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## Camas Mor, Isle of Muck

OS Grid Reference: NM403789

### Highlights

This locality shows a well exposed sequence of interbedded tuffs, clastic sediments and lavas at the base of the Tertiary succession. It also shows that a 'giant' dyke of gabbro has produced a suite of high-temperature calc-silicate minerals by the thermal metamorphism of Jurassic sediments.

### Introduction

The base of the Palaeocene lava succession overlies Jurassic sediments at Camas Mor and these rocks are intruded by a dense swarm of NW-trending basalt dykes and by a large gabbro dyke. The general geology of the site has been described by Harker (1908) and the Camas Mor gabbro and associated metamorphism of Jurassic sediments was the subject of a detailed investigation by Tilley (1947). The dyke swarm was included in the survey by Speight *et al.* (1982) and the Tertiary lavas, tuffs and sediments have been mapped and described by Allwright (1980).

### Description

The exposures on the shores of Camas Mor show an interesting sequence of basal Tertiary tuffs and sediments at the junction of the Tertiary lavas with Jurassic sediments (Fig.3.18). Two localities are of special interest, the first is among the boulders on the foreshore below the An Stac cliffs, a few metres east of Sgorr nan Loagh where two horizons of bedded, water-lain tuffs occur. The exposures are terminated to the east by a dyke which has apparently intruded along a fault which throws the basal Palaeocene beds down against the Jurassic limestones. The second locality, at the eastern end of the An Stac cliffs (NM 403 789), is figured by Harker (1908) and has been reinvestigated by Allwright (1980) who produced the following succession:

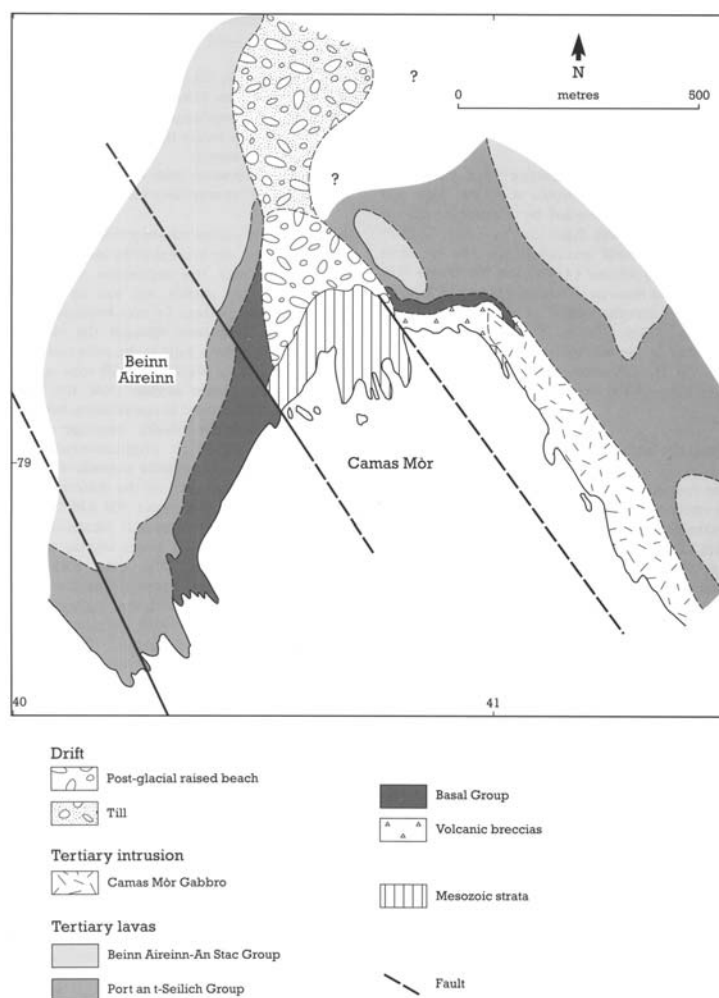


Figure 3.18: Geological map of the Camas Mòr site, Muck (after Allwright, 1980, fig. 2.2.2)

#### Approximate thickness

- |     |   |        |
|-----|---|--------|
| 10. | Coarse plagioclase-rich basaltic lava in discontinuous flow units.                | 8.5 m  |
| 9.  | Red laminated tuff infilling fissures in reddened scoriaceous lava.               | 0.75 m |
| 8.  | Plagiophyric basaltic lava.   | 7.10 m |
| 7.  | Finely brecciated flow top.   | 1.10 m |
| 6.  | Aphyric, very fine-grained, mugearite lava.                                       | 5.80 m |
| 5.  | Coarsely bedded, greyish-pink sediment enclosing numerous small basalt fragments. | 0.95 m |
| 4.  | Gap (possibly the thin lava flow of Harker, 1904).                                | 0.60 m |
| 3.  | Brown–red mudstone.   | 0.80 m |
| 2.  | Purplish-red, sandy tuffs often distinctly banded.                                | 1.10 m |
| 1.  | Jurassic limestone with thin shales and concretionary sandstones.                 |        |

The Palaeocene sediments are predominantly air-fall deposits and the bedded units most probably originated through the deposition in shallow water of airborne basaltic ash and lapilli from adjacent fissures, perhaps by lava fountaining.

A complete sequence through the lavas of Muck is provided by a gully at the west end of An Stac and exposures above the cliff tops on the hillside towards Beinn Aireinn (NM 403 792).

The lavas are transitional in composition between alkaline and tholeiitic basalts, they are mostly olivine-phyric, but with plagioclase-rich porphyritic types and a mugearite towards the base.

The cliffs and the beach on the eastern side of Camas Mor, especially between NM 416 782 and NM 412 781, expose lavas and Mesozoic sediments in contact with a major olivine gabbro dyke trending NW–SE. The dyke rock is a relatively iron-rich, hypersthene-normative gabbro consisting of large titaniferous augites enclosing laths of zoned labradorite, irregular olivines and anhedral titanomagnetite. This central facies locally develops centimetre-scale diffuse mafic and felsic layering, somewhat similar to that found in the Trotternish sills of Skye (Rubha Hunish). There is also a finer-grained marginal facies to the gabbro which is mildly nepheline normative. The dyke, which in places attains 150 m–200 m in width, has incorporated and partly assimilated some of the adjacent Mesozoic limestones, resulting in the formation of contact assemblages as reported by Tilley (1947); the assimilation is believed responsible for the undersaturated, nepheline-bearing nature of the marginal facies of the dyke (Tilley, 1952; Ridley, 1973).

Minerals recorded by Tilley from the contact zone include calcite, grossularite, wollastonite, monticellite, melilite (gehlenite), spurrite, merwinite, larnite, rankinite, cuspidine, tilleyite, periclase, brucite, spinel and perovskite and from the skarn zone where the limestones were soaked in solutions from the gabbro he noted clinopyroxene, analcite, soda-sanidine and titanite (sphen). The gabbro is modified for a few centimetres from its contact with the sediments; pyroxenite is followed away from the contact by theralite (nepheline gabbro) with wollastonite, melilite and soda-sanidine and iron-rich olivine in segregations.

Immediately north of the dyke, the Mesozoic sediments are found to be extensively brecciated. Blocks of limestone, sandstone and black shale up to 1 m in diameter are set in a comminuted matrix of these rocks which is, apparently, free of any igneous material. Unbrecciated Palaeocene lavas margin the breccias but do not themselves show any disturbance. The origin of this breccia is uncertain; it may represent an early explosive vent immediately prior to lava effusion. It predates intrusion of the olivine gabbro dyke.

Muck is characterized by a dense swarm of NW-trending basic dykes which are less alkaline than the lavas they intrude (Allwright, 1980). Harker (1908) recorded at least 40 dykes along the south coast between Camas Mor and Port Mor with an aggregate width of about 60 m.

## Interpretation

The Palaeocene lava successions in the BTVP frequently provide glimpses of interbedded sediments and thin pyroclastic deposits (Anderson and Dunham, 1966). This site clearly exposes a succession of water-lain sediments, fine-grained air-fall tuffs, possible volcanic breccias and basaltic lava flows which mark the onset of the Palaeocene volcanism. These rocks are cut by numerous basaltic dykes which represent a crustal dilation of c. 6%, not including the very thick gabbroic dyke at Camas Mor. Tilley's (1947) examination of this dyke showed that, in addition to producing a suite of high-temperature, calc-silicate minerals in the country rocks, there had been a reaction between the hypersthene-normative basaltic magma of the dyke and the calcareous sediments to form a limited, marginal zone of nepheline normative, critically undersaturated rocks rather similar in nature to that described by Tilley from Scawt Hill, Co. Antrim (Tilley and Harwood, 1931). Ages of about 63 Ma obtained from the Muck and Eigg lavas are among the oldest in the BTVP (Mussett *et al.*, 1988).

## Conclusions

Camas Mor contains particularly good examples of basaltic lavas with interbedded sediments of volcanic origin and a dense swarm of basaltic dykes. A very thick gabbro dyke cuts the lavas and Jurassic sediments, altering them to high-temperature hornfelses with distinctive calc-silicate minerals. Reaction between the gabbro and calcareous sediments has resulted in a distinctive marginal zone of nepheline-normative rock and skarn mineral assemblages. The lavas are among the oldest in the Province, which accords with their pre-Rum central complex age.

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## Reference list

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