Cuillin Hills 1:

Camasunary Bay

Camasunary Bay from the west side of the outflow of the Abhainn Camas Fhionnairigh (Camasunary River). The pale rock in the foreground is the Coire Uaigneich Granite. The highest summit, Blà-bheinn (929m OD) is composed of bytownite gabbro (summit) and Jurassic strata (lower ground). The prominent Red Hills at the far end of the strath (valley), composed of various granites, are Ruadh Stac and Marsco.

Aspects covered: Mesozoic sedimentary rocks; Paleocene lavas and dykes; Late Proterozoic ('Torridonian') sedimentary rocks; the Camasunary-Skerryvore Fault; Holocene raised marine deposits; the Coire Uaigneich Granite; hornfelsed basaltic lavas; Ordovician marbles and the Kishorn Thrust; a complex marginal facies of the Cuillin Intrusive Centre; Torridonian sedimentary rocks subjected to high-temperature contact metamorphism and melting.

Route: Kilmarie - Am Màm - Abhainn nan Leac – Camas Fhionnairigh - Camasunary (Cottage) - Abhainn Camas Fhionnairigh - (Sgùrr na Stri) – southern slopes of Blà-bheinn (- return Kilmarie).

Distance: *c.* 12 kilometres.

Time: Up to 8 hours, but excursion can be cut short at several points.

General comments: An excursion that includes rocks of the Paleocene Cuillin Intrusive Centre, whilst staying on relatively low ground. The Abhainn Camas Fhionnairigh must be forded to visit some localities: easy during periods of good weather ('drought'!) and low tide, but very difficult during periods of heavy rainfall and high tide (and no better if attempting upstream).

Proceed to Kilmarie on the Broadford-Elgol (B8083) road, 19km (12 miles) SW of Broadford. 500 m SW of Kirkibost, the Camasunary Footpath joins the main road. Space for vehicles is available on the east side of the road.

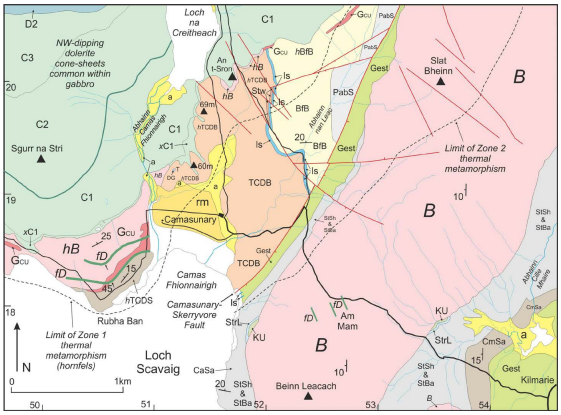


Figure Cuillin 1.1: Summary map of the Camasunary Bay area.

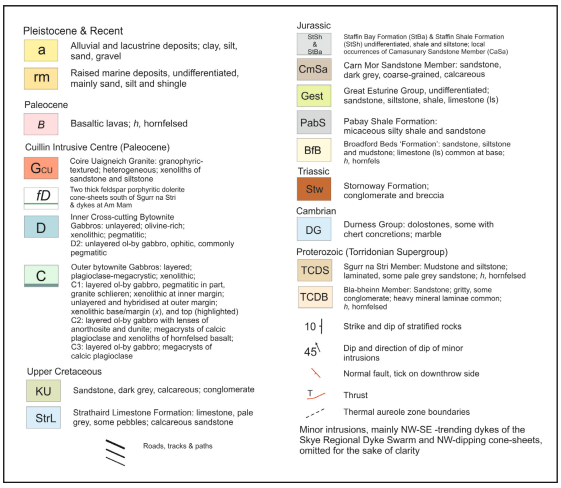


Figure Cuillin 1.2: Key to summary map of the Camasunary Bay area.

Figure Cuillin 1.3: Camasunary Bay viewed west from the main access track. The summit in the middle ground is Sgùrr na Stri, composed of layered bytownite gabbros, intruded by dolerite cone-sheets dipping towards the NW (right-hand-side). The lower ground to the south (left of) the summit of Sgùrr na Stri comprises country-rock Paleocene lavas overlying Torridonian sedimentary rocks. In the distance is the main arc of the Cuillin Hills.

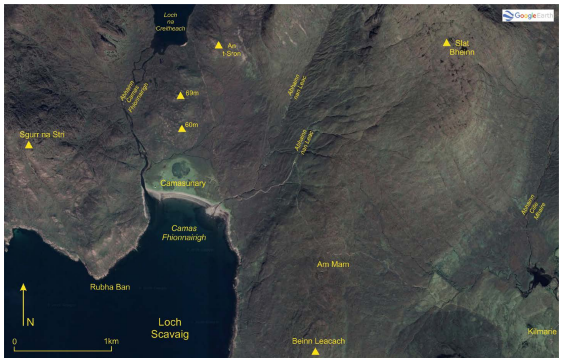


Figure Cuillin 1.4: Annotated Google Earth® image of the Camasunary Bay area.

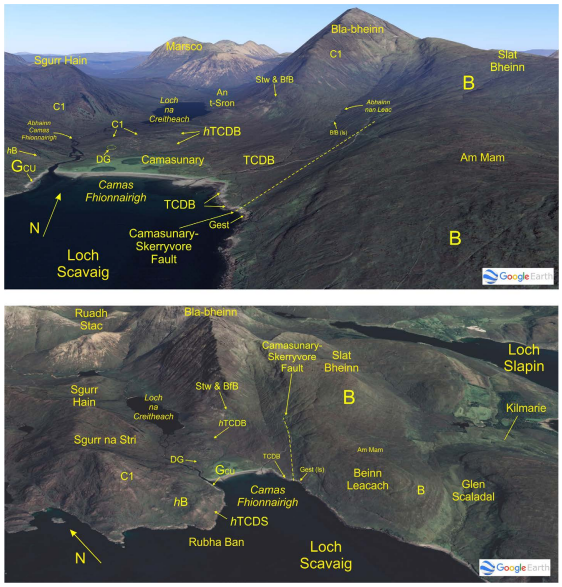


Figure Cuillin 1.5: Annotated oblique Google Earth® images of the Camasunary Bay area. Lithology codes as per Figure Cuillin 1.2, above.

Locality 1 [NG 5449 1720]:

The track you are about to use was constructed by a Territorial Army unit based in Manchester and formally opened on 20th June 1968. A bridge over the Abhainn Camas Fhionnairigh (Camasunary River) was also constructed but has long since disappeared. Photographs are included, below, of the bridge at various points in its short life.

Towards the NE from the beginning of the Camasunary Track at Kilmarie, note the trap topography of Slat Bheinn and An Càrnach to the north, with Paleocene plateau lavas overlying the lower cultivated ground composed of Middle and Upper Jurassic sedimentary rocks, all of which dip at a shallow angle to the west. At least twenty lavas (or flow units of compound lavas) may be identified readily on Slat Bheinn. In the immediate area, especially in the vicinity of the track, are poorly exposed Jurassic strata belonging to the Great Estuarine Group, intruded by NW-SE -trending Paleocene dolerite dykes.

Proceed 1.5km (1 mile) along the track over Jurassic strata (Great Estuarine Group and Staffin Bay Formation) to where a gate crosses the path.

Locality 2 [NG 5344 1772]:

Exposed on the track, 30m west of the gate, are basaltic lavas at the base of the Paleocene plateau sequence. These amygdaloidal lavas are distinctly green and contain visible secondary chlorite, epidote, albite, calcite and quartz, hence the green coloration. Secondary zeolites are rare. Fresh olivine is uncommon and is typically replaced by aggregates of chlorite, serpentine, talc, magnetite and carbonate,. Primary features of the lavas, such as flow structures, have been destroyed by the pervasive hydrothermal (meteoric) fluid circulation and alteration which occurred in the Paleocene.

From here, continue NW along the footpath, upwards through the lava sequence, to Am Màm.

Locality 3 [NG 5269 1803]:

At Am Màm, 25m south of the path, a large dolerite dyke (at least 10m wide) forms a prominent feature, trending *c.* 150°. This intrusion consists of euhedral calcic plagioclase megacrysts (typically up to 10mm) and olivine phenocrysts (1–2mm), set in a fine-grained, dark groundmass. A vertical contact to this dyke is exposed on its west side, together with a 30cm-thick skin of contact-metamorphosed plateau lava.

Figure Cuillin 1.6: Plagioclase-porphyritic dolerite dyke intruded into (poorly exposed) basalt lavas at Am Màm. View is towards south. Iain Allison for scale.

Continue along the track to where Camasunary Bay is fully visible. This is a spectacular view (see photograph at beginning of excursion), one of the best on Skye and a wonderful reward for a modest walk of an hour, or less.

Locality 4 [NG 5180 1863]:

Continue along the track, down into Camasunary Bay. In doing so, you cross the poorly exposed Camasunary (-Skerryvore) Fault, which brings Middle Jurassic strata on the eastern (downthrow) side into contact with Late Proterozoic 'Torridonian' strata on the western (upthrow) side. The location of the fault is better

constrained on the coast on the eastern side of the bay, outlined below.

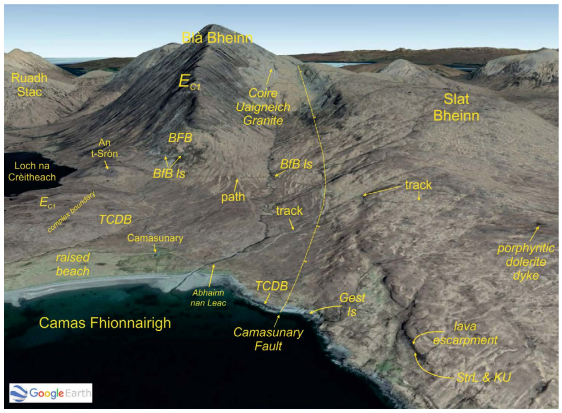


Figure Cuillin 1.7: Annotated oblique Google Earth® image, approximately towards north, of the east side of Camasunary Bay, indicating the location of the Camasunary (-Skerryvore) Fault, the Blà-bheinn Member Torridonian strata, the Great Estuarine Group strata, and other general points of interest. Lithology codes as per Figure Cuillin 1.2, above.

In the vicinity of the bridge over the Abhainn nan Leac, relatively undeformed Torridonian siltstones, sandstones and grits of the Blà-bheinn Member are exposed but lack clear evidence of cross-bedding and grading, more obvious in coastal exposures to the south (see below). Paleocene basaltic and doleritic dykes of the NW-SE -trending regional swarm cut these rocks and are exposed in the stream bed south of the bridge.

Follow the rough path to the south, to the rocky coast south of the bothy (built in 2015 and maintained by the Mountain Bothies Association).

Locality 5 [NG 5169 1820]:

Follow the path down to the east side of the bay, near to the bothy. Here, steeply dipping Torridonian strata of the Blà-bheinn Member of the Diabaig Formation (Torridon Group), intruded by Paleocene basaltic and doleritic dykes, are exposed on relatively clean surfaces.

The Camasunary (-Skerryvore) Fault is not exposed but is relatively well constrained. Cross the small beach to the downside of the fault, where various limestones, sandstones and siltstones of the Middle Jurassic Great Estuarine Group are exposed.

Figure Cuillin 1.8: Dark basaltic and doleritic dykes with irregular margins within pale, stratified Blà-bheinn Member ('Torridonian') strata, on the eastern side of Camasunary Bay, immediately west of the Camasunsary (-Skerryvore) Fault. Pole *c.* 1m long.

Figure Cuillin 1.9: Interbedded sandstones, siltstones and limestones of the Great Estuarine Group intruded by dolerite and basalt sheets, east of the Camasunary (-Skerryvore) Fault.

Figure Cuillin 1.10: Interbedded sandstones, siltstones and limestones of the Great Estuarine Group intruded by dolerite and basalt sheets, east of the Camasunary (-Skerryvore) Fault. Pole *c.* 1m long.

Figure Cuillin 1.11: Burrows within limestone (partially recrystallized during thermal metamorphism) of the Great Estuarine Group, east of the Camasunary (-Skerryvore) Fault. Coin *c.* 20mm across.

Locality 6 [NG 5155 1878]:

Camasunary Cottage sits upon raised marine deposits, formed when relative sea-level was higher in response to Holocene glacio-isostatic uplift (rebound due to retreat of the ice) and eustatic sea-level change.

The hummocky ground *c.* 500m to the NW constitutes the irregular boundary between the Cuillin Intrusive Centre and Torridonian country-rocks and will be examined later in this excursion.

Continue westwards to the Abhainn Camas Fhionnairigh.

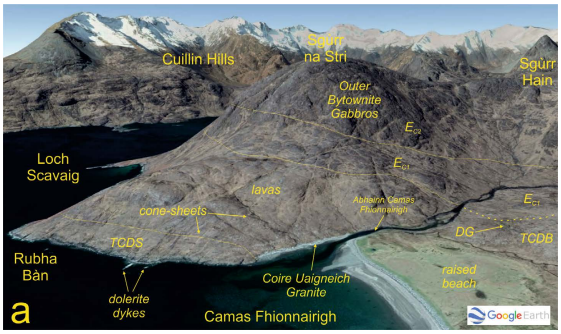
Caution needs to be exercised when crossing the river. It is tidal (where entering the bay) and, during periods of high tide, can only be crossed further (sometimes much further) upstream. During periods of high rainfall, even at low tide, the river may be difficult to cross. Conversely, during periods of drought, at low tide, the river can be safely crossed with ease (and exceptionally with dry boots).

The foot bridge, constructed in 1968, has long since disappeared, which made crossing the river easy.

The (new) footbridge at Camasunary, 1968 © Jim Barton.

The footbridge at Camasunary, May 1983 © Ian Taylor.

The footbridge at Camasunary, May 2008 © Tom Richardson.



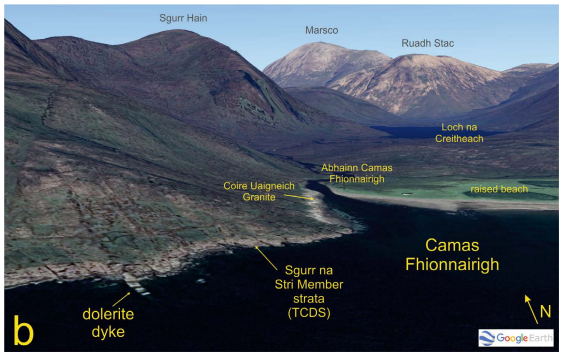


Figure Cuillin 1.12: Annotated oblique Google Earth® images: (a) NW towards Sgùrr na Stri, illustrating the distribution of the Sgùrr na Stri Member (TCDS) Torridonian strata, Paleocene (plateau) lavas, and units of the Outer Bytownite Gabbros (E), together with other general points of interest; and, (b) detail of area west of the Abhainn Camas Fhionnairigh. Lithology codes as per Figure Cuillin 1.2, above.

Locality 7 [NG 5094 1873]:

The approximate location of the contact between the Paleocene plateau lavas and the Coire Uaigneich Granite can be identified on the west side of the river. The contrasting rock-types, the dark green lavas and the pale grey granite, are readily distinguished. Brecciation by the younger granite has led to the incorporation of blocks of the lava. The boundary between these two rock-types dips to the SE at *c.* 60°. 10–20m south from this contact, where the granite is exposed on the wave-cut platform, several of its features may be observed. First, scattered xenoliths of Torridonian sedimentary rock, in various stages of digestion, may be identified. These xenoliths are typically 1–10cm across, although 'rafts' up to 5m long are also present. Their margins are commonly irregular and diffuse. This foreign material is typically finer-grained and somewhat darker than the granite. Second, the granite is pale grey and contains needles of hypersthene, up to 1cm long (commonly altered to chlorite), together with less obvious phenocrysts of sodic plagioclase, tridymite (now inverted to quartz) and Fe-Ti oxide. The distribution of these minerals is irregular, and all are set in a granophyric groundmass of alkali feldspar and quartz. Cone-sheets associated with the nearby Cuillin Intrusive Centre cut the Coire Uaigneich Granite but are not found within the clearly younger granites of the Srath na Crèitheach, Western Red Hills and Eastern Red Hills intrusive centres, providing a useful relative order of emplacement.

Figure Cuillin 1.13: Clean exposed surfaces of the Coire Uaigneich Granite on shore west of the Abhainn Camas Fhionnairigh, with inclusions/xenoliths of modified Torridonian material. Pole *c.* 1m long.

Figure Cuillin 1.14: Clean exposed surface of the Coire Uaigneich Granite on shore west of the Abhainn Camas Fhionnairigh, with an inclusion of modified Torridonian (sedimentary) material. Coin *c.* 26mm across.

The outcrop of the granite may be traced along the beach to where it gives way, abruptly, to well-bedded Torridonian siltstones, sandstones and grits of the Sgùrr na Stri Member, dipping at a shallow angle to the NW. The (intrusive) contact strikes *c.* 040° and dips at *c.* 35° to the NW.

The Torridonian strata south of the Coire Uaigneich Granite outcrop, as far as Rubha Bàn, are attributed to the Sgùrr na Stri Member and are predominantly relatively fine-grained, comprising tabular, well-bedded, siltstones and shales. These strata contain obvious ripples, as seen in both cross-section and plan view, and are interpreted to have been deposited in a relatively low energy, possibly lacustrine, environment. These remarkably clean exposures should be examined as far south as the prominent NW-SE –trending dolerite dykes that form obvious small promontories.

Figure Cuillin 1.15: Tabular fine-grained sandstones, siltstones and shales with well-developed ripples in the Sgùrr na Stri Member, in the coastal section on the west side of Camas Fhionnairigh. Pole *c.* 1m long.

Figure Cuillin 1.16: A wide, NW-SE –trending dolerite dyke of the Paleocene regional dyke swarm intruded into Sgùrr na Stri Member strata on the coast SE of Sgùrr na Stri. Further inland, to the NW, this dyke, and many others, cut (lower units) of the overlying lava sequence.

From here, if desired, a SE-to-NW traverse can be undertaken, towards the summit of Sgùrr na Stri, which will pass through the Sgùrr na Stri Member strata, across the poorly defined sub-lava unconformity and, ultimately into the Outer Bytownite Gabbros that form the summit of Sgùrr na Stri. However, these rocks are considered elsewhere (for example, Excursion Cuillin 2), where exposure is generally better, and access is considerably easier (although typically involving using of one of the tourist boat services that run out of Elgol to Loch Coruisk). If undergoing this traverse, extreme care should be taken on the steeper slopes of Sgùrr na Stri and the time taken/involved sensibly considered.

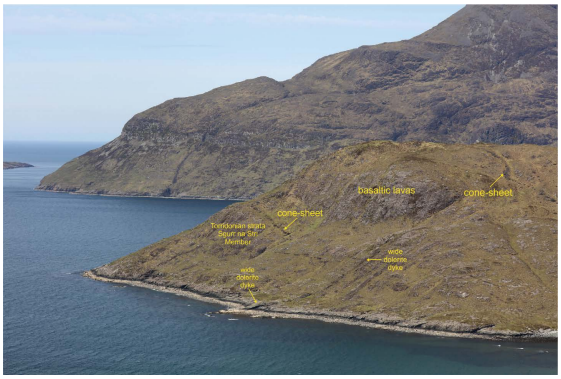


Figure Cuillin 1.17: The south side of Sgùrr na Stri, viewed towards the west. The Torridonian strata of the Sgùrr na Stri Member and the overlying hornfelsed basaltic lavas have distinctive topographic expressions. Cone-sheets of the Cuillin Intrusive Centre and NW-SE –trending dykes of the Paleocene regional swarm are also readily identified by their topographic expressions.

Figure Cuillin 1.18: The SE side of Sgùrr Hain from Camasunary, comprising layered bytownite gabbros intruded by cone-sheets and dykes. The pale rocks in the foreground are thermally metamorphosed (Torridonian) strata of the Blà-bheinn Member**.**

The basaltic lavas that overlie the Sgùrr na Stri Member can be examined on the lower slopes on the west side of the Abhainn Camas Fhionnairigh. Walking up the west bank of the river to a point opposite the northern limit of the raised beach in the bay, gain the higher ground where obvious relatively dark crags are composed of the lavas.

Locality 8 [NG 5079 1911]:

The typical terraced character of the lavas is absent, and it is difficult to identify individual lava tops and bases. The rocks are thermally metamorphosed, to pyroxene hornfels grade, and, consequently, are considerably altered, also containing abundant veins of secondary hydrothermal minerals. Fresh rock surfaces are typically grey-green or grey-blue, with the original magmatic minerals replaced by metamorphic pyroxene and plagioclase in a typically granulitic arrangement. Primary joints (including any columnar joints) are sealed with hydrothermal minerals such as epidote, chlorite, various zeolites and carbonates. Amygdaloidal texture is still preserved and is one of the few features of these rocks

that aid the interpretation of their field relationships as lavas. Amygdale mineral assemblages include chlorite, prehnite and plagioclase, not easily distinguished in the field.

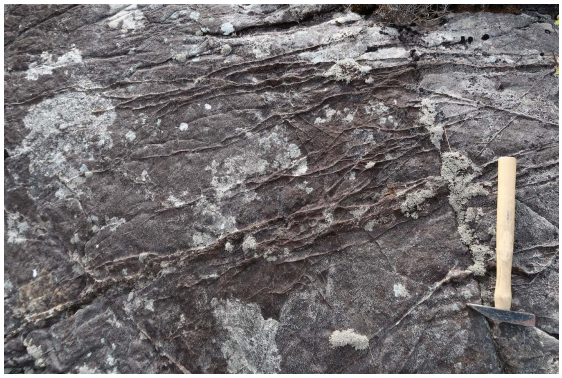


Figure Cuillin 1.19: Hornfelsed basaltic lava on the west side of the Abhainn Camas Fhionnairigh, *c.* 60m above the level of the river, with abundant veins containing various secondary hydrothermal minerals, including epidote, chlorite, various zeolites and carbonates. Hammer *c.* 30cm long.

Figure Cuillin 1.20: Detail of hornfelsed basaltic lava on the west side of the Abhainn Camas Fhionnairigh, *c.* 60m above the level of the river, with amygdale mineral assemblages including epidote, chlorite, various zeolites and carbonates. Length of hand lens *c.* 50mm.

Re-cross the Abhainn Camas Fhionnairigh onto its east side, to where remnants of a stone wall run at right-angles to the river at [NG 5092 1922]. Follow the wall eastwards to where it goes through a right-angle and trends north, but continue eastwards for *c.* 60m to an area of bright green grass at [NG 5110 1924].

Locality 9 [NG 5110 1924]:

Here, a small outcrop of marble, encircled and partially covered by a *c.* 15m x 10m area of bright green grass, sits in isolation. High grade thermal metamorphism of original limestone by the Cuillin Intrusive Centre in the Paleocene resulted in the development of the marble.

This outcrop of marble has been variously interpreted as: (a) *in situ* material of Jurassic age unconformably overlying Torridonian strata (Blà-Bheinn Member); (b) Jurassic age limestone within a fault-block; and, (c) Durness Group Cambro-Ordovician dolostone in a thrusted contact with (structurally overlying) Torridonian strata (Blà-Bheinn Member). The last of these three interpretations infers that the Moine Thrust Belt extended this far west. Chert nodules and stringers are relatively common in this impure marble, very similar to material that crops out to the east in the district of Strath, in the area around Torrin. During high-temperature thermal metamorphism, in the Paleocene, a complex, high-grade mineral assemblage formed, which includes wollastonite, melilite, spurrite, garnet, monticellite and perovskite, possibly at a temperature in excess of 900°C.

Figure Cuillin 1.21: Isolated outcrop of marble, most likely originally Durness Group Cambro-Ordovician dolostone, on the west side of Camasunary Bay. Pole *c.* 1m long.

Return to the right-angled junction of the old wall and follow the N-S –trending portion to where it meets large relatively continuous exposures of glacially-moulded gabbro.

Locality 10 [NG 5097 1965]:

These slabs are composed of relatively homogeneous unlayered gabbro belonging to the marginal E_{C1} unit, cut by numerous dykes of the regional swarm. This variety of gabbro, in which the plagioclase crystals are calcium-rich (hence the term Bytownite Gabbro), is composed predominantly of clinopyroxene (augite) and plagioclase (bytownite to labradorite), together with lesser amounts of olivine, orthopyroxene (commonly pseudomorphed by bastite) and Fe-Ti oxides. Large ovoid segregation pods and veins are common, containing large (up to 20mm) crystals of augite and plagioclase. These crystals have developed in response to a more hydrous environment during crystallisation. Also present within the gabbro are large xenoliths of gabbro, dolerite and basalt, up to several metres across.

Figure Cuillin 1.22: Marginal facies of the E_{C1} unit, comprising unlayered bytownite gabbro, locally with xenoliths of gabbro, dolerite and basalt, intruded by NW-SE –trending basalt and dolerite dykes of the Paleocene regional swarm, together with minor gabbro pegmatites. View is SE towards Camasunary Cottage. Pole *c.* 1m long.

In a traverse from this area, SE, towards the margin of the intrusion and onward into the adjacent country-rock Blà-bheinn Member (Torridonian) strata, the relatively simple character of the rock sequence/section changes in a predictable, though locally variable manner (**b** → **a** in Figure Cuillin 1.23):

1. Marginal gabbro(s) with veins of pale felsite and micro-granite;

2. Localised breccias dominated by a matrix of similar pale material, with angular fragments of gabbro, dolerite and basalt;

3. Dominant fine-grained pale material that upon close inspection is stratified, although locally somewhat disrupted, and interpreted as the country-rock Torridonian strata;

4. Abundant veins, with a variety of orientations, containing hydrothermal minerals such as chlorite, epidote and carbonates;

5. Dykes divergent from their normal NW-SE –trends, commonly with irregular (or non-planar) margins, also veined by felsite and micro-granite;

6. Clearly recognisable Torridonian strata of the Blà-bheinn Member, comprising mainly fine- to medium-grained sandstones.

Essentially, over this *c.* 300m traverse, is a complex contact interval between the marginal gabbros and the country-rock Torridonian strata. The various heterogeneous lithologies within the interval have formed by the intense heating, deformation and partial melting of the country-rock sandstones by the 'gabbro' magma(s), with the resultant silicic magma back-veining the gabbro during its progressive cooling and crystallisation. The lithologies encountered in this traverse are of almost infinite variability and worthy of careful examination and contemplation; this is a remarkable contact metamorphic aureole.

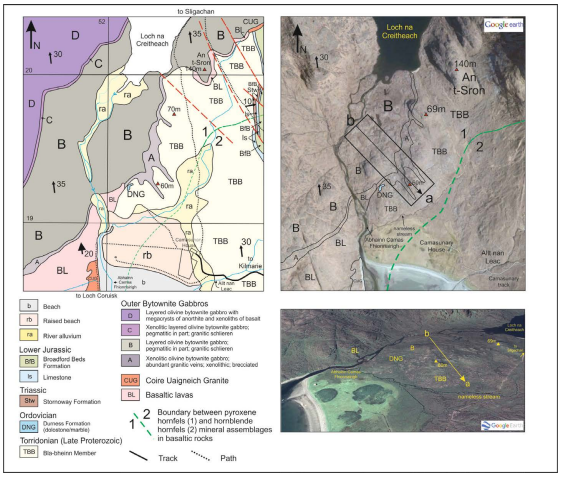


Figure Cuillin 1.23: Location of traverse in Camasunary Bay, where Torridonian strata (Blà-bheinn Member) are the dominant country-rocks, displaying increasing degrees of modification towards the margin of the CIC.

Figure Cuillin 1.24: Granitic veins within marginal gabbro of the Cuillin Intrusive Centre, Camasunary Bay. Pole *c.* 1m long.

Figure Cuillin 1.25: Granitic veins within marginal gabbro of the Cuillin Intrusive Centre, Camasunary Bay. Pole *c.* 1m long.

Figure Cuillin 1.26: Sheets of dolerite with non-planar margins within thermally metamorphosed Torridonian sandstones, Camasunary Bay. Pole *c.* 1m long.

Figure Cuillin 1.27: Dominant stratified thermally metamorphosed Torridonian sandstones (Blà-bheinn Member), Camasunary Bay. Pole *c.* 1m long.

This excursion can end here, by walking towards Camasunary Cottage and following the main track out of Camasunary Bay, returning to Kirkibost.

Alternatively, a final stop can be made to examine the Lower Jurassic strata that forms the lower ground on the southern projection of the Blà-bheinn ridge.

Traverse towards the NE, down into the NW-SE –trending through valley that runs between Loch na Crèitheach and the east side of Camasunary Bay and up to the first obvious exposures on the lower southern slopes of Blà-bheinn.

Locality 11 [NG 5195 1992]:

These intensely intruded and disrupted strata belong to the Broadford Beds Formation, comprising limestones, siltstones, sandstones and shales. Locally, below these strata, are thin breccias and conglomerates that are attributed to the Triassic Stronoway Formation. Only the lowermost exposed beds should be examined: those on the higher ground are not easily and safely accessed. All are thermally metamorphosed, although not to the extent recorded by the Torridonian sandstones and siltstones and the Durness Group dolostones already examined further south in Camasunary Bay.

Figure Cuillin 1.28: Heavily intruded Broadford Beds Formation strata on the lower southern slopes of Blà-bheinn, intruded to the north by the Outer Bytownite Gabbros that form much of the main summit. View is towards the NE.

Figure Cuillin 1.29: Lower Jurassic Broadford Beds Formation strata on the southern slopes of Blà-bheinn.

Figure Cuillin 1.30: Lower Jurassic Broadford Beds Formation limestone on the southern slopes of Blà-bheinn. Pole *c.* 1m long.

Descend to the rough path that skirts around the southern slopes of Blà-bheinn. Follow it towards the east. Where the path crosses the Abhainn nan Leac, further good exposures of the limestones are easily accessed.

Figure Cuillin 1.31: Disrupted and intruded Lower Jurassic Broadford Beds Formation strata, above the path from Loch na Crèitheach, where it crosses the Abhainn nan Leac. View is towards the north.

Follow the path to where it joins the main Camasunary track and return to the public road at Kilmarie.

You may be fortunate to get one final view of the spectacular summit of Blà-bheinn as you return to Kilmarie.

Figure Cuillin 1.32: Blà-bheinn from the Camasunary track.

End of excursion.