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re Odhar Coire Beithe 4 4 einn Dearg Bheag 2 Coire Corsaidh noc nan Fitheach Loch Cill Chriosd Beinn na Caillich Granite + kilometre 0 Kilchrist hybrids mile 0.5 0 Kilchrist vent agglomerates Cambro-Ordovician carbonates N

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(Figure 4.9) Geological map of Centre 3, Ardnamurchan (after Gribble et al, 1976).



(Figure 4.10) The natural amphitheatre of Centre 3, Ardnamurchan. The imposing arcuate ridges in the distance are formed by the Great Eucrite. (Photo: A.P. McKirdy.)



(Figure 5.1) The flat-lying succession of basalt lavas of the Wilderness area, western Mull, give rise to the trap-type topography. Bearraich site, Mull. (Photo: C.H. Emeleus.)



(Figure 5.2) Map of the Isle of Mull, showing localities mentioned in the text.



(Figure 5.3) Sketch of the magmatic plumbing beneath south-west Mull during extrusion of the Palaeocene basaltic lavas (after Morrison et al., 1985, fig. 4). See text for explanation.



(Figure 5.4) Geological map of the Bearraich site (adapted from the British Geological Survey 'One Inch' map, Sheet 43, Iona).



(Figure 5.5) `MacCulloch's Tree' on Rubha na h-Uamha [NM 402 278], an upright coniferous trunk 12 m high engulfed by lava of Staffa Magma Type. Bearraich site, Mull. (Photo: CJ. MacFadyen.)



(Figure 5.6) Geological map of the Ardtun site (adapted from the British Geological Survey 'One Inch' map, Sheet 43, Iona).



(Figure 5.7) The best section through the Ardtun Leaf Beds at Slochd, an Uruisge [NM 377 248]. Ardtun site, Mull. (Photo: C.J. MacFadyen.)



(Figure 5.8) Geological map of the Loch Sguahain site (adapted from the British Geological Survey 'One Inch' map, Sheet 44, Mull).



(Figure 5.9) Basaltic pillow lavas, formed in a caldera lake. Loch Sguabain site, Mull. (Photo: A.P. McKirdy.)



(Figure 5.10) Geological map of the Laggan Bay site (adapted from the British Geological Survey 'One Inch' map, Sheet 43, Iona).



(Figure 5.11) A view of 'S Airde Beinn from the south. 'S Airde Beinn site, Mull. (Photo: CJ. MacFadyen.)



(Figure 5.12) Geological map of the Carsaig Bay site (adapted from the British Geological Survey One Inch' map, Sheet 44, Mull).



(Figure 5.13) The Rubh' a 'Chromain composite sill exposed at the western edge of the Carsaig Bay site, Mull. (Photo: CJ. MacFadyen.)



(Figure 5.14) Geological map of the Loch Spelve—Auchnacraig site (adapted from the British Geological Survey 'One Inch' map, Sheet 44, Mull).



(Figure 5.15) Cruach Choireadail, viewed from the Coladoir River, exposing gabbro/granophyre of the Glen More ring-dyke. Cruach Choireadail site, Mull. (Photo: CJ. MacFadyen.)



(Figure 5.16) Geological map of the Cruach Choireadail site (adapted from the British Geological Survey 'One Inch' map, Sheet 44, Mull).



(Figure 5.17) Geological map of the Allt Molach—Beinn Chaisgidle site (adapted from the British Geological Survey 'One Inch' map, Sheet 44, Mull).



(Figure 5.18) Geological map of the Loch Ba—Ben More site (adapted from the British Geological Survey 'One Inch' map, Sheet 44, Mull).



(Figure 5.19) Vent agglomerate containing fragments of Moine gneiss [NM 558 324]. Loch Ba—Ben More site, Mull. (Photo: CJ. MacFadyen.)



(Figure 5.20) Columnar jointing in the Loch Ba Felsite ring-dyke [NM 552 371]. Loch BA—Ben More site, Mull. (Photo: C.J. MacFadyen.)



(Figure 6.1) The Northern Granite Mountains of north Arran. Cir Mhor, Arran. (Photo: C.H. Emeleus.) (Figure 6.2) Map of the Isle of Arran, showing localities mentioned in the text.


(Figure 6.2) Map of the Isle of Arran, showing localities mentioned in the text.



(Figure 6.3) Geological map of the Ard Bheinn site (adapted from King, 1955, plate XVI).

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(Figure 6.4) Geological map of the Glen Catacol site (adapted from the British Geological Survey 1:50 000 Special District Sheet, Arran).



(Figure 6.5) Geological map of the Drumadoon—Tormore site (adapted from the British Geological Survey 1:50 000 Special District Sheet, Arran, with additional information from McKerrow and Atkins, 1985, figure I la).



(Figure 6.6) Columnar jointing in the composite sill, The Doon. Drumadoon—Tormore site, Arran. (Photo: A.P. McKirdy.)



(Figure 6.7) Geological map of the Dippin Head site (adapted from the British Geological Survey I:50 000 Special District Sheet, Arran).



(Figure 6.8) Dyke swarm on the foreshore at Kildonan. The dykes weather out to form reefs; the softer Triassic sandstone in between has been eroded back. South Coast of Arran site, Arran. (Photo: C.H. Emeleus.)



(Figure 6.9) Dolerite dykes forming part of the Arran dyke swarm on the shore below Kildonan Castle [NS 037 209]. South coast of Arran site, Arran. (Photo: C.J. MacFadyen.)



(Figure 6.10) Geological map of the Corrygills Shore site (adapted from the British Geological Survey 1:50,000 Special District Sheet, Arran).



(Figure 6.11) The Corrygills pitchstone sill in the cliff below the Clauchlands Sill (crinanite) at [NS 050 337]. Corrygills Shore site, Arran. (Photo: C.J. MacFadyen.)



(Figure 7.1) The north-west corner of Garbh Eilean, showing the main sill (left) and the lower sill (with natural arch), Shiant Isles. (Photo: F.G.F. Gibb.)



(Figure 7.2) Geological map of the Shiant Isles (after Walker, 1930, plate 36, with additions from Gibb and Henderson, 1984, figure 1).



(Figure 7.3) Simplified vertical sections through the main Garbh Eilean—Eilean an Tighe sill, Shiant Isles (after Gibb and Henderson, 1984, figure 2).



(Figure 7.4) 'Pillows' of basic rock in a granitic matrix. Probably due to the simultaneous intrusion of granitic and basaltic liquids; an example of 'mixed magmas'. South end of Hirta, near Dun, St Kilda. (Photo: H. Armstrong.)



(Figure 7.5) Geological map of the St Kilda archipelago (adapted from the British Geological Survey 1:25 000 Special Sheet, St Kilda).



(Figure 7.6) Sketch maps showing outcrops of the Cleveland Dyke near Great Ayton, North Yorkshire: (lower) Langbaurgh Ridge. Localities A—F refer to points where the north margin of the dyke has been preserved. (upper) Upper part of Cliff Rigg Quarry. For explanation of localities 1–4 see text.



(Table 1.1) British Tertiary Volcanic Province: summary of the geological successions, radiometric ages and magnetic polarities (after Mussett et al., 1988, figure 2)

Late dykes (dolerite, felsite and peridotite)	
Eastern Red Hills Centre Composite acid/basic sheets Five granite intrusions Kilchrist hybrids (possibly post-date some of the granites) Broadford and Beinn nan Cro gabbros Acid lavas, ignimbrites, tuffs and agglomerates of Kilchrist vent (may pre-date this Centre by a considerable amount)	
Dykes (dolerite, pitchstone)	
Western Red Hills Centre Marsco and Meall Buidhe granites Marscoite suite of hybrids, etc. Nine granite and major felsite intrusions Marsco Summit Gabbro Belig vent	
Dykes (dolerite)	
Strath na Crèitheach Centre Three granite intrusions Loch na Crèitheach vent	
Dykes (dolerite)	
Cuillin Centre Cone-sheets (dolerite) Coire Uaigneich Granophyre (but see text) Intrusive tholeiites Druim na Ramh Eucrite Explosive vents (of several ages) Inner Layered Series: allivalite, eucrite, gabbro Outer Layered Series: allivalite, eucrite, gabbro Layered Peridotite Series Border Group: gabbro, allivalite Cone-sheets and dykes (overlap with many of the above)	
Palaeocene lavas Preshal More tholeiitic flows Skye Main Lava Series (SMLS) flows (with sparse clastic sedimentary horizons, and basal sediments and tuffs)	

(Table 2.1) Summary of the Palaeocene igneous geology of the Isle of Skye (based on Bell, J.D., 1976, table 1; Bell, B.R. and Harris, 1986)

WEST-CENTRAL SKYE (2) Williamson (1979)	Based mainly on NORTHERN SKYE (3) Thompson et al. (1972)
7. Talisker Group	Preshal Mhor tholeiitic basalts
6. Loch Dubh Group 5. Arnaval Group	
4. Tusdale Group	Skye Main Lava Series
3. Cruachan Group*	Transitional and alkali-olivine basalts, hawaiites, mugearites, benmoreites and trachytes. More fractionated types are more common in the higher groups
2. Bualintur Group	contrion in the inglier groups.
1. Meacnaish Group	
	 WEST-CENTRAL SKYE (2) Williamson (1979) 7. Talisker Group 6. Loch Dubh Group 5. Arnaval Group 4. Tusdale Group 4. Tusdale Group 3. Cruachan Group* 2. Bualintur Group 1. Meacnaish Group

(Table 2.2) Correlation of the divisions of the Palaeocene lavas of the Isle of Skye (mainly after Williamson, 1979, table 1).

14	Thin, alkali olivine basalts with scoriaceous tops	7 m
13	Massive basaltic lava with pillow structures towards the base	5 m
12	Thin white ash	0.03 m
11	Coal	0.05 m
10	Sandstone with obscure plant remains occurring as diffuse carbonaceous streaks	
	and rootlets, possibly seat earth	0.2 m
9	Coal 0.01	-0.05 m
8	Conglomerate with well-packed, rounded pebbles and cobbles of granophyre.	
~	quartzite, porphyritic rhyolite and red arkose. Clasts have a maximum diameter of	
	0.10-0.15 m, and are set in a pale sandy matrix	3.2 m
7	Sandstone with micaceous partings	0.2 m
6	Coal	0.02 m
5	Sandstone with plant remains	18 m
4	Conglomerate with a more sandy matrix than Bed 2 and a smaller proportion of acid	1.0 10
*	impose to avanageous sodiments than Bod 9. Pare people of amurdaloidal and	
	foldenar magronarphyritic bacalt Clast size <0.20 m. ausrasing 0.10.0.15 m. Thin	
	lenges of mixing conditions in lenger begins of mixing 0.10-0.15 m. Thin	0.0-
~	Tenses of white sandstone in lower horizons	2.3 m
3	Fine-grained sandstone, laminated base	1.1 m
2	Massive conglomerate with densely packed, crudely imbricated clasts of red arkose	
	up to 0.30 m in diameter. Contains green siltstones with a sandstone wedge thickening	
	to the north	2.75 m
1	Highly amygdaloidal basaltic lavas forming the top of the cliff at about	
	125 m elevation	10 m

(Table 2.3) The succession at Allt Geodh a' Ghamhna (after Williamson, 1979, table 2)

	Ska	arn zones	
Aureole beyond	Group 1	Group 2	
the skarn zones	Primary skarns	Boron-fluorine ore	skarns
Talc	Grossular-	Magnetite*	Grossular-
Tremolite	andradite*	Tremolite	andradite
Forsterite	Wollastonite	Forsterite*	Hydro
Diopside	solid solutions*	Diopside*	grossular
Periclase	Diopside-	Monticellite*	Idocrase
Wollastonite	hedenbergite	Cuspidine*	Bornite
Spinel	Spinel	Fluorite	Chalcosite
Idocrase	Plagioclase	Chondrodite*	Covellite
Grossular	Idocrase	Humite	Chalcopyrite
Phlogopite	Xanthophyllite	Clinohumite	Pyrite
Brucite	Phlogopite	Ludwigite	Blende
Serpentine	Orthite	Fluoborite	Galena
Chlorite	Clinozoisite-	Szailbelyite	Chessylite
Hydromagnesite	epidote	Datolite	Malachite
	Prehnite	Harkerite	
	Apophyllite		
	Pectolite		
	Xonotlite		

(Table 2.4) Minerals present in skarn zones (after Tilley, 1951, Table 1)

Granites of the Strath na C	rèitheach Centre
Volcaniclastic deposits of \$	Strath na Crèitheach dolerite cone-sheets
Coire Uaigneich Granite	
Intrusive tholeiites of the C	Duter and Main Ridge Complexes
Inner Layered Series Inner Layered Gabbros (?vent agglomerates in H Inner Layered Eucrites Inner Layered Allivalites	Iarta Corrie)
Druim nan Ramh Eucrite Agglomerates and explo Dykes (Gars Bheinn ultraba	sion breccias of diatremes asic sill?)
Outer Layered Series Outer Layered Gabbros Outer Layered Eucrites Outer Layered Allivalites Layered Peridotites	3
Border Group (including W Cone-sheets Dykes	Vhite Allivalite)
Outer Marginal Gabbros an	nd Eucrites
?Early Granites (may pre-d	late Palaeocene basalts of south-west Skye)
Basalt lavas	
Torridonian sediments	

(Table 2.5) Succession in the Cuillin Hills site (after Bell and Harris, 1986, pp. 45–6)

Valley-filling pitchstone of the Sgurr of Eigg, and associated conglomerates

Dolerite dykes

Lavas and fluviatile sediments of north-west Rum and Canna-Sanday, olivine basalts, hawaiites, mugearite (on Canna), including also tholeiitic basaltic andesite, icelandite (on Rum)

— Period of profound erosion during which the Rum central igneous complex was unroc fed and eroded

The Rum Layered Igneous Complex:

Central Series: feldspathic peridotites, including breccias and some layered allivalites and peridotites

Western Layered Series (WLS): feldspathic peridotites and gabbroic rocks at Harris

Eastern Layered Series (ELS): layered feldspathic peridotite and allivalite, also gabbroic and ultrabasic intrusive bodies

(The WLS and ELS above may be coeval)

Dolerite and basalt dykes (some also post-date the Layered Igneous Complex)

Dolerite and basalt cone-sheets on Rum

Early phase of acid igneous activity:

Western Granite, also granite at Papadil and Long Loch

Porphyritic felsite (ignimbrites, in caldera, and intrusions)

Tuffisites (some may post-date porphyritic felsite)

Volcaniclastic breccias – probably a mixture of explosion breccias and breccias formed by caldera wall collapse

Dolerite and basalt dykes (some intruded after breccias and prior to felsites)

Initiation of the Main Ring Fault System: movement on this system of arcuate faults probably continued at least until emplacement of the ELS/WLS and was a major tectonic feature during the early acid phase of igneous activity. Lavas of Eigg and Muck, and those involved in the Main Ring Fault on Rum. Principally olivine basalts, feldspar-phyric olivine basalts and mugearites on Eigg. The dykes cutting these lavas belong to the main post-felsite and granite phase of dyke intrusion on Rum. Thin sedimentary layers occur in the Eigg and Muck successions.

(Table 3.1) Summary of the Palaeocene igneous geology of Rum and the Small Isles (based on Emeleus and Forster, 1979, table 1, with later amendments)



(Table 3.2) Harris Bay: subdivisions of the ultrabasic and basic layered rocks (modified from Wadsworth, 1961, table 1, with amended Western Layered Series).



(Table 4.1) The geological succession in the Ardnamurchan Central Complex (based on Richey and Thomas, 1930, Chapter 7)

(youngest) Dykes were intruded throughout the sequence (Loch Bà-Ben More) Loch Bà Centre (Centre 3; North-West or Late Caldera) Loch Bà felsite ring-dyke (Allt Molach-Beinn Chaisgidle, Loch Bà-Ben More) Hybrid masses of Sron nam Boc and Coille na Sroine (Loch Bà-Ben More) Beinn a' Ghraig Granophyre (Loch Bà-Ben More) Knock Granophyre (Loch Bà-Ben More) Late basic cone-sheets (Loch Bà-Ben More) Early Beinn a' Ghraig Granophyre and felsite (Loch Bà-Ben More) Glen Cannel complex and some late basic cone-sheets (Allt Molach-Beinn Chàisgidle, Loch Bà-Ben More) Beinn Chàisgidle Centre (Centre 2) Glen More ring-dyke (Loch Sguabain, Cruach Choireadail) Late basic cone-sheets (Allt Molach-Beinn Chàisgidle), Loch Scridain sheets (intruded towards middle and end of Centre 2 and start of Centre 3) Ring-dyke intrusions around Beinn Chaisgidle ?Augite diorite masses of An Cruachan and Gaodhail (Loch Bà-Ben More) Corra-bheinn layered gabbro (Loch Bà-Ben More) Second suite of early basic cone-sheets Second suite of early acid cone-sheets Explosion vents (numerous at margin of the South-East Caldera) (Loch Bà-Ben More) Glen More Centre (Centre 1; including the Early or South-East Caldera) Ben Buie layered gabbro Loch Uisg granophyre-gabbro First suite of early basic cone-sheets (Loch Bà-Ben More) Early acid and intermediate cone-sheets (Loch Bà-Ben More) Acid explosion vents containing porphyritic rhyolite material (Loch Bà-Ben More) Glas Bheinn and Derrynaculen granophyres (Loch Spelve-Auchnacraig) Updoming and folding in south-east Mull as a result of rising diapir (Loch Spelve-Auchnacraig). Lava eruption on to eroded surface of Mesozoic and older rocks. Latest flows overlap in time with formation of the South-East Caldera where pillow lavas are found. (Lavas: Bearraich, Ardtun,

(Table 5.1) The Mull Central Complex: sequence of events (after Skelhorn, 1969, pp. 2–6)

Carsaig Bay, Loch Bà-Ben More. Pillow lavas: Loch Squabain, Cruach Choireadail)

(oldest)

Mull Memoir (Bailey et al., 1924)	Beckinsale et al. (1978)	Morrison (1978) Thompson <i>et al.</i> (1982) Morrison <i>et al.</i> (1985) Thompson <i>et al.</i> (1986)
Central Group (= NPCMT) (Includes pillow lavas in central complex)	Not dealt with in detail	Some samples analysed, all zeolitized or hydrothermally altered.
Plateau Group (majority = PMT) Pale Group of Ben More (= PMT)	Group 1 olivine basalts (mainly sampled in north-west Mull) and Group 3 olivine basalts	Mull Plateau Group (MPG) Note that many are transitional between alkali basalt and tholeiite, and compare closely with Skye Main Lava Series. Some lower crust contamination
(with interlayered mugearite and Big-Feldspar Basalt)	(mainly sampled around Lochaline, Morven)	
(Staffa Type at base = NPCMT)	Group 2 of south-west Mull	Staffa Magma Type (SMT) Variably enriched in lower and upper crustal contaminants.

Total thickness of Mull lavas estimated about 2000 m (Bailey et al., 1924)





(Table 6.1) Tertiary igneous succession in the Isle of Arran (after Hodgson et al., 1990, figure 8)

Rock type	Position within sill	Petrological features
(a) Crinanite	Central = forms the bulk of the intrusion	Plagioclase, analcite, olivine, ophitic Al-, Ti-rich augite. Zeolites. Analcite, secondary after nepheline and of hydrothermal origin. Olivine up to 12 vol.% about 10–15 m above base.
(b) Teschenite	Marginal facies = fine-grained margins showing quench textures	Lacks fresh olivine, substantial amounts of analcite, zeolites and calcite. Margins have skeletal Ti- augites.
(c) Augite teschenite	Patches within crinanites, especially towards base.	Augite, plagioclase, analcite. Alignment of augite suggests cumulate texture. Fe-Ti oxides more abundant than in crinanite.
(d) Pegmatite(i)	At several horizons throughout sill, centimetres to metres in thickness	Brown augite with emerald-green rims (Na-rich), plagioclase, analcite, Fe- oxides, apatite, rare blue riebeckitic amphibole and rare olivine pseudomorphs. Variant of augite teschenite.
(e) Pegmatite (ii)	As pegmatite (i)	Mineralogically as (i) but has less pyroxene and is much coarser grained. Skeletal magnetite and ophitic augite, rather than euhedral as in (i).

(Table 6.2) Petrological variation within the Dippin Sill (based on Gibb and Henderson, 1978b, figure 4)

Table 7.1Geological succession in the St Kilda archipelago (adaptedfrom the British Geological Survey 1:25 000 Special Sheet, St Kilda)

Pleistocene glaciation Palaeocene igneous activity Basaltic and composite (acid and basic) inclined sheets and dykes Conachair Granite Mullach Sgar Complex (mixed magma (basic-acid) intrusions) Glen Bay Granite Glen Bay Gabbro Breccias of gabbro and dolerite Western Gabbro (layered in places)

No pre-Palaeocene rocks are exposed, but the complex is thought to be intruded into Lewisian gneisses.

(Table 7.1) Geological succession in the St Kilda archipelago (adapted from the British Geological Survey 1:25 000 Special Sheet, St Kilda)