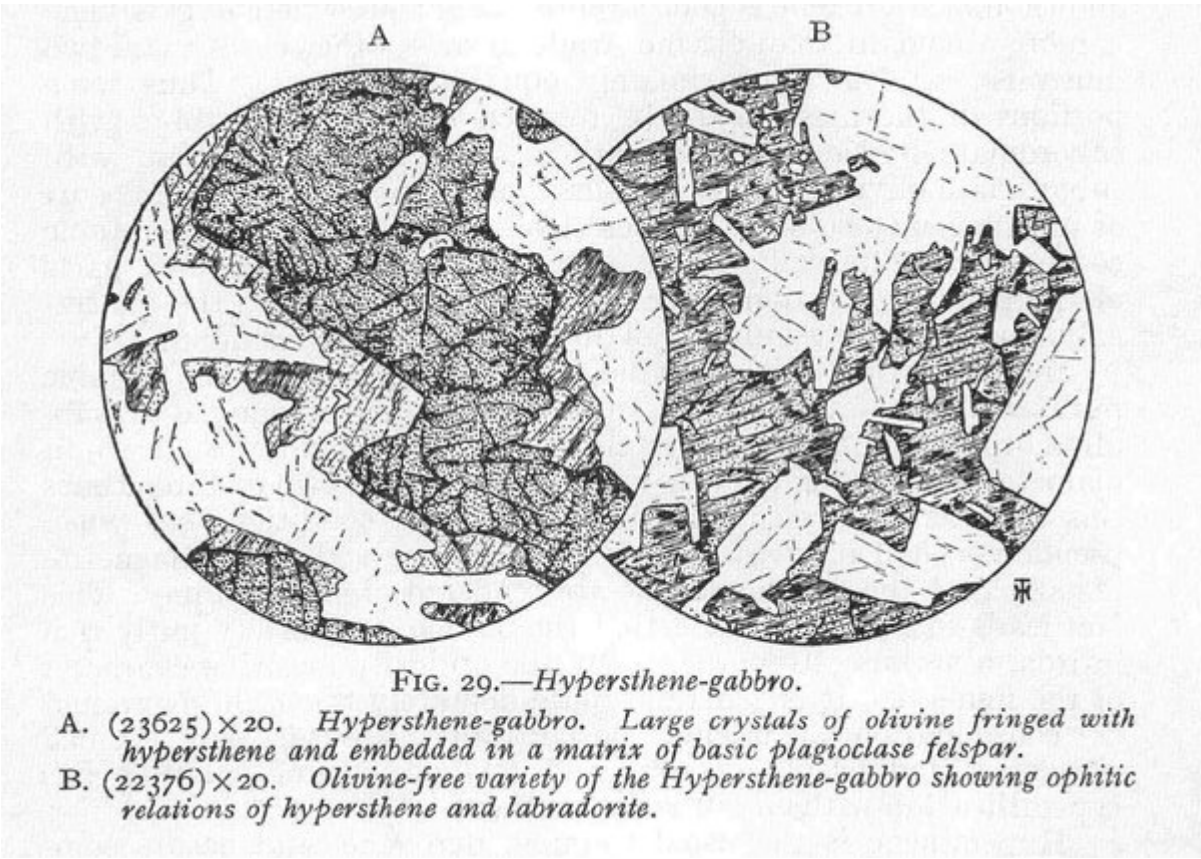


FIG. 29.—*Hypersthene-gabbro.*

A. (23625) × 20. *Hypersthene-gabbro. Large crystals of olivine fringed with hypersthene and embedded in a matrix of basic plagioclase felspar.*

B. (22376) × 20. *Olivine-free variety of the Hypersthene-gabbro showing ophitic relations of hypersthene and labradorite.*

(Figure 29) Hypersthene-gabbro. A. (S23625) [NM 4499 6364] × 20. Hypersthene-gabbro. Large crystals of olivine fringed with hypersthene and embedded In a matrix of basic plagioclase felspar. B. (S22376) [NM 4195 6705] × 20. Olivine-free variety of the Hypersthene-gabbro showing ophitic relations of hypersthene and labradorite.

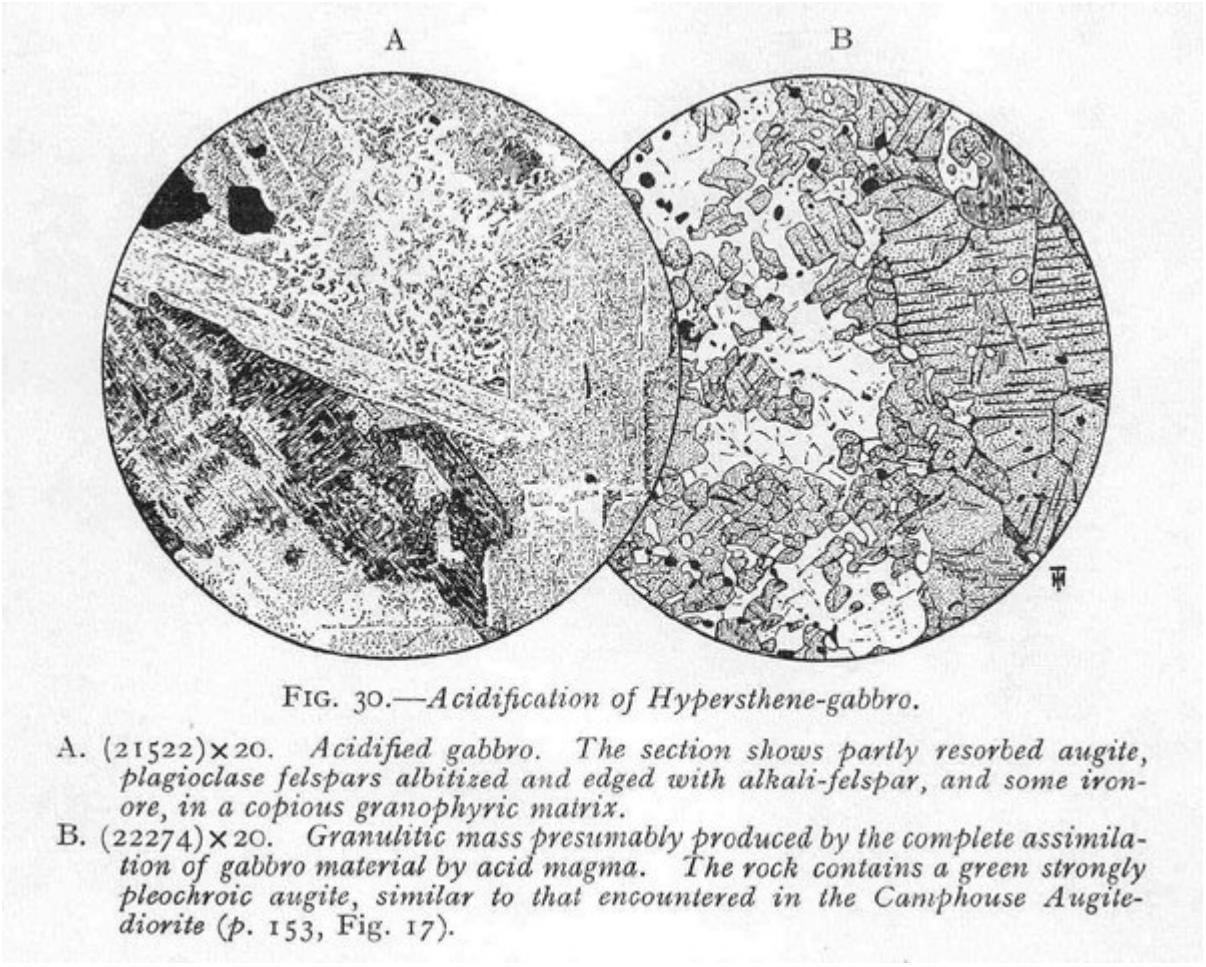


FIG. 30.—*Acidification of Hypersthene-gabbro.*

A. (21522)×20. *Acidified gabbro. The section shows partly resorbed augite, plagioclase felspars albitized and edged with alkali-felspar, and some iron-ore, in a copious granophyric matrix.*

B. (22274)×20. *Granulitic mass presumably produced by the complete assimilation of gabbro material by acid magma. The rock contains a green strongly pleochroic augite, similar to that encountered in the Camphouse Augite-diorite (p. 153, Fig. 17).*

(Figure 30) Acidification of Hypersthene-gabbro. A. (S21522) [NM 4716 6440] × 20. Acidified gabbro. The section shows partly resorbed augite, plagioclase felspars albitized and edged with alkali-felspar, and some iron-ore, in a copious granophyric matrix. B. (S22274) [NM 4416 6942] × 20. Granulitic mass presumably produced by the complete assimilation of gabbro material by acid magma. The rock contains a green strongly pleochroic augite, similar to that encountered in the Camphouse Augitediorite (p. 153, (Figure 17)).

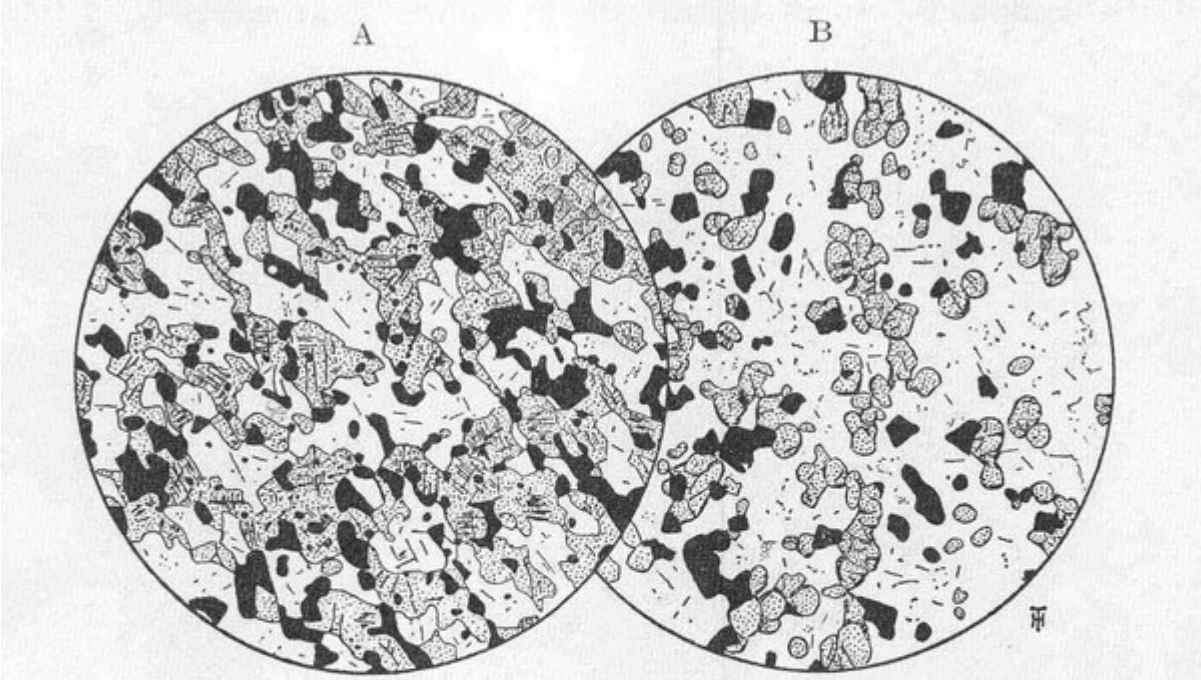


FIG. 31.—*Granulitic Masses associated with Basic Ring-dykes.*

A. (22658) ×20. *Granulitic gabbro, at margin of Great Eucrite south-west of Meall nan Con. A completely recrystallized rock composed of augite, clear plagioclase, and abundant iron-ore. All the constituents tend to have a granulitic development.*

B. (23620) ×20. *Granulitic gabbro of allivalitic composition, enclosed by Hypersthene-gabbro. It is composed of granulitic olivine, basic plagioclase felspar, and iron-ore. The rock has been completely recrystallized and has developed a faint banding.*

(Figure 31) Granulitic masses associated with basic ring-dykes.. A. (S22658) [NM 4986 6764] × 20. Granulitic gabbro, at margin of Great Eucrite south-west of Meall nan Con. A completely recrystallized rock composed of augite, clear plagioclase, and abundant iron-ore. All the constituents tend to have a granulitic development. B (S23620) [NM 4223 6631] × 20. Granulitic gabbro of allivalitic composition, enclosed by Hypersthene-gabbro. It is composed of granulitic olivine, basic plagioclase felspar, and iron-ore. The rock has been completely recrystallized and has developed a faint banding.

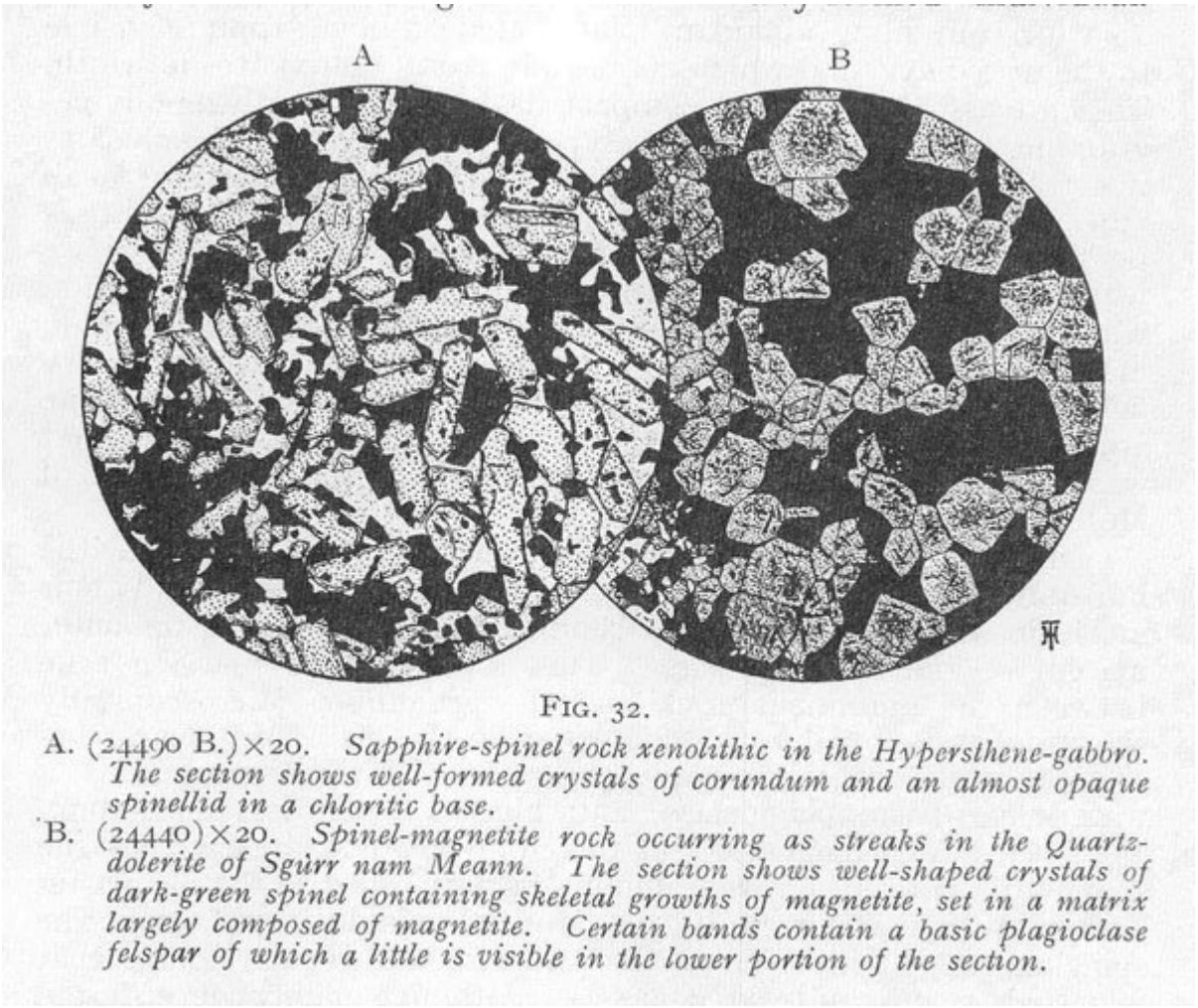


FIG. 32.

A. (24490 B.) × 20. *Sapphire-spinel rock xenolithic in the Hypersthene-gabbro. The section shows well-formed crystals of corundum and an almost opaque spinellid in a chloritic base.*

B. (24440) × 20. *Spinel-magnetite rock occurring as streaks in the Quartz-dolerite of Sgùrr nam Meann. The section shows well-shaped crystals of dark-green spinel containing skeletal growths of magnetite, set in a matrix largely composed of magnetite. Certain bands contain a basic plagioclase felspar of which a little is visible in the lower portion of the section.*

(Figure 32) A (S24490 B) [NM 4805 6478] × 20. Sapphire-spinel rock xenolithic in the Hypersthene-gabbro. The section shows well-formed crystals of corundum and an almost opaque spinellid in a chloritic base. B (S24440) [NM 4283 6815] × 20. Spinel-magnetite rock occurring as streaks in the Quartz-dolerite of Sgùrr nam Meann. The section shows well-shaped crystals of dark-green spinel containing skeletal growths of magnetite, set in a matrix largely composed of magnetite. Certain bands contain a basic plagioclase felspar of which a little is visible in the lower portion of the section.

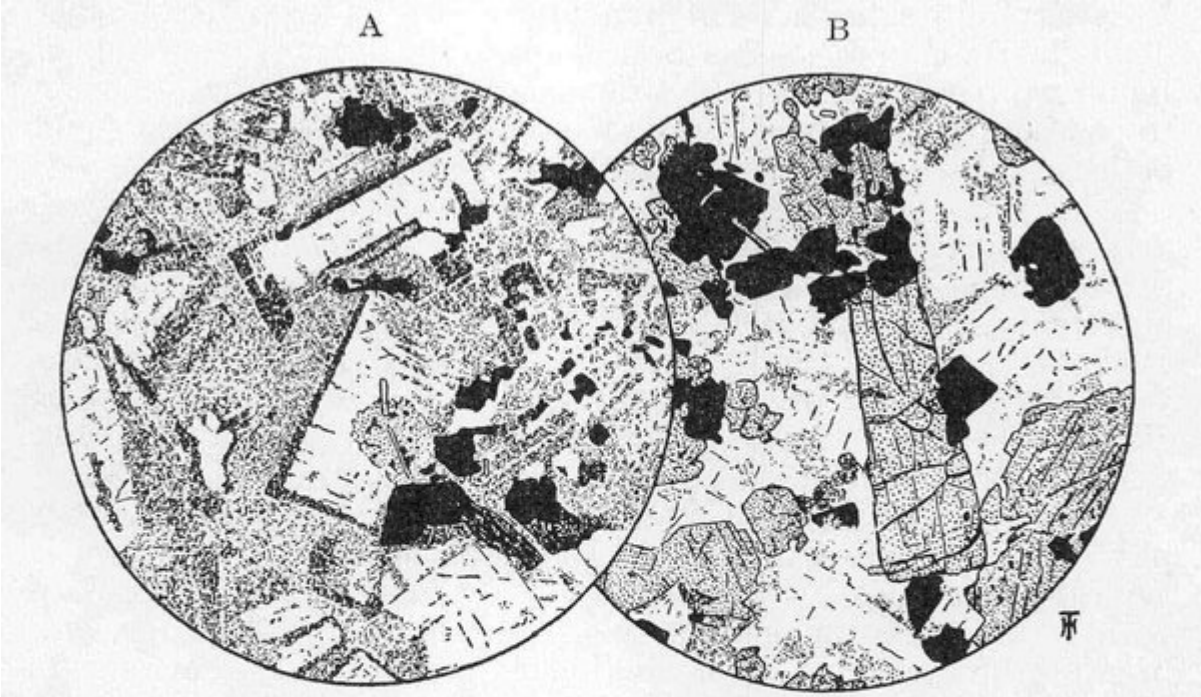


FIG. 33.—*Granophyre of Grigadale and Quartz-dolerite of Sgùrr nam Meann.*

A. (22820) × 20. *Grigadale Granophyre. Crystals of plagioclase edged with turbid alkali-felspar, partially resorbed augites of gabbro origin, and occasional patches of iron-ore, in a granophyric matrix of alkali-felspar and quartz.*

B. (22409) × 20. *Quartz-dolerite of Sgurr nam Meann. The section shows a large crystal of hypersthene, with partially recrystallized augite and iron-ore, in a matrix of plagioclase felspar that has been invaded by acid material and locally albitized.*

(Figure 33) Granophyre of Grigadale and Quartz-dolerite of SgUrr nam Meann. A. (S22820) [NM 437 664] × 20. Grigadale Granophyre. Crystals of plagioclase edged with turbid alkali felspar, partially resorbed augites of gabbro origin, and occasional patches of iron-ore, in a granophyric matrix of alkali felspar and quartz. B. (S22409) [NM 432 662] × 20. Quartz-dolerite of Sgùrr nam Meann. The section shows a large crystal of hypersthene, with partially recrystallized augite and iron-ore, in a matrix of plagioclase felspar that has been invaded by acid material and locally albitized.

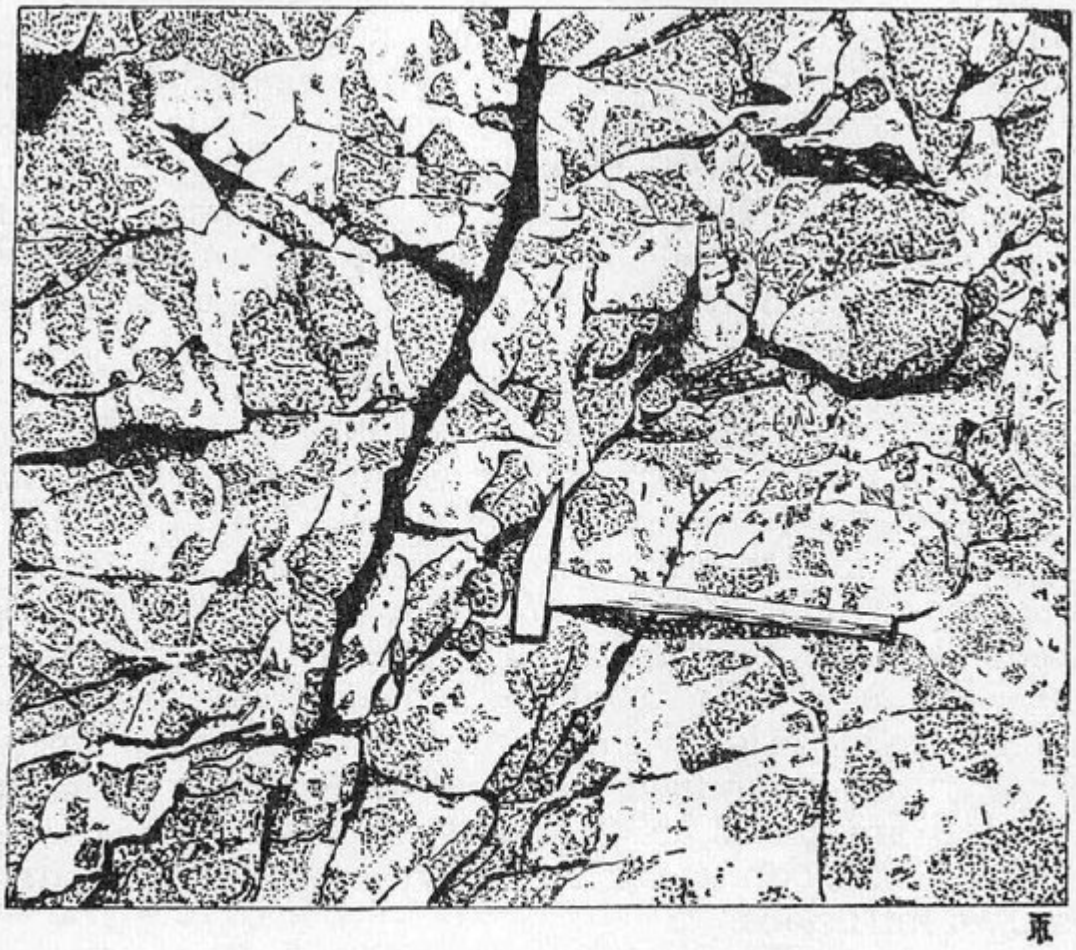


FIG. 34.—*Quartz-dolerite net-veined by granophyre, Sgùrr nam Meann Ring-dyke, on shore south-west of Sgùrr nam Meann.*
Drawn from Geological Survey Photograph, No. C. 2773.

(Figure 34) Quartz-dolerite net-veined by granophyre, Sgùrr nam Meann Ring-dyke, on shore south-west of Sgitrr nam Meann. Drawn from Geological Survey Photograph, No. C. 2773.

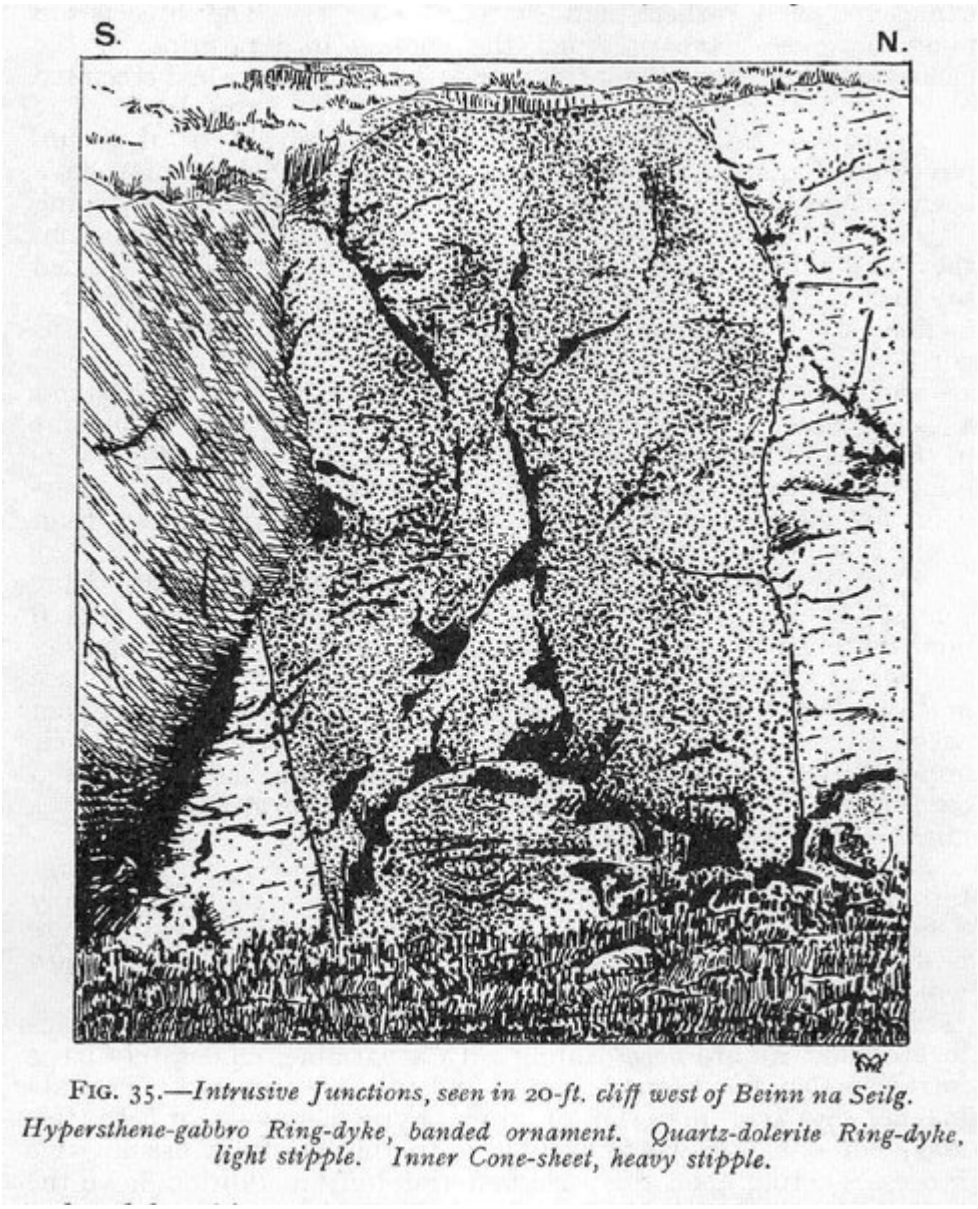


FIG. 35.—*Intrusive Junctions, seen in 20-ft. cliff west of Beinn na Seilg. Hypersthene-gabbro Ring-dyke, banded ornament. Quartz-dolerite Ring-dyke, light stipple. Inner Cone-sheet, heavy stipple.*

(Figure 35) Intrusive Junctions, seen in 20-ft. cliff west of Beinn na Seilg. Hypersthene-gabbro Ring-dyke, banded ornament. Quartz-dolerite Ring-dyke, light stipple. Inner Cone-sheet, heavy stipple.

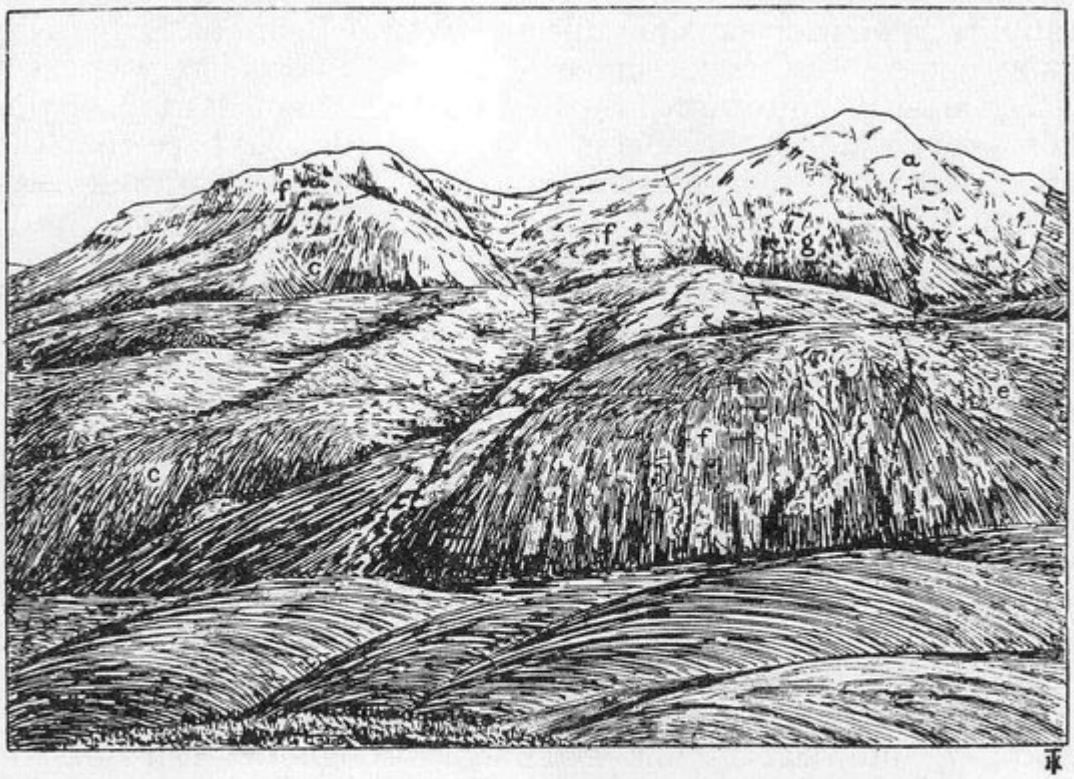


FIG. 36.—*View of the western side of Beinn na Seilg.*

a, *Hypersthene-gabbro.* c, *Quartz-gabbro of Garbh-dhail.* e, *Quartz-dolerite of Sgùrr nam Meann.* f, *Eucrite of Beinn nan Ord.* g′, *Quartz-gabbro of Beinn na Seilg. Broken lines indicate margins of ring-dykes (not shown in foreground).*

(Figure 36) View of the western side of Beinn na Seilg. a, Hypersthene-gabbro. c, Quartz-gabbro of Garbh-dhail. e, Quartz-dolerite of Sgitrr nam Meann. f, Eucrite of Beinn nan Ord. g′, Quartz-gabbro of Beinn na Selig. Broken lines indicate margins of ring-dykes (not shown in foreground).

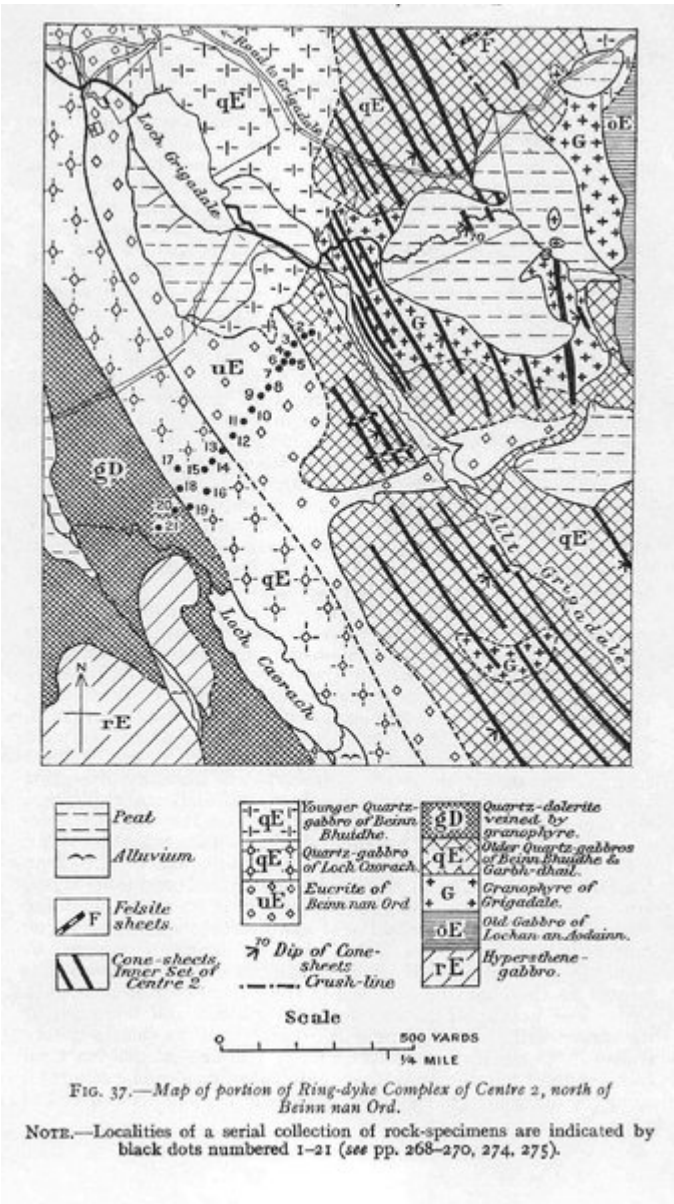


FIG. 37.—*Map of portion of Ring-dyke Complex of Centre 2, north of Beinn nan Ord.*

NOTE.—Localities of a serial collection of rock-specimens are indicated by black dots numbered 1–21 (*see* pp. 268–270, 274, 275).

(Figure 37) Map of portion of Ring-dyke Complex of Centre 2, north of Beinn nan Ord. Note. Localities of a serial collection of rock-specimens are indicated by black dots numbered 1–21 (see pp. 268–270, 274, 275).

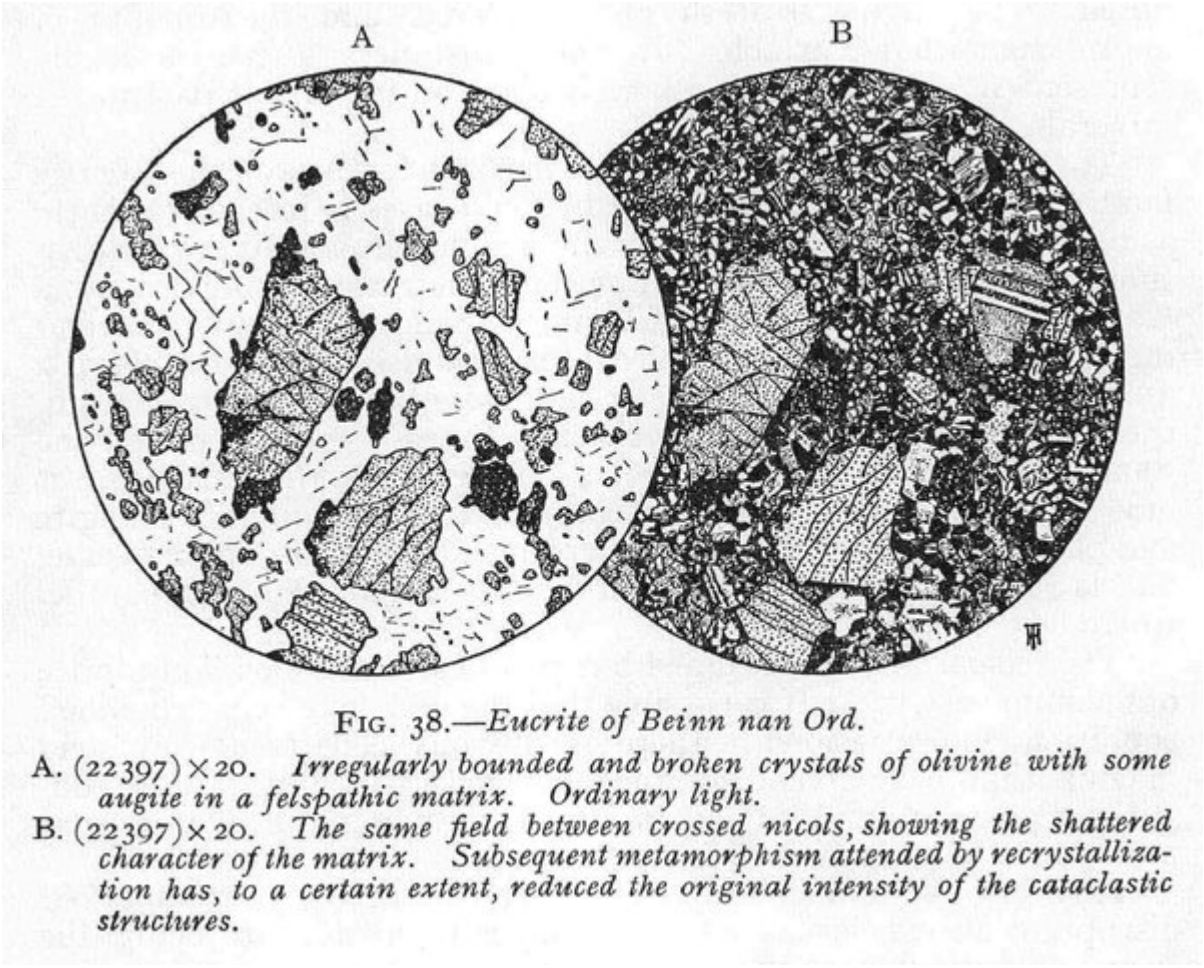


FIG. 38.—*Eucrite of Beinn nan Ord.*

A. (22397) × 20. *Irregularly bounded and broken crystals of olivine with some augite in a felspathic matrix. Ordinary light.*

B. (22397) × 20. *The same field between crossed nicols, showing the shattered character of the matrix. Subsequent metamorphism attended by recrystallization has, to a certain extent, reduced the original intensity of the cataclastic structures.*

(Figure 38) Eucrite of Beinn wan Ord. A. (S22397) [NM 432 662] × 20. Irregularly bounded and broken crystals of olivine with some augite in a felspathic matrix. Ordinary light. B. (S22397) [NM 432 662] × 20. The same field between crossed nicols, showing the shattered character of the matrix. Subsequent metamorphism attended by recrystallization has, to a certain extent, reduced the original intensity of the cataclastic structures.

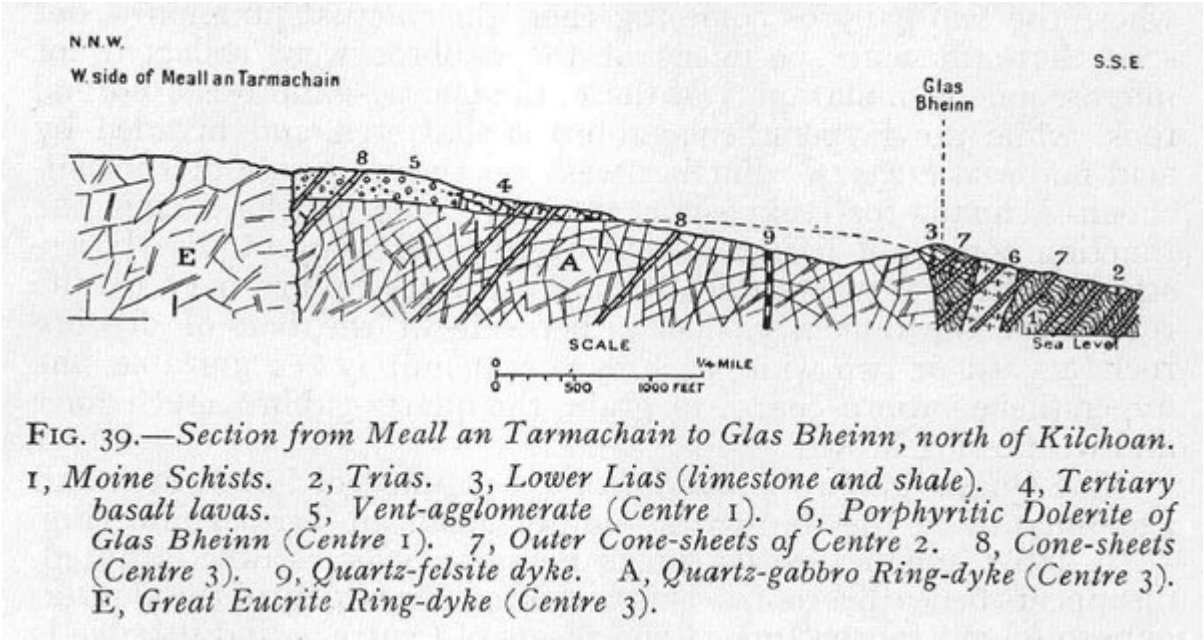


FIG. 39.—*Section from Meall an Tarmachain to Glas Bheinn, north of Kilchoan.*

1, *Moine Schists.* 2, *Trias.* 3, *Lower Lias (limestone and shale).* 4, *Tertiary basalt lavas.* 5, *Vent-agglomerate (Centre 1).* 6, *Porphyritic Dolerite of Glas Bheinn (Centre 1).* 7, *Outer Cone-sheets of Centre 2.* 8, *Cone-sheets (Centre 3).* 9, *Quartz-felsite dyke.* A, *Quartz-gabbro Ring-dyke (Centre 3).* E, *Great Eucrite Ring-dyke (Centre 3).*

(Figure 39) Section from Meall an Tarmachain to Glas Bheinn, north of Kilchoan. 1, Moine Schists. 2, Trias. 3, Lower Lias (limestone and shale). 4, Tertiary basalt lavas. 5, Vent-agglomerate (Centre 1). 6, Porphyritic Dolerite of Glas Bheinn (Centre 1). 7, Outer Cone-sheets of Centre 2. 8, Cone-sheets (Centre 3). 9, Quartz-felsite dyke. A, Quartz-gabbro Ring-dyke (Centre 3). E, Great Eucrite Ring-dyke (Centre 3).

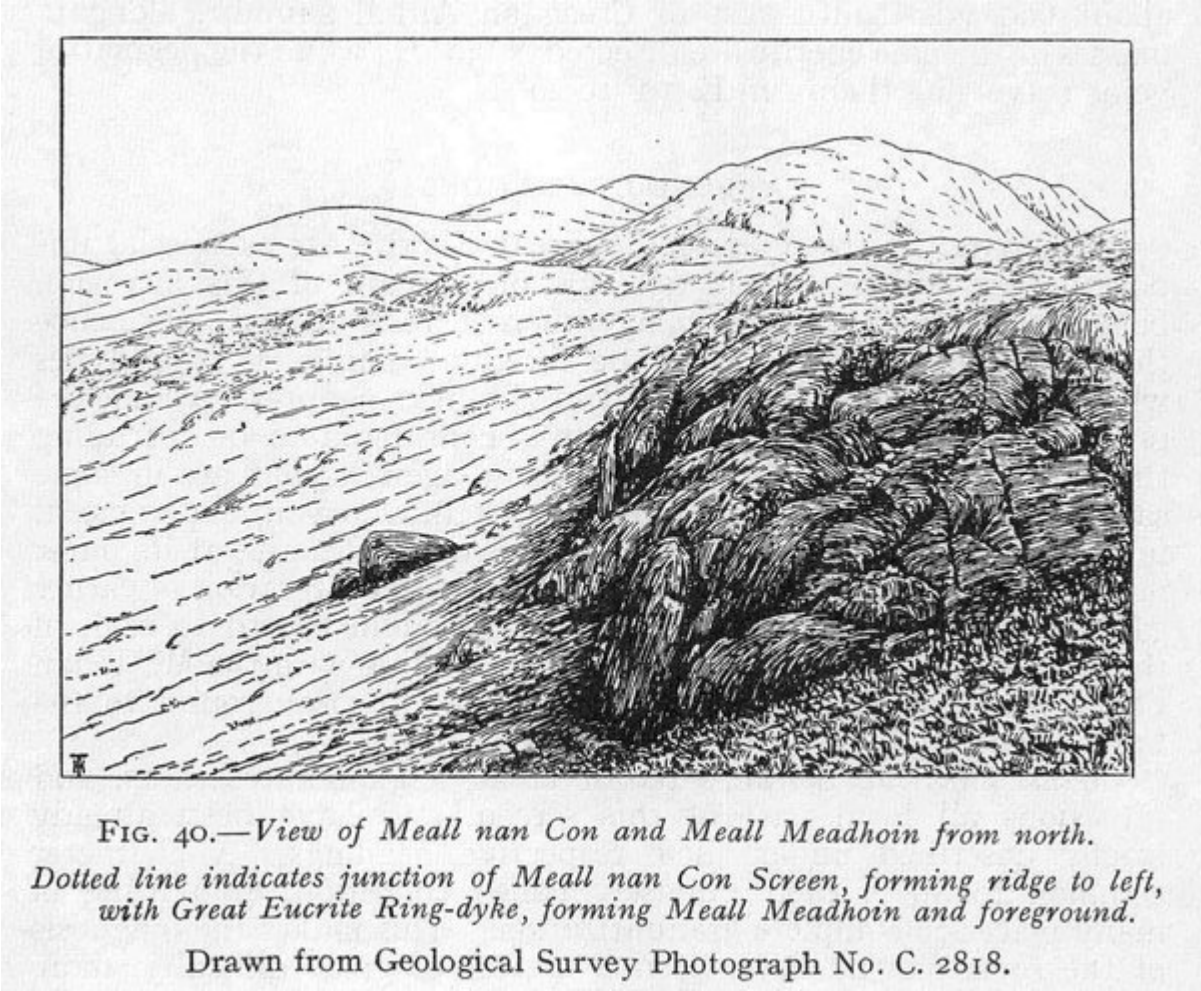


FIG. 40.—*View of Meall nan Con and Meall Meadhoin from north.*
Dotted line indicates junction of Meall nan Con Screen, forming ridge to left, with Great Eucrite Ring-dyke, forming Meall Meadhoin and foreground.
Drawn from Geological Survey Photograph No. C. 2818.

(Figure 40) View of Meall nan Con and Meall Meadhoin from north.Dotted line indicates junction of Meall nan Con Screen, forming ridge to left, with Great Eucrite Ring-dyke, forming Meall Meadhoin and foreground. Drawn from Geological Survey Photograph No. C. 2818.

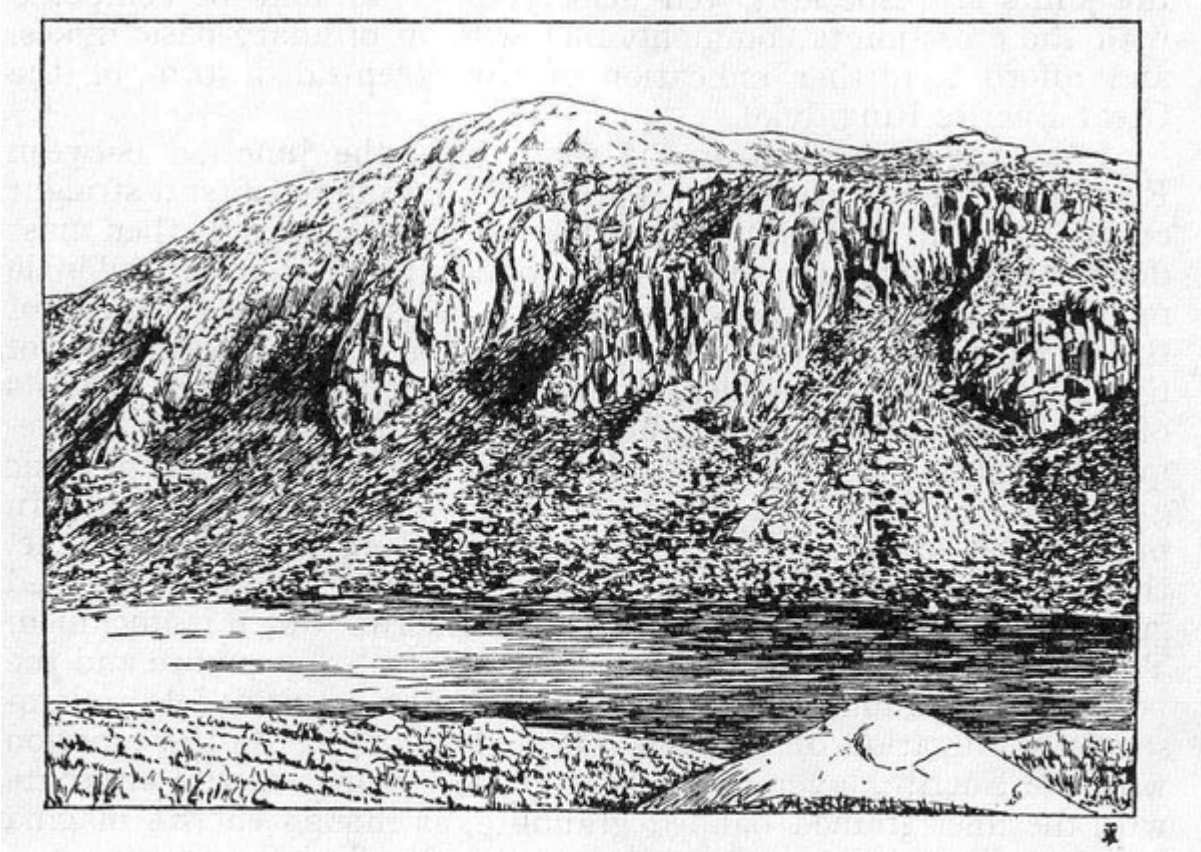


FIG. 41.—*View of crags on west side of Meall nan Con.*
Broken line indicates junction of granulitized rocks of Meall nan Con Screen with Great Eucrite Ring-dyke, that forms vertically-jointed crag overlooking loch.
Drawn from Geological Survey Photograph No. C. 2817.

(Figure 41) View of crags on west side of Meall nan Con.Broken line indicates junction of granulitized rocks of Meall nan Con Screen with Great Eucrite Ring-dyke, that forms vertically-jointed crag overlooking loch.Drawn from Geological Survey Photograph No. C. 2817.

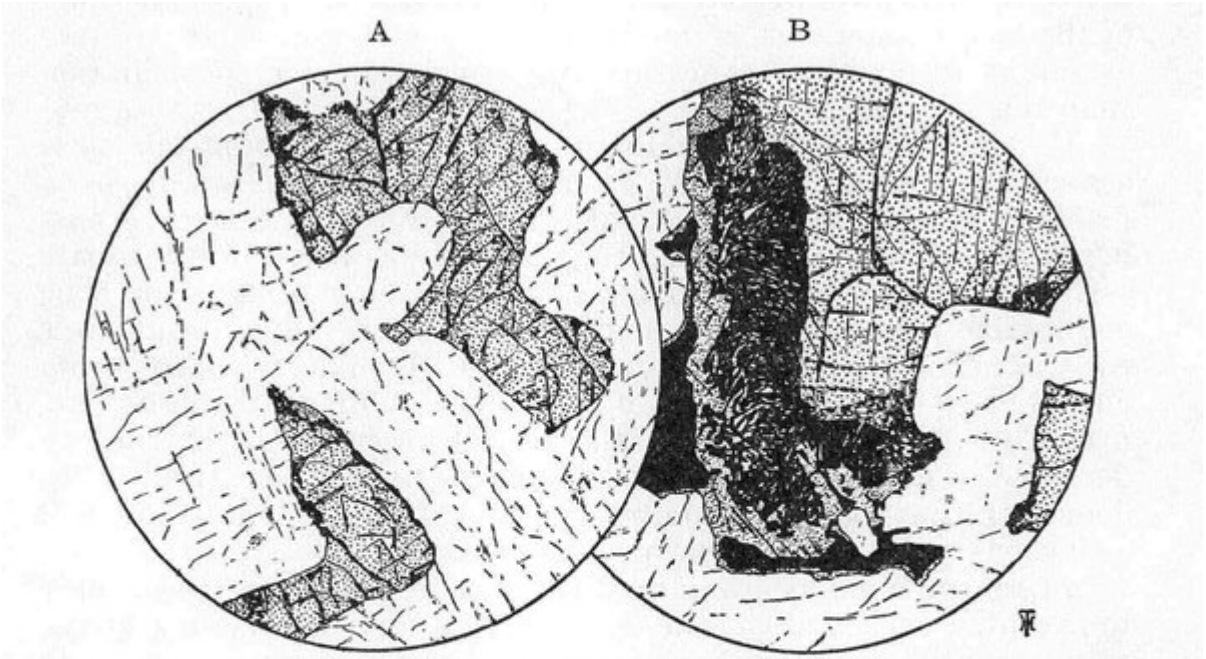


FIG. 42.—*Great Eucrite.*

A. (22675) × 20. *Eucrite, typical of the Great Eucrite of Centre 3. The section shows olivine with slight marginal development of secondary magnetite, and plagioclase that varies in composition from basic labradorite to bytownite.*
B. (22355) × 20. *Same type with well-developed reaction border between olivine and felspar. The reaction border consists of dendroid magnetite and hypersthene.*

(Figure 42) Great Eucrite. A. (S22675) [NM 4680 6659] × 20. Eucrite, typical of the Great Eucrite of Centre 3. The section shows olivine with slight marginal development of secondary magnetite, and plagioclase that varies in composition from basic labradorite to bytownite. B. (S22355) [NM 4422 6816] × 20. Same type with well-developed reaction border between olivine and felspar. The reaction border consists of dendroid magnetite and hypersthene.

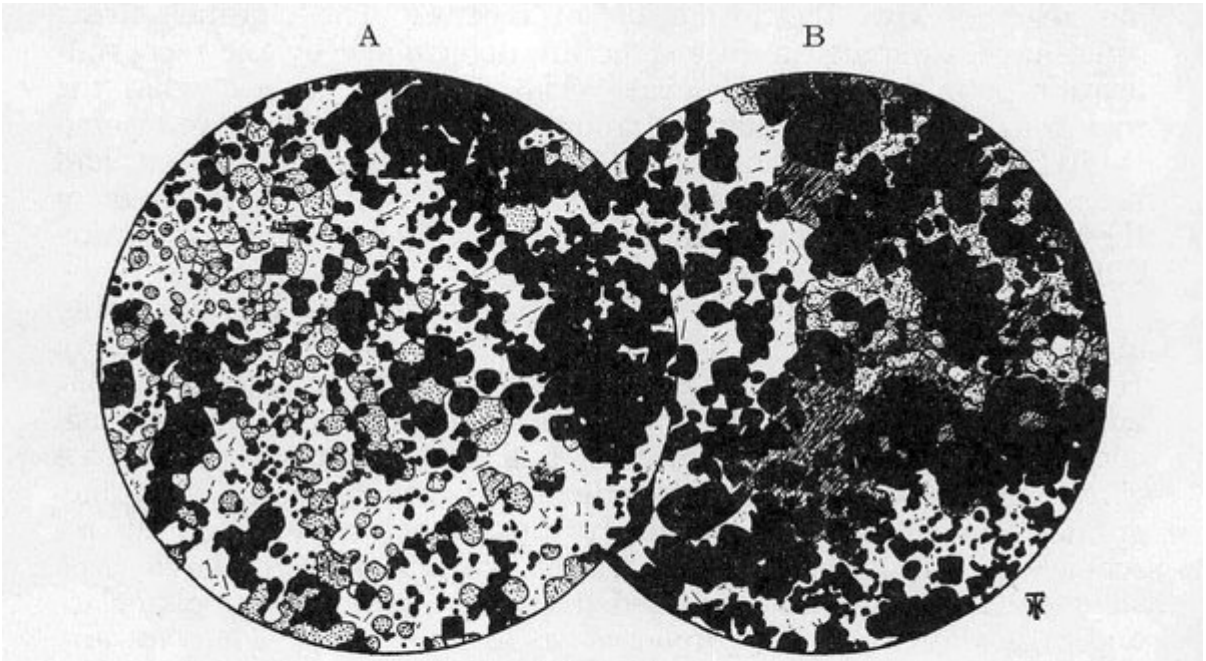


FIG. 43.—*Olivine-spinel-granulite.*

A. (26671) × 20. *The rock consists of rounded grains of olivine and an almost opaque dark-green spinellid in a matrix of basic plagioclase felspar.*
B. (26671) × 20. *Another portion of the same section, with the same magnification, showing the large plates of biotite that occasionally replace felspar as the matrix of the other constituents.*

(Figure 43) Olivine-spinel-granulite. A. (S26671) [NM 5024 6681] × 20. The rock consists of rounded grains of olivine and an almost opaque dark-green spinellid in a matrix of basic plagioclase felspar. B. (S26671) [NM 5024 6681] × 20. Another portion of the same section, with the same magnification, showing the large plates of biotite that occasionally replace felspar as the matrix of the other constituents.

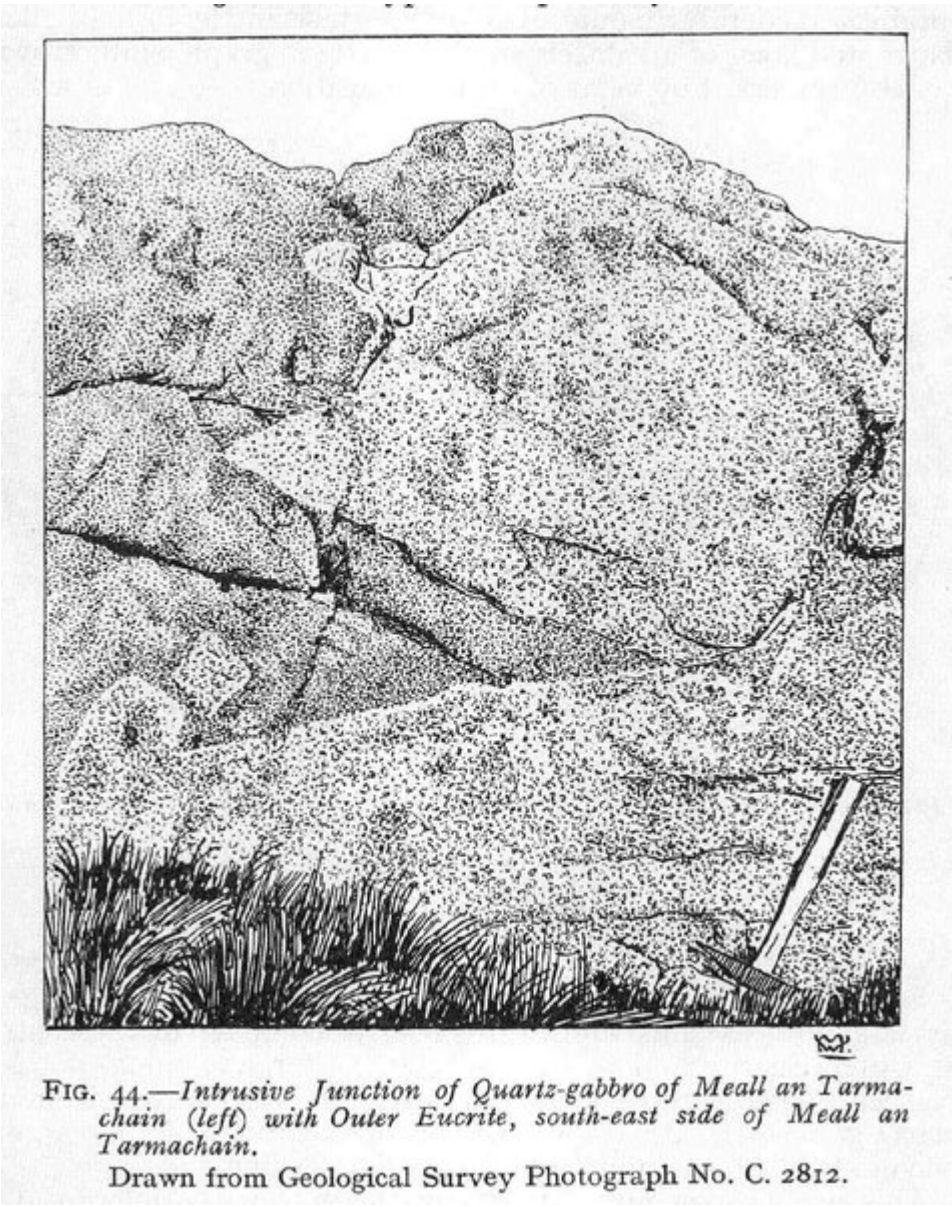


FIG. 44.—*Intrusive Junction of Quartz-gabbro of Meall an Tarmachain (left) with Outer Eucrite, south-east side of Meall an Tarmachain.*
Drawn from Geological Survey Photograph No. C. 2812.

(Figure 44) Intrusive Junction of Quartz-gabbro of Meall an Tarmachain (left) with Outer Eucrite, south-east side of Meall an Tarmachain. Drawn from Geological Survey Photograph No. C. 2812.

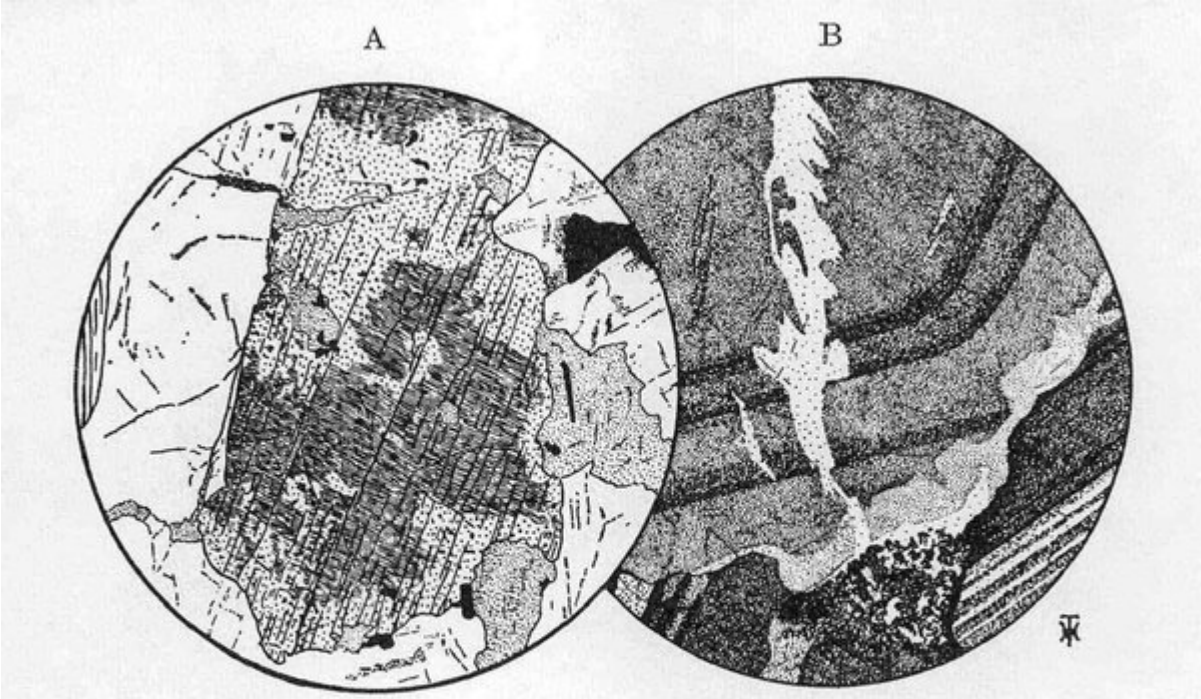


FIG. 45.

A. (22345) ×20. *Large crystal of augite showing the local obliteration of schiller-structure as one of the results of acidification* (p. 276).
B. (22351) ×23. *Zoned crystal of basic plagioclase fringed with a late crystallization of albite-oligoclase and veined by albite. Crossed nicols.*

(Figure 45) A. (S22345) [NM 4373 6780] × 20. Large crystal of augite showing the local obliteration of schillerstructure as one of the results of acidification (p. 276). B. (S22351) [NM 4390 6770] × 23. Zoned crystal of basic plagioclase fringed with a late crystallization of albite-oligoclase and veined by albite. Crossed nicols.

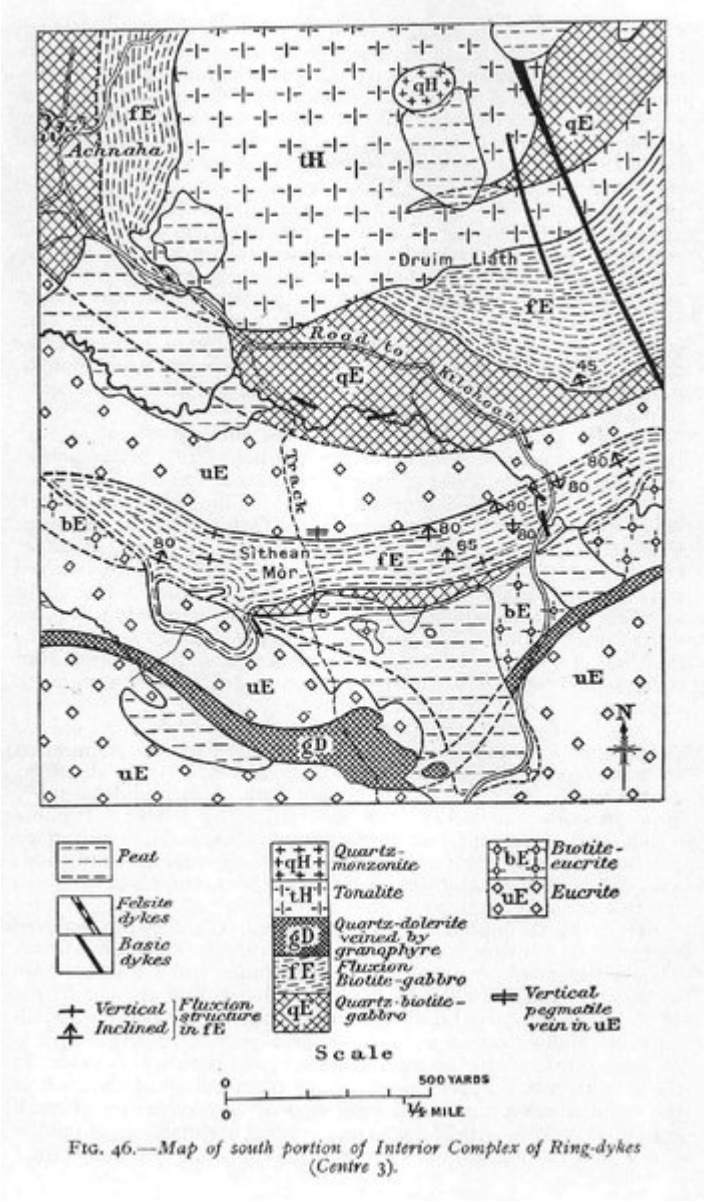


FIG. 46.—*Map of south portion of Interior Complex of Ring-dykes (Centre 3).*

(Figure 46) Map of south portion of Interior Complex of Ring Dykes (Centre 3).

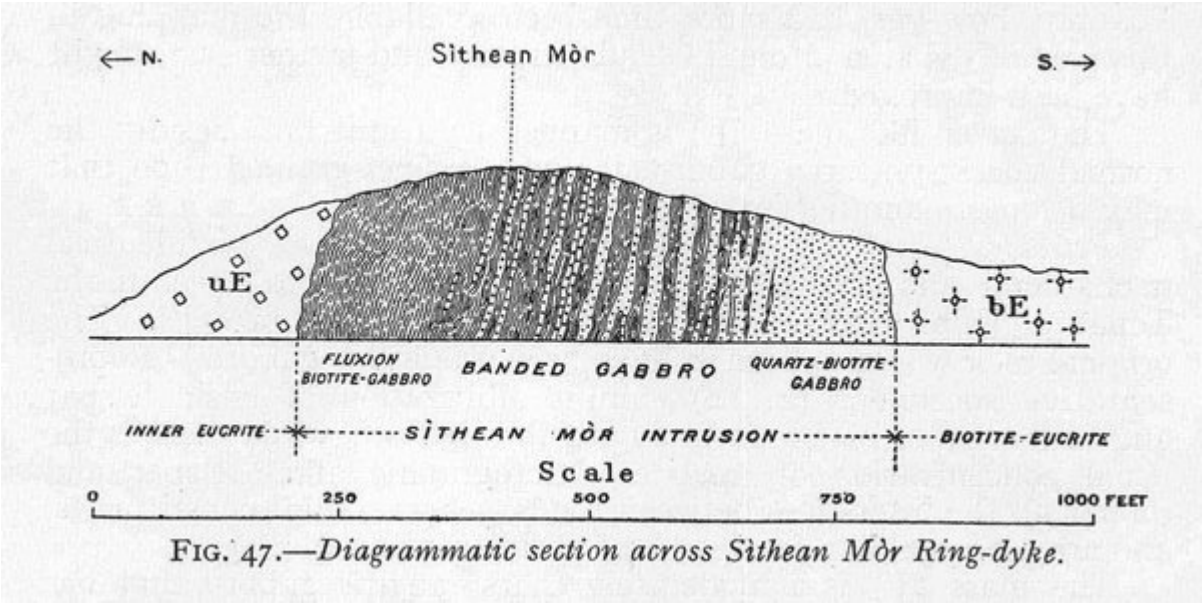


FIG. 47.—*Diagrammatic section across Sithean Mòr Ring-dyke.*

(Figure 47) Diagrammatic section across Sìthean Mòr Ring-dyke.

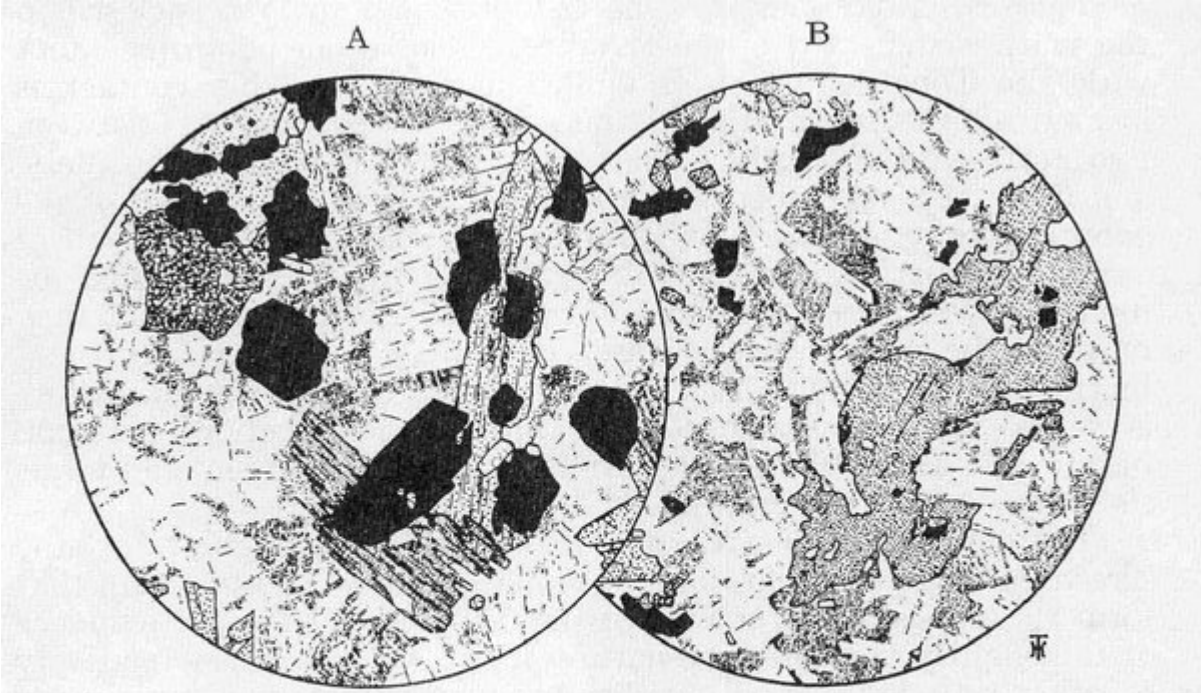


FIG. 48.—*Tonalite and Quartz-monzonite.*

A. (21248) × 20. *Tonalite. Biotite, hornblende, and augite with plagioclase felspar, perthite, and quartz. Magnetite and apatite are abundant accessories. The alkali-felspar is mainly turbid.*

B. (21247) × 20. *Quartz-monzonite. The section shows a large plate of biotite, with subordinate augite, abundant elongate crystals of oligoclase-andesine felspar, in an apatite-rich turbid base of albite-perthite and quartz.*

(Figure 48) Tonalite and Quartz-monzonite.A. (S21248) [NM 4735 6873] × 20. Tonalite. Biotite, hornblende, and augite with plagioclase felspar, perthite, and quartz. Magnetite and apatite are abundant accessories. The alkali-felspar is mainly turbid. – B. (S21247) [NM 4699 6843] × 20. Quartz-monzonite. The section shows a large plate of biotite, with subordinate augite, abundant elongate crystals of oligoclase-andesine felspar, in an apatite-rich turbid base of albite-perthite and quartz.

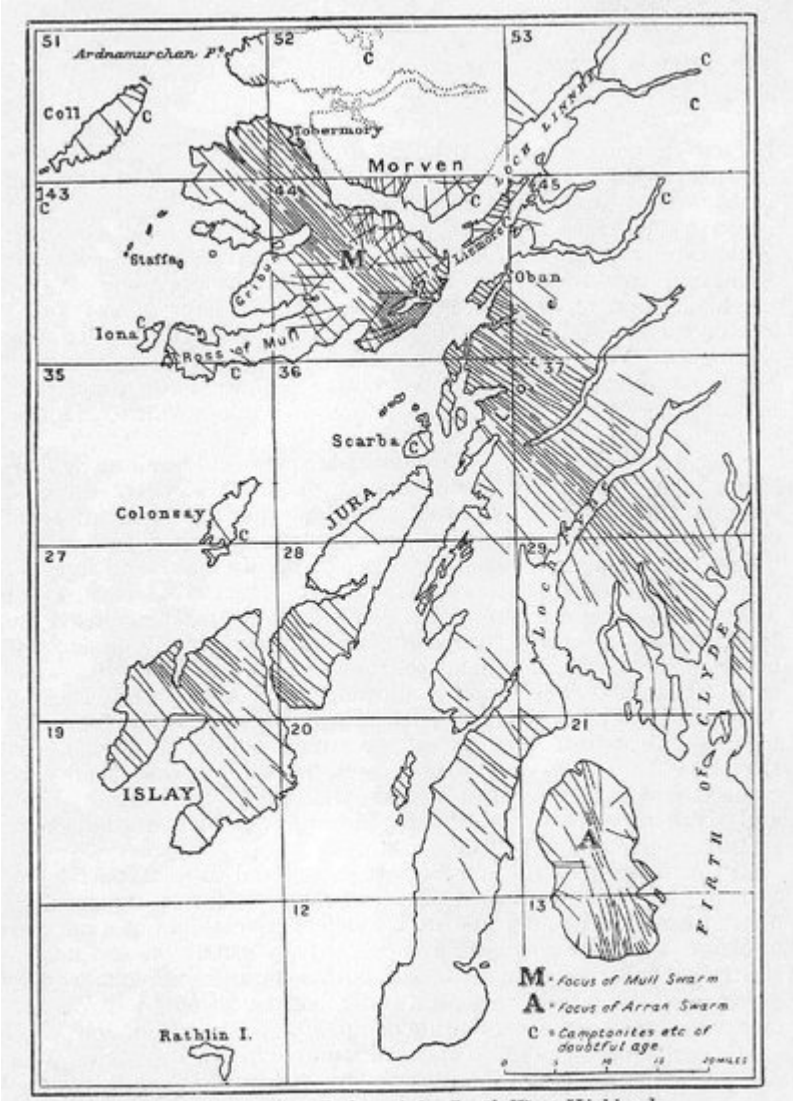


FIG. 49.—*Tertiary Dykes of the South-West Highlands.*
Only about one dyke in every ten or fifteen in shown.
Quoted from 'Tertiary Mull Memoir,' 1924, *Fig.* 60, *p.* 357.

(Figure 49) Tertiary Dykes of the South-West Highlands. Only about one dyke in every ten or fifteen in shown. Quoted from Tertiary Mull Memoir, 1924, (Figure 60), p357.

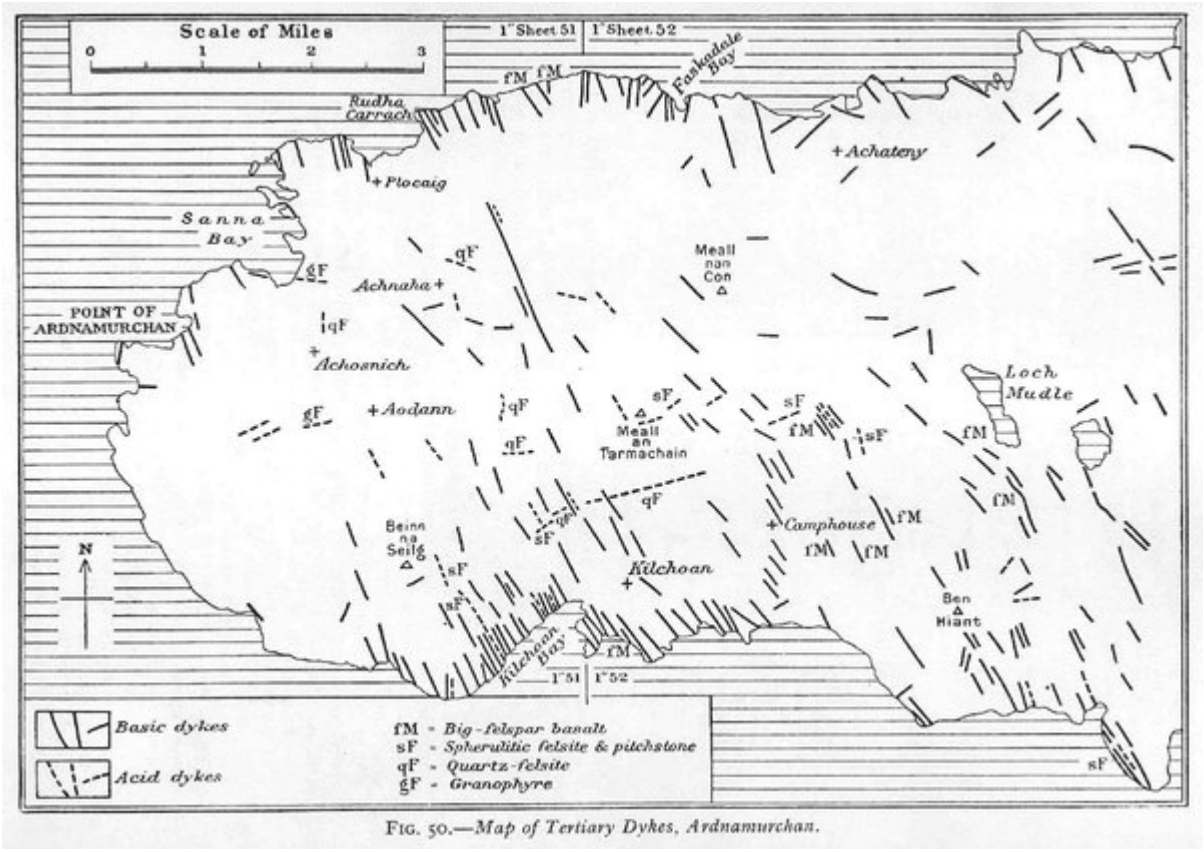


FIG. 50.—*Map of Tertiary Dykes, Ardnamurchan.*

(Figure 50) Map of Tertiary Dykes, Ardnamurchan.

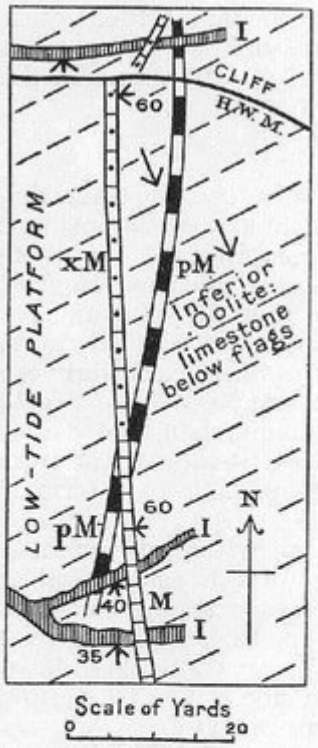


FIG. 51.—*Map showing relations of dykes and cone-sheets, on shore west of Sròn Bheag.*

pM, *4-ft. porphyritic basalt dyke.* I, *cone-sheets of quartz-dolerite (Talaidh type).* M, *5-ft. non-porphyritic dyke of quartz-dolerite (Talaidh type).* xM, *xenolithic portion of* M. H.W.M., *high-water mark.*

(Figure 51) Map showing relations of dykes and cone-sheets, on shore west of Sròn Bheag. pM, 4-ft. porphyritic basalt dyke. I, cone-sheets of quartz-dolerite (Talaidh type). M, 5-ft. Non-porphyritic dyke of quartz-dolerite (Talaidh type). xM, xenolithic portion of M. H.W.M., high-water mark.

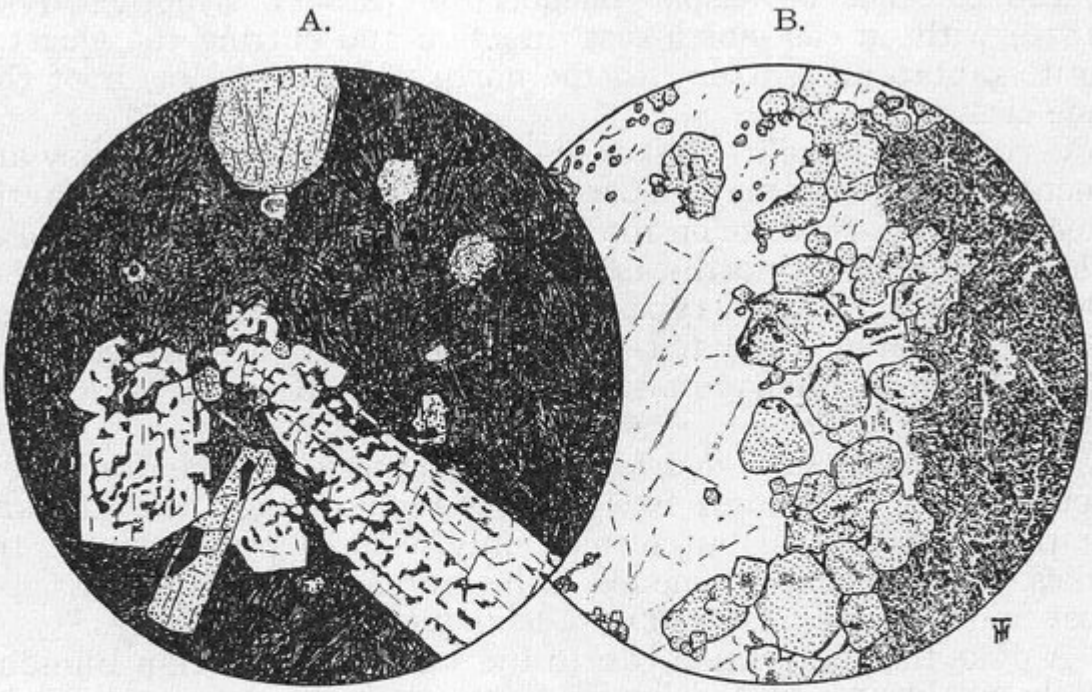


FIG. 52.—*Dyke Rocks.*

A. (24472) × 20. *Pitchstone with porphyritic felspars and pyroxene in a glassy base rendered almost opaque by skeletal growths of magnetite. The porphyritic felspars exhibit a highly characteristic spongy development and are penetrated by the ground-mass.*

B. (22425) × 63. *Amygdale from dolerite dyke showing zone of small idiomorphic garnets between turbid perthite and colourless prehnite.*

(Figure 52) Dyke rocks. A. (S24472) [NM 5605 6101] × 20. Pitchstone with porphyritic felspars and pyroxene in a glassy base rendered almost opaque by skeletal growths of magnetite. The porphyritic felspars exhibit a highly characteristic spongy development and are penetrated by the ground-mass. B. (S22425) [NM 4721 6297] × 63. Amygdale from dolerite dyke showing zone of small idiomorphic garnets between turbid perthite and colourless prehnite.

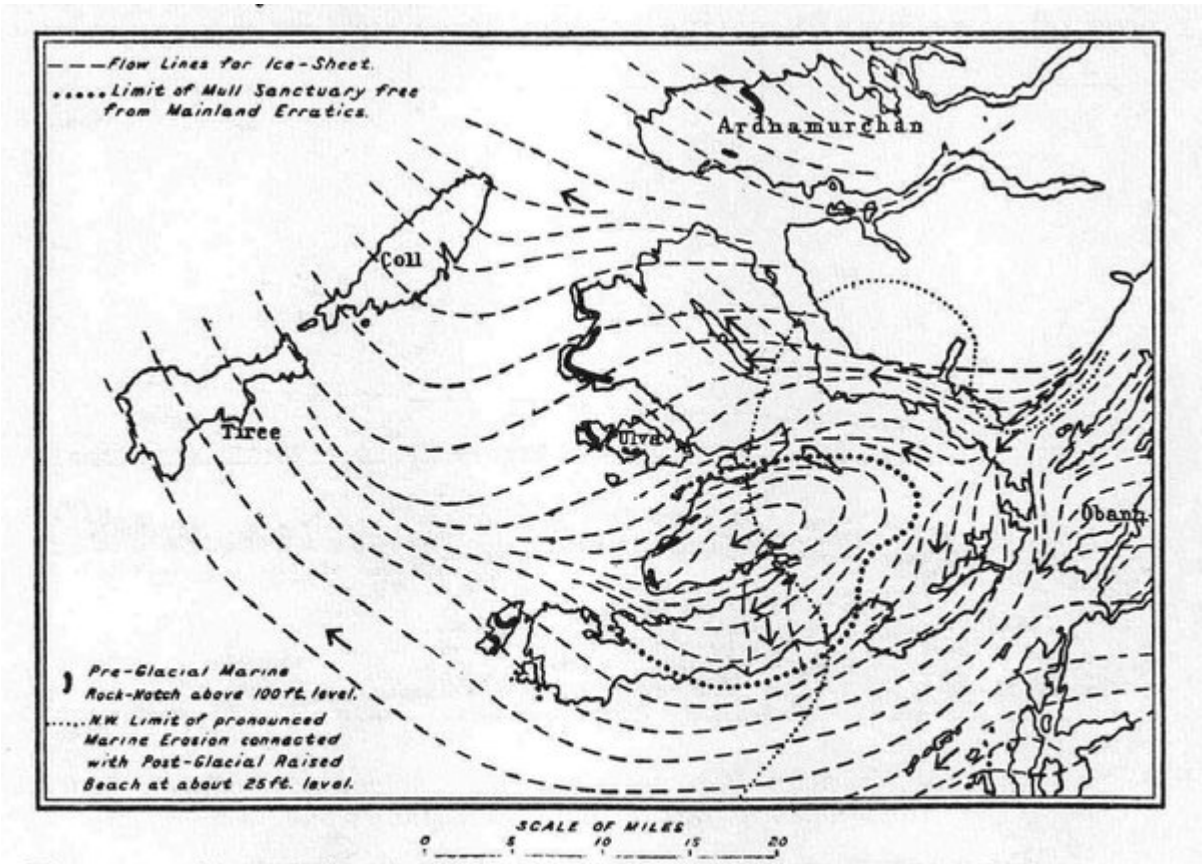


FIG. 53.—*General Glaciation of District, and some Raised-Beach phenomena.*
Quoted from 'Tertiary Mull Memoir,' 1924, Fig. 65, p. 395.

(Figure 53) General glaciation of district, and some raised-beach phenomena. Quoted from Tertiary Mull Memoir, 1924, (Figure 65), p. 395.

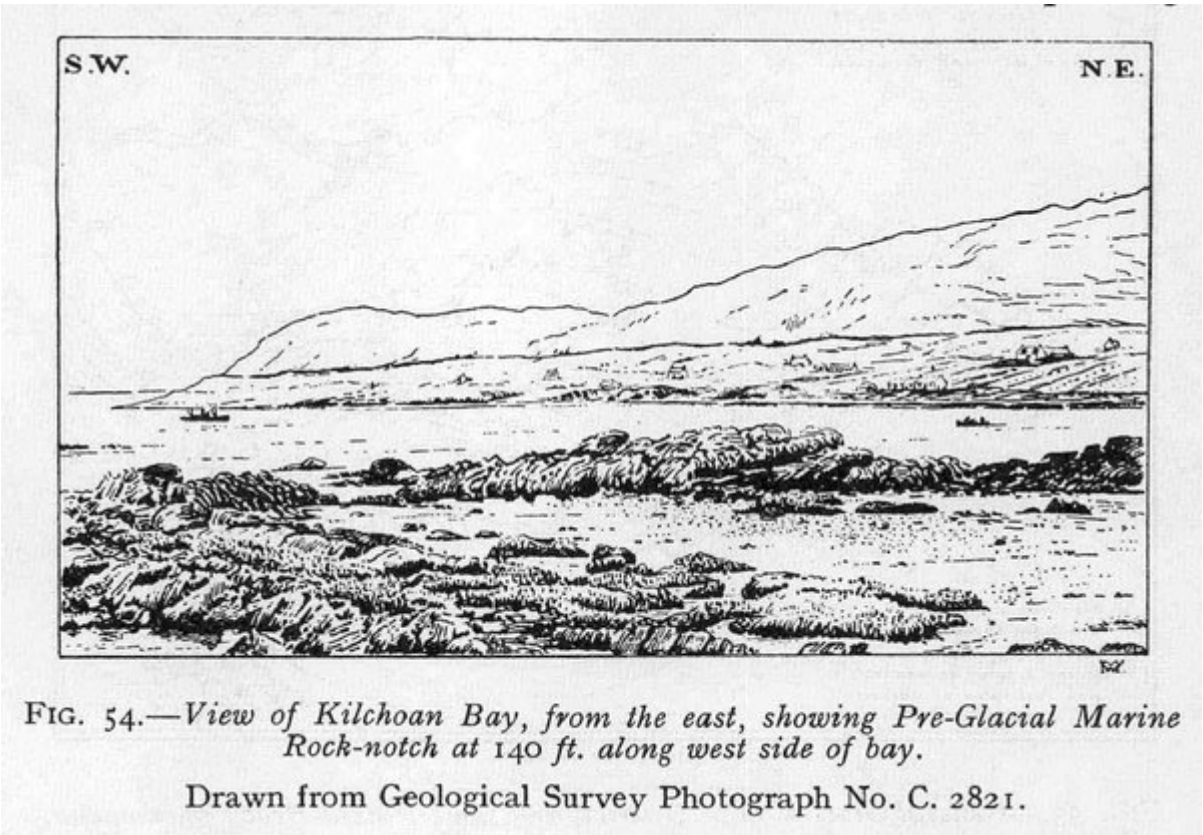


FIG. 54.—*View of Kilchoan Bay, from the east, showing Pre-Glacial Marine Rock-notch at 140 ft. along west side of bay.*
Drawn from Geological Survey Photograph No. C. 2821.

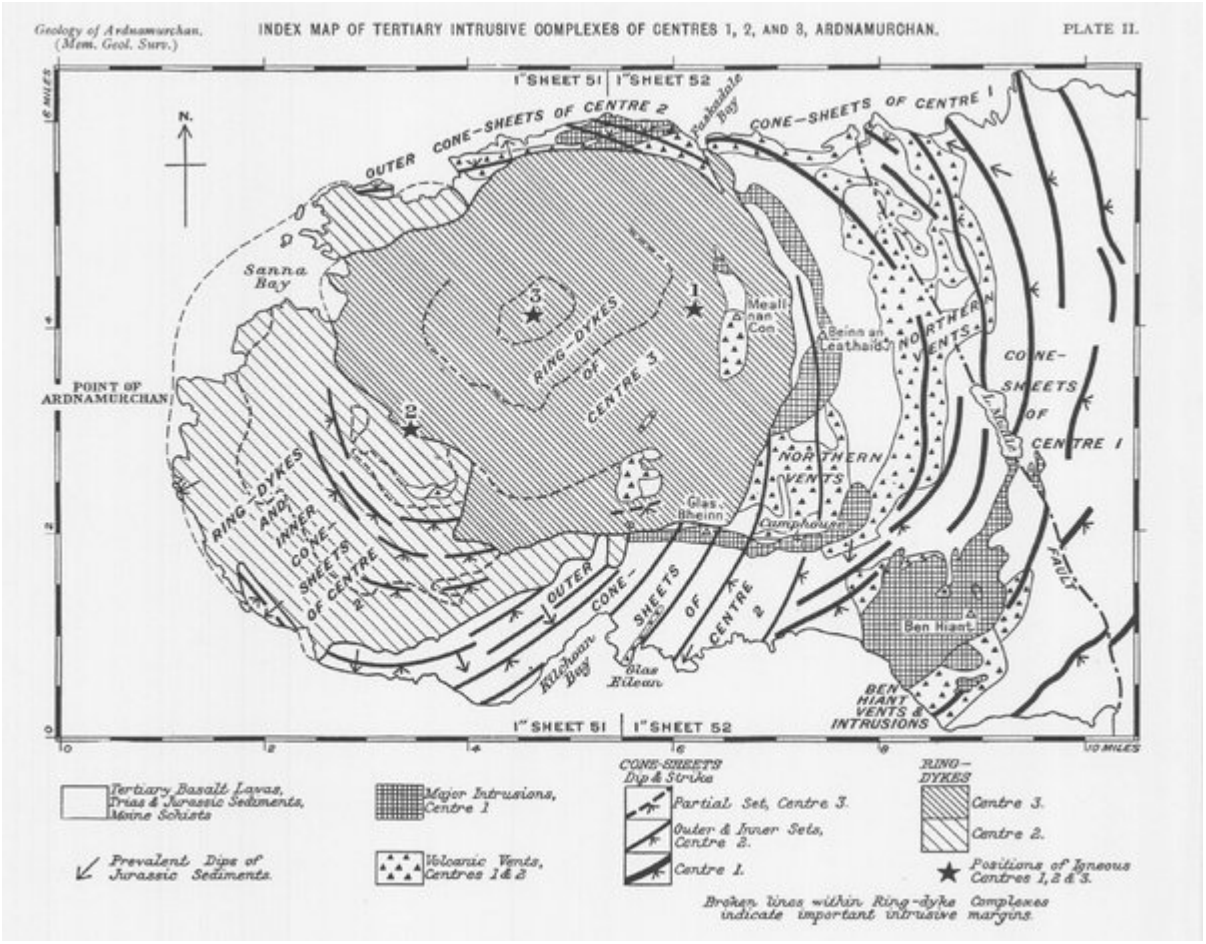
(Figure 54) View of Kilchoan Bay, from the east, showing Pre-Glacial Marine Rock-notch at 140 ft. along west side of bay. Drawn from Geological Survey Photograph No. C2821.

Beinn na h'Urchrach. Ben Hiant. Stallachan Dubha. Maclean's Nose.

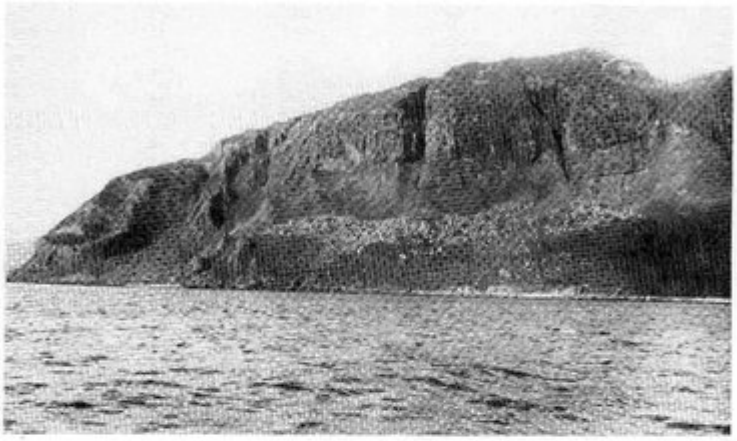
A.—*View of Ben Hiant, Ardnamurchan, from west*
(For Explanation, *see* p. viii.)

B.—*Marginal Scarp of Ben Hiant Intrusion, seen from south-east*
(For Explanation, *see* p viii.)

(Plate 1) A. View of Ben Hiant, Ardnamurchan, from west. Main mass of this rocky hill is Ben Hiant Intrusion (see (Figure 19), p. 160). Maclean's Nose to right is agglomerate. Junction of these rocks extends from shore up well-marked hollow, seen on photograph above Mingary Castle (see also Plate 1, B). Stallachan Dubha is formed of outlying portion of Ben Hiant Intrusion. Scarp-features in middle distance are due to cone-sheets. Mingary Castle stands on a craignurite sill. Promontory beyond is Rudha a' Mhìle ((Figure 25), p. 177). Geological Survey Photograph, No. C2829. B. Marginal Scarp of Ben Want Intrusion, seen from south-east. The view is taken from west of Stallachan Dubha (see Plate 1, A and Explanation). The Ben Hiant Intrusion is closely jointed. Vent-agglomerate forming foreground contains two large masses of big-felspar basalt (p. 126), one in centre of view, the other to the left. Geological Survey Photograph, No. C2850 .



(Plate 2) Index map of Teriary intrusive complexes of Centre 1, 2, and 3 Ardnamurchan.



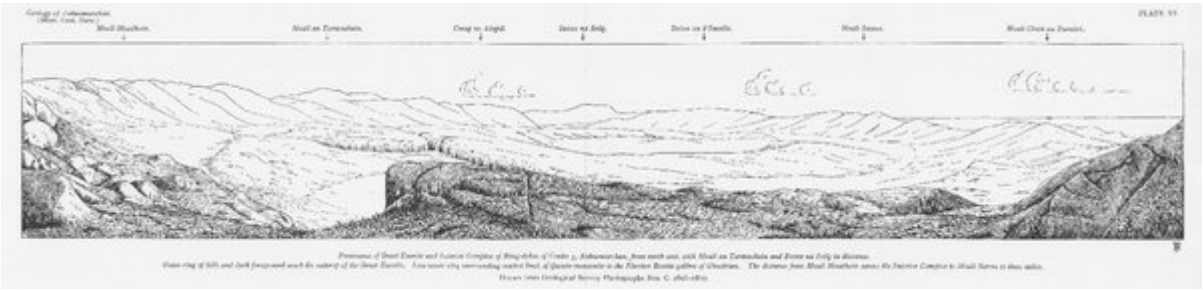
A.—*View of Maclean's Nose, Ardnamurchan, from east.*
(For Explanation, *see* p. viii.)

B.—*Agglomerate cliffs of Maclean's Nose.*
(For Explanation, *see* p. viii.)

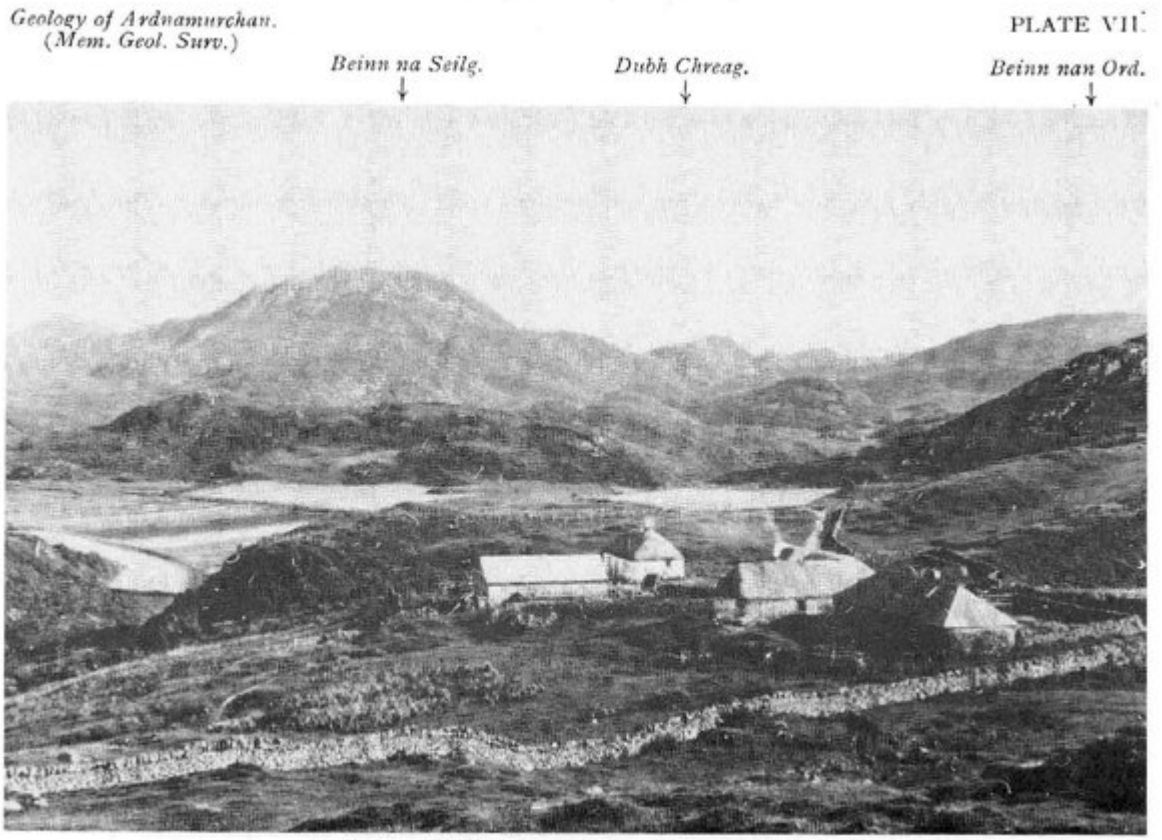
(Plate 3) A. View of Maclean's Nose, Ardnamurchan, from east. Cliffs extend up to 800 ft. above sea-level, and are formed of vent-agglomerate with flatly interbedded tuffs. On extreme right of scree, buttress of basalt lava marks a vertical wall of the vent. Exposure of vent-wall (Moine Schist) again occurs on shore near point of Nose (see p. 124). Geological Survey Photograph, No. C2859. B. Agglomerate Cliff of Maclean's Nose. In foreground, flat bed of tuff (below hammer) with agglomerate above and below. The view is taken from near extreme right of Plate 3, A, looking towards the Nose. Geological Survey Photograph, No. C2848.

Quartz-dolerite Cone-sheets along Shore south of Kilchoan, Ardnamurchan.
(For Explanation, *see* p. viii.)

(Plate 4) Quartz-dolerite cone-sheets along shore south of Kilchoan, Ardnamurchan. The cone-sheets are inclined away from the camera, and show well-developed cross-jointing. (See (Figure 23), p. 174.) Geological Survey Photograph, No. C2826.

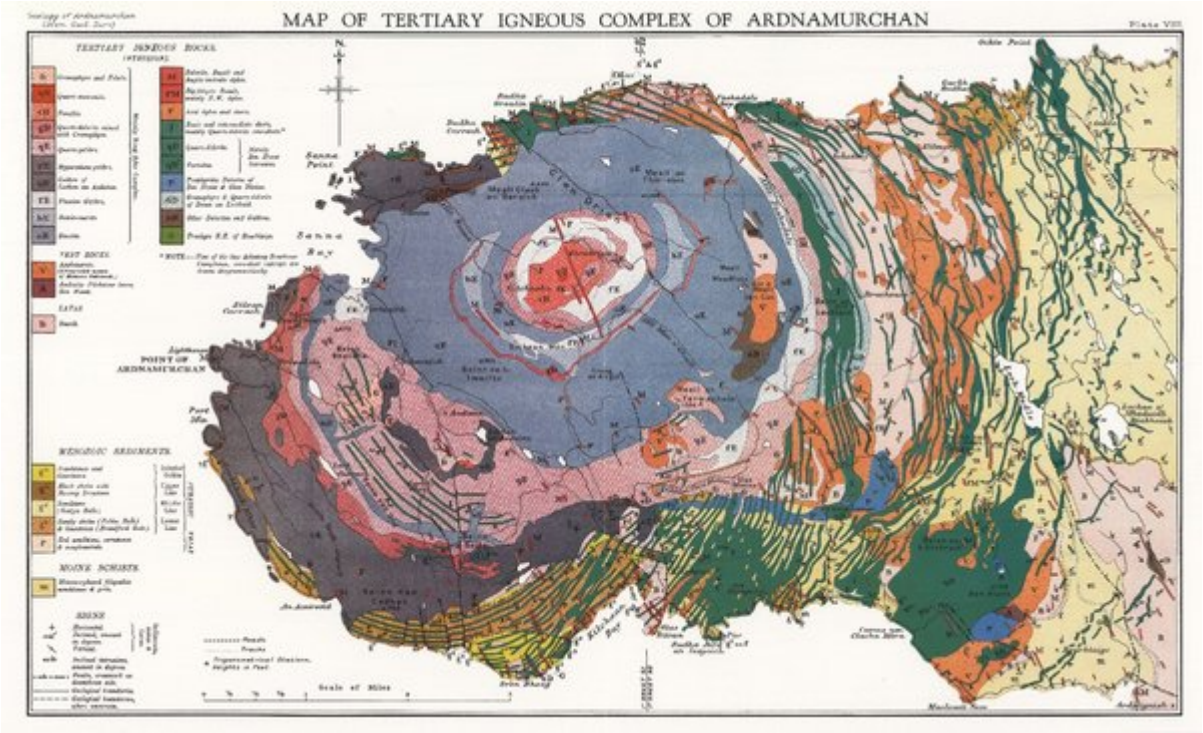


(Plate 6) Panorama of Great Eucrite and Interior Complex of Ring-dykes of Centre 3, Ardnamurchan, from north-east, with Meall an Tarmachain and Beinn na Seilg in distance. Outer ring of hills and dark foreground mark the outcrop of the Great Eucrite. Low inner ring surrounding central knob of Quartz-monzonite is the Fluxion Biotite-gabbro of Glendrian. The distance from Meall Meadhoin across the Interior Complex to Meall Sanna is three miles. Drawn from Geological Survey Photographs Nos. C2806, C2807, C2808, C2809.



Tertiary Gabbro Topography, Ardnamurchan.
View looking south from Achosnich across Ring-dyke Complex of Centre 2.
(For Explanation, *see* p. viii.)

(Plate 7) Tertiary Gabbro Topography, Ardnamurchan. View looking south from Achosnich across Ring-dyke Complex of Centre 2. Beinn na Seilg and Beinn nan Ord are formed mainly of eucrite. Intervening valley is eroded along north-south crush-lines. Dubh Chreag and other distant hills are hypersthene-gabbro. Lower ground between Beinn na Seilg and crofts in foreground (Achosnich) is mainly quartz-gabbro. Geological Survey Photograph, No. C2785.



(Plate 8) Map of Teriary Igneous Complex of Ardnamurchan.

TABLE I

ANALYSES

	I.	A.	II.	III.	B.	IV.	C.	V.	D.	E.	VI.	
	Igneous.			Sed.	Ign.	Sed.	Ign.	Sedimentary.			Sed.	
Metamorphic or Non-metamorphic.	Met.	Non-met.	Met.	Met.	Non-met.	Met.	Non-met.	Met.	Non-met.		Met.	Metamorphic or Non-metamorphic.
SiO_2	68·97	67·00	66·19	81·89	79·19	76·15	63·03	64·23	67·92	59·96	18·29	SiO_2
Al_2O_3	14·66	15·19	15·58	9·10	9·88	5·55	17·72	15·87	12·89	16·52	2·77	Al_2O_3
Fe_2O_3	1·36	1·98	1·38	0·17	0·21	0·87	2·27	0·03	3·73	2·37	1·11	Fe_2O_3
FeO	1·92	2·17	2·90	0·16	0·63	0·82	1·92	3·84	2·42	3·20	nt. fd.	FeO
MgO	1·88	1·76	2·11	0·02	0·55	6·48	3·63	3·32	2·69	2·47	15·52	MgO
CaO	4·28	3·55	4·20	0·64	0·00	6·78	5·97	5·06	3·84	5·32	31·44	CaO
Na_2O	4·18	3·88	3·64	0·11	0·66	0·49	3·92	2·86	1·82	5·00	0·05	Na_2O
K_2O	1·42	2·99	2·18	7·11	7·68	0·66	1·06	1·68	1·59	2·82	0·78	K_2O
$H_2O+105°$ C.	0·47	0·77	0·63	0·21	0·54	0·46	0·44	0·84	0·89	1·27	4·01	$H_2O+105°$ C.
$H_2O-105°$ C.	0·03	—	0·04	0·03	0·03	0·08		0·05	0·17	0·15	0·51	$H_2O-105°$ C.
TiO_2	0·38	0·51	0·54	0·06	0·00	0·12	—	0·67	0·82	0·59	0·09	TiO_2
P_2O_5	0·13	0·13	0·13	0·07	0·00	0·45	—	0·13	0·06	0·24	0·22	P_2O_5
MnO	0·38	0·07	0·37	0·26	0·00	0·30	—	0·42	0·10	0·09	0·42	MnO
CO_2	0·13	—	0·39	0·28	0·64	0·95	—	0·10	1·28	trace	24·84	CO_2
FeS_2	nt. fd.	—	nt. fd.	nt. fd.	—	nt. fd.	—	0·88	—	—	nt. fd.	FeS_2
S	—	—	—	—	—	—	—	—	0·05	0·00	—	S
Cr_2O_3	—	—	—	—	—	—	—	trace	0·00	—	—	Cr_2O_3
(Co, Ni)O	nt. fd.	—	nt. fd.	nt. fd.	—	0·03	—	nt. fd.	—	—	nt. fd.	(Co, Ni)O
BaO	nt. fd.	—	nt. fd.	0·03	—	nt. fd.	—	0·04	—	—	nt. fd.	BaO
Li_2O	nt. fd.	—	nt. fd.	trace	—	trace	—	trace	—	—	trace	Li_2O
Cl	—	—	—	—	—	0·03	—	—	—	—	—	Cl
	100·19	100·00	100·28	100·14	100·01	100·22	99·96	100·02	100·27	100·00	100·05	

nt. fd.=not found.

(Table 1) Analyses.

TABLE II

NON-PORPHYRITIC CENTRAL MAGMA-TYPE (*see* Fig. 6).

	QUARTZ-DOLERITE.					
	I.	II.	III.	IV.	A.	
SiO_2	50·10	50·67	50·79	51·06	52·16	SiO_2
Al_2O_3	12·08	11·89	12·10	11·79	11·95	Al_2O_3
Fe_2O_3	4·35	8·61	4·10	3·41	4·86	Fe_2O_3
FeO	11·18	7·08	11·29	11·68	9·92	FeO
MgO	3·93	3·94	4·02	4·35	3·77	MgO
CaO	8·85	7·75	8·05	7·57	7·14	CaO
Na_2O	3·06	2·94	3·50	3·36	2·36	Na_2O
K_2O	0·96	1·50	1·30	1·23	1·74	K_2O
$H_2O>105°$	1·01	0·77	0·23	0·92	1·95	$H_2O>105°$
$H_2O<105°$	0·53	1·05	1·56	0·56	0·56	$H_2O<105°$
TiO_2	2·98	2·88	2·46	3·10	3·25	TiO_2
P_2O_5	0·17	0·55	0·22	0·23	0·24	P_2O_5
MnO	0·25	0·20	0·26	0·20	0·18	MnO
CO_2	trace	0·21	0·17	—	0·18	CO_2
FeS_2	0·28	0·02	0·28	—	—	FeS_2
Fe_7S_8	0·02	—	—	—	—	Fe_7S_8
SO_3	—	0·38	trace	—	—	SO_3
S	—	—	—	0·11	0·18	S
Cr_2O_3	trace	trace	0·02	—	—	Cr_2O_3
(Co, Ni)O	—	0·00	—	—	—	(Co, Ni)O
BaO	0·05	0·02	trace	0·00	—	BaO
LiO	—	0·00	trace	—	—	Li_2O
Cl	—	—	—	0·00	—	Cl
C	—	—	0·04	—	—	C
Organic matter	—	0·01	—	—	—	Organic matter
	99·80	100·47	100·39	99·57	100·44	

I. (22819; Lab. No. 788.) Quartz-dolerite, Talaidh type. Cone-sheet, Centre 2, Ardnamurchan. Quarry west of crofts at Tom a'Chroch-aidh, ½ mile E. of Kilchoan. *Anal.* B. E. Dixon.

(Table 2) Non-porphyritic Central Magma-Type (see (Figure 6)).

TABLE III

SUB-ACID AND ACID MAGMA-TYPES (*see* Fig. 6)

	Inninmorite.			Granite and Granophyre.			
	A.	I.	II.	III.	B.	C.	
SiO_2	64·13	64·30	66·06	68·42	71·60	74·87	SiO_2
Al_2O_3	13·15	14·18	13·14	13·54	13·60	11·24	Al_2O_3
Fe_2O_3	1·08	1·09	2·27	2·53	2·40	0·34	Fe_2O_3
FeO	6·31	4·44	2·84	2·02		1·22	FeO
MgO	1·08	1·47	0·77	0·22	0·21	0·22	MgO
CaO	3·62	2·87	2·75	2·13	2·30	1·30	CaO
Na_2O	3·64	4·30	4·28	5·12	5·55	3·31	Na_2O
K_2O	2·32	2·83	1·54	4·08	3·53	5·68	K_2O
$H_2O>105°$	2·71	3·02	3·38	0·15	0·70	0·49	$H_2O>105°$
$H_2O<105°$	0·36		0·74	0·25		0·29	$H_2O<105°$
TiO_2	1·19	0·75	1·08	0·81	—	0·26	TiO_2
P_2O_5	0·31	0·17	0·09	0·38	—	0·09	P_2O_5
MnO	0·27	0·26	0·31	0·10	—	0·05	MnO
CO_2	—	0·00	0·37	0·06	—	0·49	CO_2
FeS_2	0·00	—	trace	0·05	—	0·33	FeS_2
SO_3	—	0·00	0·16	trace	—	—	SO_3
Cr_2O_3	—	0·00	trace	trace	—	0·02	Cr_2O_3
(Co, Ni)O	0·00	—	0·00	—	—	—	(Co, Ni)O
BaO	0·09	0·16	trace	0·03	—	0·04	BaO
Li_2O	0·00	—	trace	trace	—	0·00	Li_2O
F	—	—	—	—	—	0·00	F
C	—	traces	—	—	—	—	C
Organic matter	—	—	0·02	—	—	—	Organic matter
	100·26	99·84	99·80	99·89	99·89	100·24	

A. (15990; Lab. No. 387.) Fairly glassy Inninmorite or Inninmorite-Pitchstone. Sheet. $\frac{1}{16}$ mile S.W. of Trigonometrical Station on Beinn an Lochain, Mull. Quoted from E. M. Anderson and E. G. Radley, *Quart. Journ. Geol. Soc.*, vol. lxxi., 1915, p. 212. *Anal.* E. G. Radley.

I. Inninmorite-Pitchstone. Lava. E. slope of Ben Hiant, Ardnamurchan. *Anal.* Harcourt Phillips.[1]

II. (21255; Lab. No. 739.) Inninmorite-Pitchstone. Lava. In stream bank $\frac{1}{4}$ mile S. 12° E. of Trigonometrical Station at 1729 ft., Ben Hiant, and $\frac{1}{2}$ mile W. 3° S. of Bourblaige, Ardnamurchan. *Anal.* B.E. Dixon.

III. (22820; Lab. No. 789.) Augite-granophyre. Major intrusion, Centre 2, Ardnamurchan. 800 yds. S. 30° E. of Grigadale. *Anal.* B. E. Dixon.

B. Augite-granophyre. 100 yds. E. of summit, Carrock Fell, Cumberland. Quoted from A. Harker, *Quart. Journ. Geol. Soc.*, vol. li., 1895, p. 129. *Anal.* G. Barrow.

C. (24380; Lab. No. 820.) Biotite-granite. Northern granite mass, Arran. Glen Rosa, $\frac{1}{4}$ mile above confluence with Garbh Allt. Quoted from G. W. Tyrrell, 'The Geology of Arran,' *Mem. Geol. Surv.*, 1928, pp. 155–156. *Anal.* B. E. Dixon.

[1] Supplied by Dr. A. Harker.

(Table 3) Sub-acid and Acid Magma-Types (see (Figure 6)).

TABLE IV

PORPHYRITIC CENTRAL MAGMA-TYPE (*see* Fig. 7)

	EUCRITE, GABBRO, AND BASALT.								
	I.	A.	II.	III.	B.	IV.	V.	VI.	
SiO_2 ..	47·26	47·28	47·75	48·28	48·34	49·60	49·78	50·12	SiO_2
Al_2O_3 ..	22·80	21·11	19·46	20·38	20·10	15·06	18·82	15·98	Al_2O_3
Fe_2O_3 ..	2·21	3·52	2·31	1·78	1·97	5·29	5·58	4·91	Fe_2O_3
FeO ..	5·41	3·91	6·28	6·70	6·62	5·00	4·85	6·31	FeO
MgO ..	7·76	8·06	7·50	7·93	5·49	4·44	4·15	4·43	MgO
CaO ..	10·93	13·42	11·32	11·80	13·16	9·69	10·40	10·86	CaO
Na_2O ..	1·72	1·52	2·46	1·75	1·66	2·62	3·04	3·60	Na_2O
K_2O ..	0·29	0·29	0·24	0·14	0·98	0·70	0·56	0·70	K_2O
$H_2O > 105°$	0·90	0·53	0·50	0·76	0·44	1·29	1·35	0·53	$H_2O > 105°$
$H_2O < 105°$	0·11	0·13	0·18	0·09	0·02	2·65		0·46	$H_2O < 105°$
TiO_2 ..	0·38	0·28	0·43	0·23	0·95	2·38	1·34	1·76	TiO_2
P_2O_5 ..	0·06	trace	0·62	0·02	0·04	0·29	trace	0·08	P_2O_5
MnO ..	0·31	0·15	0·17	0·28	0·32	0·19	0·28	0·18	MnO
CO_2 ..	0·10	—	trace	0·03	0·11	0·44	—	0·21	CO_2
FeS_2 ..	0·00	—	0·16	0·04	0·00	0·00	0·00	0·05	FeS_2
Fe_7S_8 ..	0·00	—	trace	0·00	—	—	—	—	Fe_7S_8
SO_3 ..	—	—	trace	—	—	0·40	0·00	trace	SO_3
Cr_2O_3 ..	—	—	0·05	—	—	0·02	0·00	0·04	Cr_2O_3
(Co, Ni)O ..	0·00	—	—	0·00	0·00	0·00	—	—	(Co, Ni)O
BaO ..	0·00	—	—	0·00	0·10	trace	0·03	0·04	BaO
Li_2O ..	0·00	—	trace	0·00	0·00	trace	—	trace	Li_2O
C	—	—	—	—	—	—	traces	—	C
Organic matter ..	—	—	—	—	—	trace	—	—	Organic matter
	100·24	100·20	99·83	100·21	100·30	100·06	100·18	100·26	

I. (21250; Lab. No. 735.) Biotite-eucrite. Ring-dyke, Centre 3, Ardnamurchan. Bank of stream, 1 mile E. 33° S. of Achnaha. *Anal.* E. G. Radley.

A. (8194; Lab. No. 19.) Olivine-gabbro. Major Intrusion. Coir' a' Mhadaidh, Cuillins, Skye. Quoted from A. Harker, 'Tertiary Igneous Rocks of Skye,' *Mem. Geol. Surv.*, 1904, p. 103. *Anal.* W. Pollard.

II. (22821; Lab. No. 790.) Hypersthene-gabbro. Ring-dyke, Centre 2, Ardnamurchan. In side of hollow ¼ mile W. 33° S. of Trigonometrical Station at 1123 ft., Beinn na Seilg, and 1000 yds. E. 27° N. of

(Table 4) Porphyritic Central Magma-Type (see (Figure 7)).

TABLE V

TONALITE AND QUARTZ-MONZONITE MAGMA-SERIES (*see* Fig. 8).

	GABBRO.	TONALITE–QUARTZ-MONZONITE.				GRANITE.			
	I.	II.	A.	B.	III.	C.	D.	E.	F.
SiO_2	44·50	51·59	54·00	54·20	59·16	68·15	70·48	73·09	75·65
Al_2O_3	13·00	16·76	13·09	15·73	16·50	15·95	14·24	14·15	11·89
Fe_2O_3	8·25	2·26	3·53	3·67	3·23	0·74	3·72	0·70	1·19
FeO	9·97	7·49	8·45	5·40	3·66	3·24		1·03	1·02
MgO	6·31	3·85	3·49	3·40	2·70	0·04	0·40	0·47	0·15
CaO	11·10	7·41	5·55	8·50	4·40	1·88	1·48	1·04	0·91
Na_2O	1·88	3·04	3·27	3·07	3·66	3·40	3·66	3·76	3·44
K_2O	0·25	1·95	1·80	4·42	3·72	5·00	4·26	4·21	4·26
$H_2O>105°$	0·83	1·36	1·71	0·50	0·83	0·22	1·59	0·70	0·40
$H_2O<105°$	0·29	0·30	1·26		0·44	0·65		0·60	0·41
TiO_2	2·99	2·15	2·83	0·40	1·21	0·20	—	0·22	0·28
P_2O_5	0·06	0·66	0·31	0·50	0·28	0·12	—	0·09	0·16
MnO	0·49	0·40	0·37	0·70	0·27	trace	—	0·00	0·26
CO_2	0·14	0·79	0·25	—	0·08	0·00	—	0·00	0·09
FeS_2	0·00	0·00	0·14	—	0·00	—	—	—	0·00
Fe_7S_8	0·00	0·00	—	—	0·00	—	—	—	—
(Co, Ni)O	0·00	0·00	0·00	—	0·00	—	—	—	0·02
BaO	0·00	0·00	0·02	—	0·00	—	—	—	0·03
Li_2O	0·00	0·00	trace	—	0·00	—	—	—	0·00
	100·06	100·01	100·07	100·49	100·14	99·59	99·83	100·06	100·16

I. (21249; Lab. No. 734.) Fluxion Biotite-gabbro. Glendrian Ring-dyke, Centre 3, Ardnamurchan. Ridge ¾ mile E. 17° S. of Achnaha, *Anal.* E. G. Radley.

II. (21248; Lab. No. 733.) Tonalite. Ring-dyke, Centre 3, Ardnamurchan. Knoll at edge of moss ⅜ mile W. 33° S. of Glendrian. *Anal.* E. G. Radley.

A. (24459; Lab. No. 828.) Quartz-dolerite. Garbad sill, Arran. Gorge in Allt Dhepin, ¼ mile E.N.E. of Trigonometrical Station at 873 ft. O.D., Cnoc an Fheidh, Whiting Bay. Quoted from G. W. Tyrrell, 'The Geology of Arran,' *Mem. Geol. Surv.*, 1928, pp. 147–148. *Anal.* E. G. Radley.

B. Monzonite. Monzoni, Tyrol. Quoted from W. C. Brögger, 'Die Eruptivgesteine des Kristianiagebietes. II. Die Eruptionsfolge der triadischen Eruptivgesteine bei Predazzo in Südtyrol.' Kristiania, 1895, p. 24. *Anal.* V. Schmelck.

III. (21247; Lab. No. 732.) Quartz-monzonite. Boss, Centre 3, Ardnamurchan. Small summit in low ground ½ mile E. of Achnaha. *Anal.* E. G. Radley.

C. Hornblende-granite. Granite 1, Mourne Mountains. Eagle Rock,

(Table 5) Tonalite and Quartz-monzonite Magma Series (see (Figure 8)).

TABLE VI

Data concerning Cone-sheets, Ardnamurchan

Order of Age.	Title of Set.	Angle of Inclination.	Thickness in Feet.	Age Relations with Other Intrusions.
1	Set of Centre 1	10–20°	20–50	Pene-contemporaneous with Ben Hiant Intrusion, and later than Ben Hiant and Northern Vents.
2	Outer Set of Centre 2	35–45°	5–20	Later than the Major Intrusions of Centre 1, generally. Almost all earlier than all ring-dykes.
3	Inner Set of Centre 2	70°	5–30	Later than most ring-dykes of Centre 2. Earlier than all ring-dykes of Centre 3.
4	Partial Set of Centre 3	50°	3–5	Later than earliest of the ring-dykes of Centre 3, and earlier than Great Eucrite Ring-dyke.

(Table 6) Data concerning cone-sheets, Ardnamurchan.

TABLE VIII

Data concerning Mull Dyke-Swarm

Locality.	Breadth of Swarm or Portion of Swarm Examined.	Number of Dykes.	Total Aggregate Thickness of Dykes.	Average Individual Thickness.	Average Number per mile.	Average Aggregate Thickness per mile.	Amount of Crustal Stretch due to Dyke-Intrusion.
S.-Central * Mull.	12½ mls.	375	2504 ft.	5·8 ft.	30	200 ft.	1 in 25
N.-Central * Mull.	1¼ mls.	142	817 ft.	5·8 ft.	114	654 ft.	1 in 8
North-west Mull.	5 mls.	62	480 ft.	7·7 ft.	12	96 ft.	1 in 55
South-west Ardnamurchan.	1½ mls.	36	272 ft.	7·5 ft.	24	180 ft.	1 in 30

* Data from 'Tertiary Mull Memoir,' p. 360.

(Table 8) Data concerning Mull Dyke-swarm.

TABLE IX

ANALYSES OF RAASAY IRONSTONE

	I.	II.	III.	A.
SiO_2	30·15	17·07	7·73	8·58
Al_2O_3 ..	7·89	11·08	3·53	4·24
Fe_2O_3 ..	12·20	23·40	0·03	1·24
FeO	16·73	7·22	4·75	11·79
MgO	3·56	3·88	1·41	1·71
CaO	24·57	25·79	43·49	35·43
Na_2O ..	0·41	0·45	0·42	0·08
K_2O	0·28	0·28	0·26	0·02
$H_2O > 105°$	0·94	1·62	1·20	4·44
$H_2O < 105°$	0·19	0·14	0·36	1·37
TiO_2	0·33	0·42	0·16	0·28
P_2O_5	1·43	1·90	1·90	1·68
MnO ..	0·53	0·67	1·08	0·65
CO_2	0·99	6·35	28·57	27·54
FeS_2	0·22	0·16	4·71	0·72
Fe_7S_8 ..	0·00	0·00	0·58	0·15
SO_3	—	—	—	0·15
(CoNi) O ..	0·06	0·05	0·00	0·04
BaO	0·00	0·00	0·00	0·00
Li_2O	0·00	0·00	0·00	0·00
C	—	—	—	0·26
	100·48	100·48	100·18	100·37

I, II, and III.—Quoted from E. G. Radley *in* 'Summary of Progress' for 1921, *Mem. Geol. Surv.*, 1922, pp. 109–110.

A. Quoted from E. G. Radley *in* 'The Mesozoic Rocks of Applecross, Raasay, and North-east Skye,' *Mem. Geol. Surv.*, 1920, p. 34.

(Table 9) Analyses of Raasay Ironstone.