Excursion 9 Lower Glen Dibidil – shoulder of Sgurr nan Gillean – Papadil

Highlights

This excursion highlights the complexity of the Main Ring Fault system between Dibidil and Papadil (Figure 62), (Figure 72), and the effects of the intrusion of the Layered Centre on the Torridonian country rocks. Evidence of antithetic motions on inner and outer strands of the Ring Fault system are seen, and a sedimentary origin for the 'mesobreccias' is demonstrated south of Sgurr nan Gillean. Also verified hereabouts is the close temporal and spatial relationship between intrusive rhyodacite and an enigmatic (Am Màm-type) intrusive breccia, as well as the later emplacement date of these rock types relative to the sedimentary mesobreccias. The Papadil Microgranite, thought to be the final instalment of Stage 1, is examined on the south-west slopes of Sgurr nan Gillean. The southernmost end of the influential Long Loch Fault is seen at Inbhir Ghill. Around Loch Papadil, ductile deformation and remobilisation of the Torridonian rocks by the Layered Centre is seen in spectacular contact exposures. Finally, unusual minor intrusions into the gently inclined uppermost member of the Torridonian succession of Rum are inspected.

This excursion will take a full day and it is best to start and finish from a base at or near the Dibidil bothy, in which case the total distance is about 7 km. Extremely fit persons could walk from Kinloch to Dibidil by the well-marked path, follow the excursion route and return to Kinloch by the same path. The total distance for this strenuous day would be about 23 km.

Locality 9.1 Along the Papadil path – evidence for multiple movements on the Main Ring Fault [NM 3916 9263]

From the Dibidil bothy or ford, walk along the path toward Papadil. About 170 m west-south-west of the bothy at [NM 39138 92736], a few metres above the path, there are small, scattered exposures of feldspathic sandstone (TCAM). Bedding consistently strikes north-east and dips very steeply north-west. For a few hundred metres further upslope there are several exposures of laminated siltstone (TCDL), which strike north-east and dip north-west, but also young south-west (e.g. cross-laminations at [NM 38856 92642]). An overturned (outward-rotated) block of sandstone and siltstone (TCDL-TCAM) occupies the grassy slopes from just above the bothy to the steep crags on the lower slope of Sgurr nan Gillean (Figure 71). About 200 m south-west of the bothy, the path crosses a waterfall that cuts into gneiss [NM 3916 9263]. The overturned Torridonian beds just to the north must have subsided along a fault to now lie inside this gneiss. This fault, the 'Southern Mountains Ring Fracture' of Hughes (1960a), is likely to be equivalent to the central strand of the Main Ring Fault system at Beinn nan Stac (Localities 7.3 and 7.4).

Just past a second waterfall cutting into gneiss [NM 3912 9248], about 220 m farther south on the path, are exposures of crushed-looking dark- grey siltstone (TCDL). These beds dip steeply north-west, as do feldspathic sandstones in an exposure 50 m farther south along the path. Another 150 m south along the path, thick-bedded, orange-pink, coarse feldspathic sandstones (TCAS) exhibit the shallow regional north-west dip. These beds form a thick succession that dominates much of the southern tip of Rum and, as in the north of the island, impart a characteristic terraced topography. The TCDL siltstone is probably a fault-bound sliver between TCAS sandstone and the Lewisian gneiss; the latter was uplifted along an outer strand of the Main Ring Fault system (Figure 72).

Locality 9.2 Southern lower slope of Sgurr nan Gillean – depositional contact between mesobreccia and uplifted gneiss [NM 3845 9248]

Walk 350 m north-west upslope over gently inclined beds of feldspathic sandstone (TCAS) to where the second stream crossed on the path first bends to flow eastward at ([NM 38735 92390] – *c*. 240 m OD). The Outer Main Ring Fault continues from the last locality to here, where crushed coarse feldspathic sandstone (TCAS?) crops out adjacent to crags of gneiss upstream (e.g. at [NM 38569 92379]). Continue walking north-west next to the stream for another 200 m, past exposures of crushed gneiss and Am Màm-type breccia, as far as the gneiss exposures in the south wall of Sgurr nan

Gillean's south corrie at approximately ([NM 38450 92480] – *c*. 360 m OD). An unfaulted depositional contact between gneiss and mesobreccia with feldspathic sandstone and gneiss clasts is exposed hereabouts. This demonstrates that the Lewisian gneiss here inside the inner ring fault was at the palaeosurface prior to deposition of the mesobreccia, and was probably raised to that level during the initial uplift along the Main Ring Fault, before subsiding to its present position.

Locality 9.3 Southern lower slope of Sgurr nan Gillean – contacts between mesobreccia, rhyodacite, and intrusive Am Màm-type breccia [NM 3826 9245]

Continue westward by the south wall of the corrie for another 150 m or so, and then walk south-east for another 50–60 m to where crags at about 420 m OD display a sharp north-west-dipping contact between light-grey and dark-red rocks [NM 38255, 92453]. The dark-red rock is sandstone-rich mesobreccia, which appears to be crushed near the contact (cf. Locality 8.1). The light-grey rock locally penetrates into, and encloses fragments of, the mesobreccia, and displays a strong foliation parallel to kinks in the contact (Figure 73). The foliated grey rock is a localised outer facies of the Am Màm-type breccia, more-typical exposures of which occur just a few metres south. Between the more-typical Am Màm-type breccia and the foliated outer facies are patches of rhyodacite-like material. A few metres west-south-west upslope [NM 38233 92439], rhyodacite occurs in sharp contact with the mesobreccia. In the adjacent exposure a metre or so south, rhyodacite is in a very intimate, intermingling contact with Am Màm-type breccia matrix. In an exposure 40 m further upslope [NM 38190 92423], rhyodacite is chilled sharply on one side against mesobreccia, but has a diffuse contact with Am Màm-type breccia matrix on the other. Rhyodacite (or similar material) thus seems locally to form a marginal facies to the Am Màm-type intrusive breccia, as is seen elsewhere (cf. Locality 7.9). Confirmation of this relationship is seen 130 m to the west on the plateau [NM 38074 92415], where rhyodacite and Am Màm-type breccia respectively form the margins and core of a composite dyke-like protrusion into mesobreccia; the rhyodacite is chilled only against mesobreccia (Figure 74). These relationships further demonstrate that the Am Màm-type breccia post-dates the lower parts of the caldera fill.

Locality 9.4 Shoulder of Sgurr nan Gillean – alternating bedding in the mesobreccia [NM 3810 9246]

The mesobreccia of the Southern Mountains was long attributed to subterranean explosive fracturing of country rocks by gas from a cooling felsic magma body at depth (Hughes, 1960a). Good evidence for a very different origin is seen at [NM 38101 92456], 40 m north-east of the composite rhyodacite and Am Màm-type breccia protrusion. Crude metre-scale bedding, defined by alternating feldspathic sandstone-rich (pink) and gneiss-rich (light-grey) zones, is visible in the mesobreccia, especially in late afternoon sunlight (Figure 75). The beds are lens shaped where defined in three dimensions (Figure 75); clasts are subangular to subrounded and generally coarse, with rare 2 m-diameter boulders. These exposures represent surficial deposits of interdigitating high-energy debris flows from discrete gneiss-rich and feldspathic sandstone-rich source areas. The bedding here and elsewhere around Sgurr nan Gillean dips generally toward the centre of the volcano, as seen in caldera-infill sequences elsewhere (Branney, 1995).

Locality 9.5 Shoulder of Sgurr nan Gillean – the Papadil Microgranite [NM 378 923]

Exposures of light-grey microgranite that is lithologically and chemically very similar to the Western Granite occur about 250 m west-south-west of Locality 9.4 toward the top of the steep grassy slopes overlooking Papadil.

Small phenocrysts of feldspar are recognisable in a matrix of intergrown quartz and feldspar crystals. There are also abundant mafic minerals and numerous small, rounded, fine-grained mafic inclusions. Unlike the rhyodacite, quartz phenocrysts are rare or absent (Hughes, 1960a). The microgranite occupies most of the hollowed ground that slopes from Sgurr nan Gillean's steep south-west cliffs down to the Papadil Burn. Though its contacts are poorly exposed and understood, the Papadil Microgranite appears to truncate the mesobreccias, rhyodacite, and Am Màm-type breccias (Figure 71), and so probably post-dates these units. Apart from where crushed along the outer strand of the Main Ring Fault system, the microgranite is undeformed (Hughes, 1960a). Though Hughes thought otherwise, the Papadil Microgranite pre-dates the basic and ultrabasic rocks against which it is thermally metamorphosed, as does the Western

Granite. Both microgranites are thus regarded as late Stage 1 intrusions.

Locality 9.6 Sandstone melted by gabbro at Inbhir Gil [NM 3579 9247]

From Locality 9.5, descend gently westward for 2 km to Inbhir Gil [NM 3585 9260]. Along the way, note the change from microgranite to peridotite breccias and gabbro of the Central Intrusion on the slopes about 600 m north-east of Papadil Lodge. Nearby, it may be verified that peridotite comes to within a metre or so of baked sandstone (TCSM) in the Papadil Burn (at about [NM 3712 9225]), some 500 m east of the ruined lodge. The sandstone lies outside the Main Ring Fault which is evidently transgressed by the mafic rocks hereabouts. Traverse the low ground to the east side of the bay at Inbhir Ghil and cross the Allt na Gile. The steep-sided valley at Inbhir Ghil marks the course of the north–south Long Loch Fault. At Inbhir Ghil, leave the cove on its western side and trace the vertical contact between gabbro and Torridonian rocks as far south as possible (to *c*. [NM 3579 9247]). At low water, near the tidemark, this locality provides excellent exposures of partially melted Torridonian sandstone near the gabbro. Note the incipient break-up of dolerite 'xenoliths' in their silicic matrix. The gabbro is cut by thin (millimetre-scale), rheomorphic felsic veins and is chilled against the baked and partially melted sandstone.

Locality 9.7 Peridotites around Loch Papadil [NM 3620 9228]

Return to the cove of Inbhir Ghil and leave by the south-eastern corner. Walk south-east for 300 m, then follow a wall east for about 250 m until an area of altered peridotite enclosed by gabbro is reached 200 m west of Loch Papadil [NM 3620 9228]. Follow the tongue of brown-weathering peridotite south for about 400 m and cross on to another brown-weathering peridotite area about 100 m west of Papadil Pinnacle [NM 3642 9183]. The contacts of this peridotite against gabbro are near vertical, as are those of the tongue to the north; both peridotite masses resemble rocks of the main ultrabasic mass north of Papadil. At Rubha na Pairce [NM 3615 9180], a small body of peridotite has intrusive wall and roof contacts against gabbro; the roof-like contact is nicely observed looking north from the peridotite. Note the extremely xenolithic character of the peridotite hereabouts, with as much as 80 per cent of the surface made up of rounded xenoliths of dolerite and gabbro, from 1 to 75 cm in diameter. The Rubha na Pairce peridotite is a much coarser grained rock than both the tongues seen earlier and Rum peridotites in general.

The gabbro hereabouts is unusual when compared with the normal Marginal Gabbro in that it is resistant to weathering. The gabbroic rocks in the shore sections are cut by abundant minor basic intrusions, the majority of which appear to be hornfelsed and to have developed large plates of biotite mica. The dykes commonly have 'welded' or annealed contacts with the host rocks.

Locality 9.8 Melted sandstone around the bay south of Loch Papadil [NM 3660 9173]

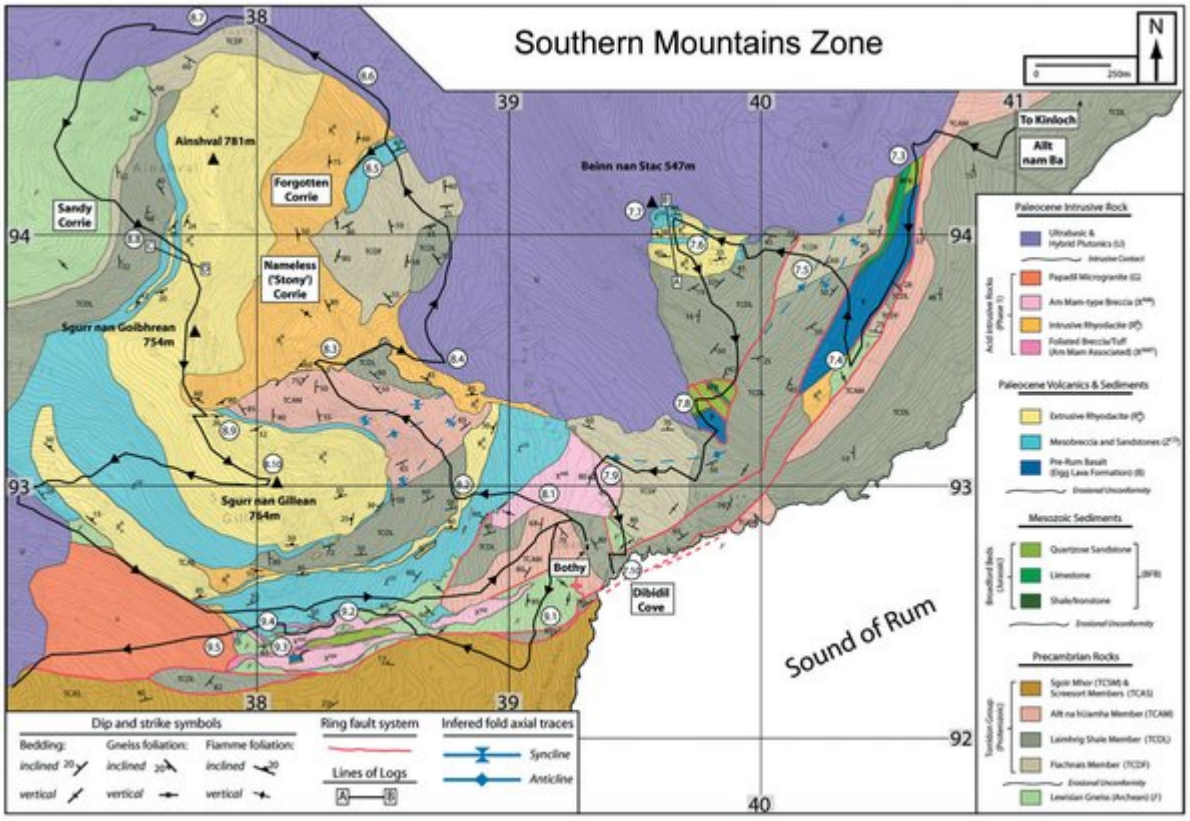
Walk eastwards and cross the stream draining Loch Papadil. About 150 m east of Papadil Pinnacle, the gabbro on the coast is cut by an aplitic vein, probably of mobilised sedimentary material. Continue south-east along the coast to a point about 200 m east of Papadil Pinnacle. If the tide is high, it may not be possible to approach the locality from the west. In this case, it is easiest to detour northward around Loch Papadil, and to access the locality from a point on the Papadil path about 220 m south-south-east of Papadil Lodge.

At Locality 9.8, gabbro occurs in near-vertical contact with sandstone (TCSM) in a low cliff at [NM 3660 9173]. Plastic deformation is very evident in the bedded sandstones which appear to sag towards the gabbro (Figure 76). Dolerite sheets have become fragmented in the relatively incompetent, partially melted sandstone, the fragments retaining their chilled edges. Note also the leucocratic sheet, of intermediate composition, exposed in the slopes below the cliff, which cuts both gabbro and sedimentary rocks.

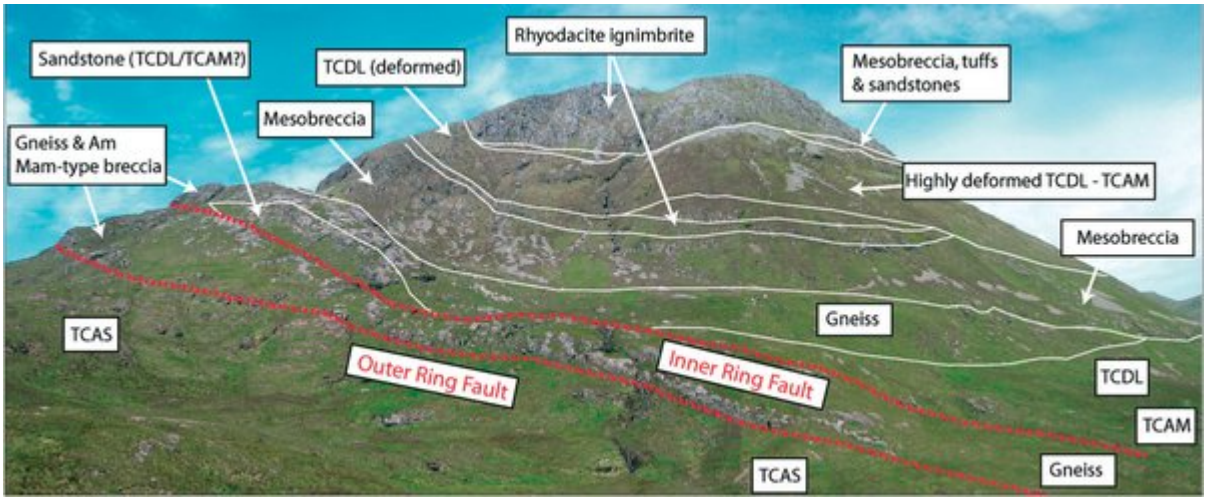
Locality 9.9 South-east of Papadil – minor intrusions and heavy-mineral bands in Torridonian sandstone [NM 3671 9164]

Climb eastwards across the contact seen at Locality 9.8. About 100 m south-east of the contact exposure, a thin pitchstone dyke crops out (Locality 9.9a [NM 3671 9164]), and some 150 m farther to the south-east, south of the path (Locality 9.9b [NM 3681 9152]), there are exposures of sandstone with conspicuous dark layers rich in heavy minerals. These layers are characteristic of the highest member of the Torridon Group on Rum – the Sgorr Mhòr Member of the Aultbea Formation (TCSM) and are particularly well developed in coastal exposures near Rubha nam Meirleach [NM 368 911]. About 60 m to the south-east the sandstone is cut by a small peridotite plug. Continue east for about 350 m, to the north end of Loch nam Meirleach [NM 3729 9148]. About 150 m to the east, a 3 m-thick dolerite sill crops out (Locality 9.10 [NM 3740 9144]). This sheet is aphyric and typifies the group of conformable sills found in this southern tract. The sills usually have a vesicular band 5 cm below the upper contact; the vesicles are infilled with calcite, hydrogarnet, and other minerals. Follow the sill in a north-east direction until it is crossed by the path from Dibidil to Papadil at [NM 3863 9152]. A good view of the ridge from Ruinsival to Sgurr nan Gillean is obtained from the path. Contrast the vegetation and morphology of the gabbro at Papadil, the peridotite slopes to the north and the microgranite and rhyodacite to the north-east. Follow the path eastwards past the terraced features of the major bedding planes in feldspathic sandstone (TCAS) to the Dibidil bothy (Figure 62).

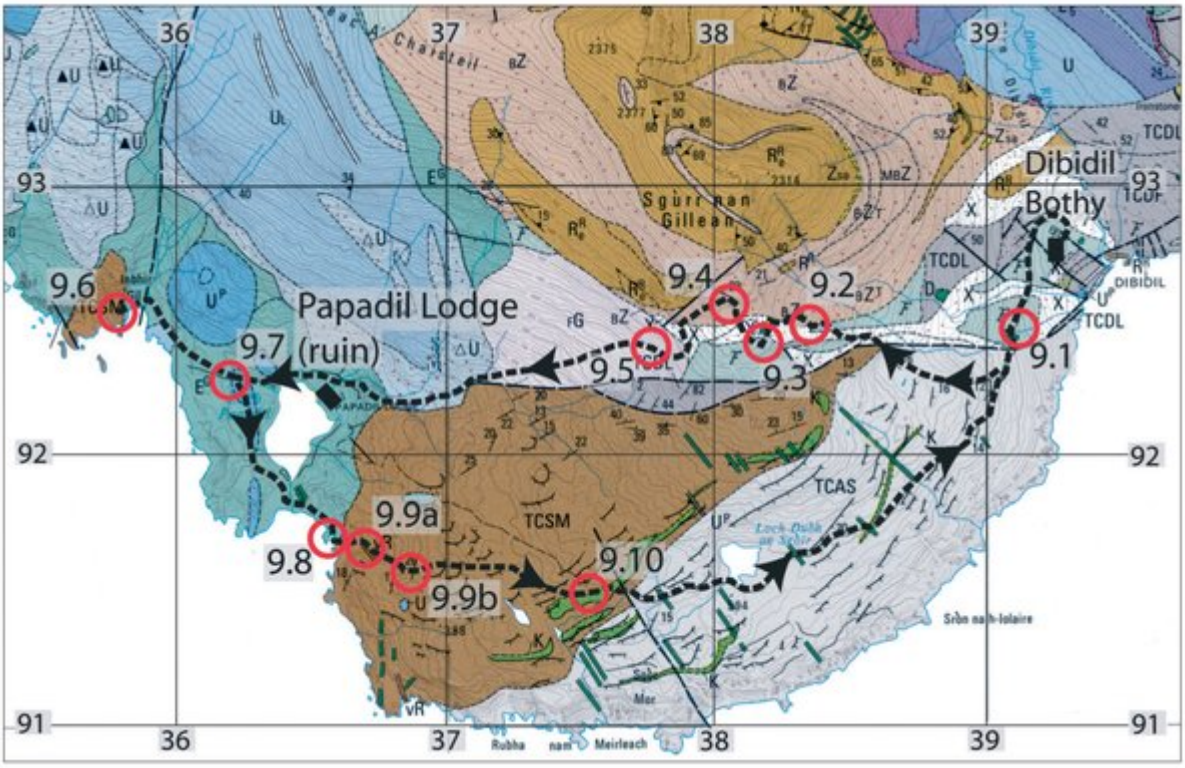
References



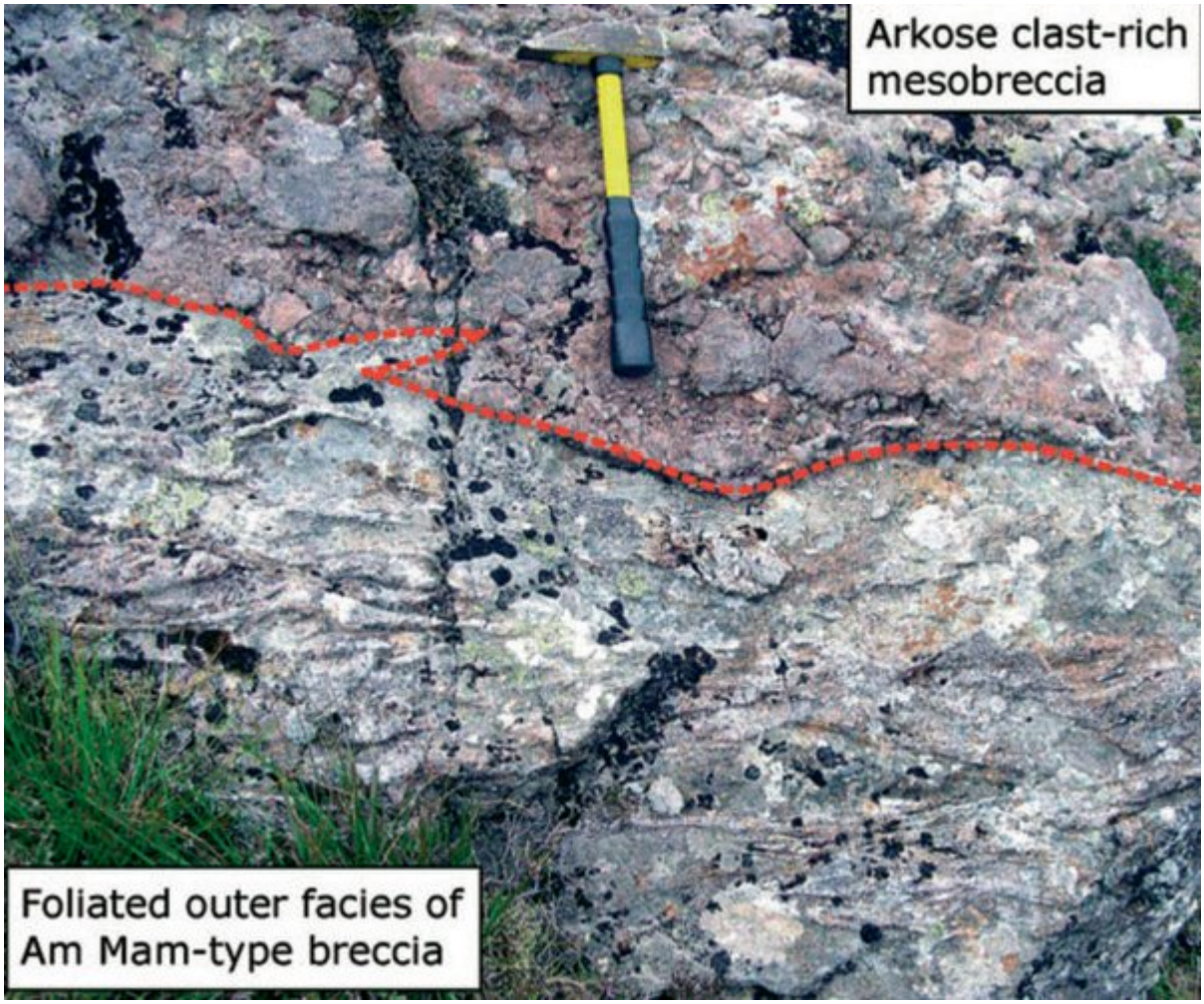
(Figure 62) Geological map of the Southern Mountains Zone. Based on SNH 1:20,000 solid geology map (© SNH), but extensively revised by E. Holohan and M. Errington. Excursions 7, 8 and part of 9. For localities 7.1 and 7.2 see (Figure 26), and for all of Excursion 9 see (Figure 71) (Key) .



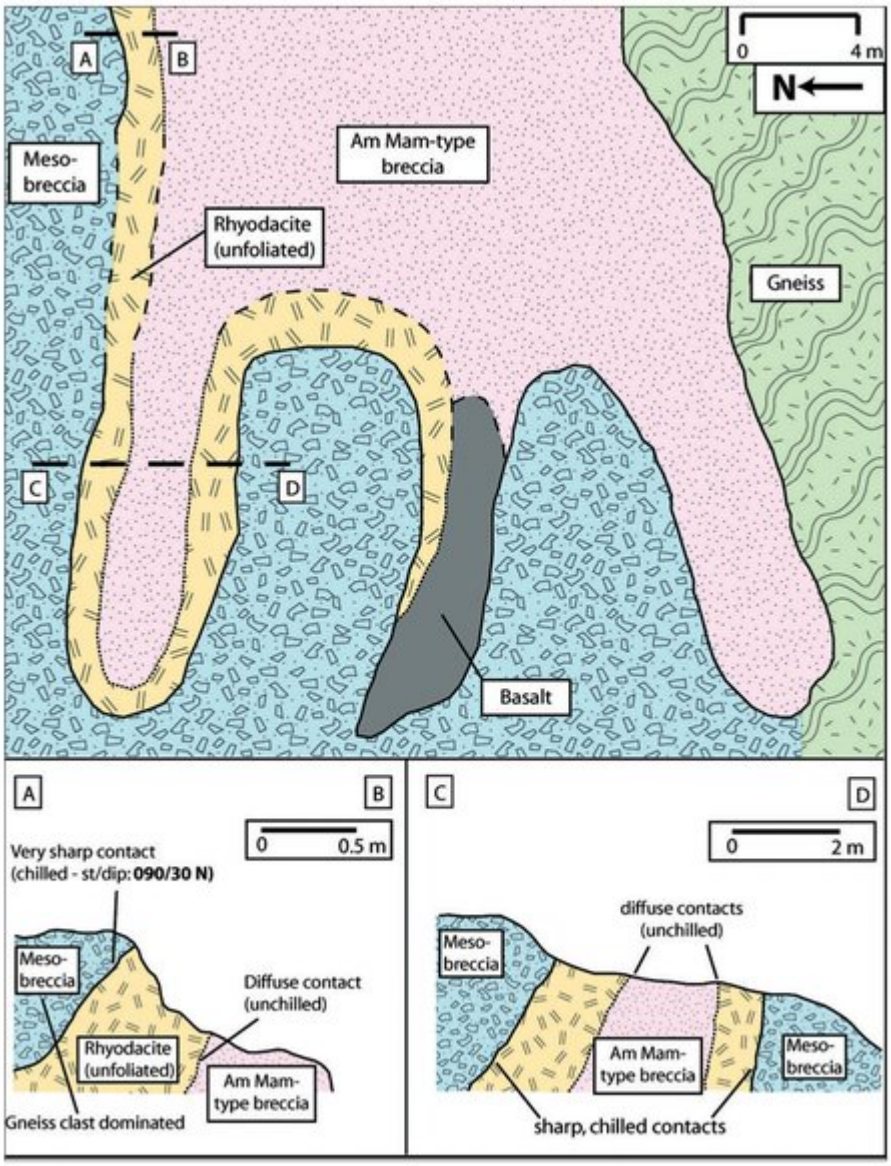
(Figure 72) Annotated, panoramic view of the southern side of Sgurr nan Gillean, as viewed from west of the Papadil path.



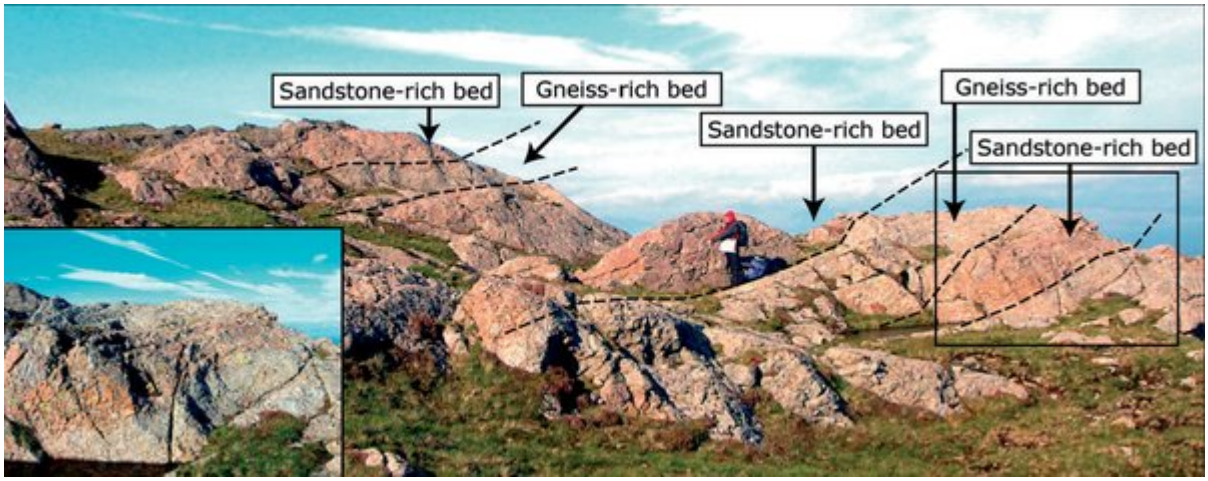
(Figure 71) Geological map of the southern end of Rum from Sgurr nan Gillean to Rubha nam Meirleach. Excursion 9. ((Key); based on SNH 1:20,000 solid geology map; © SNH.)



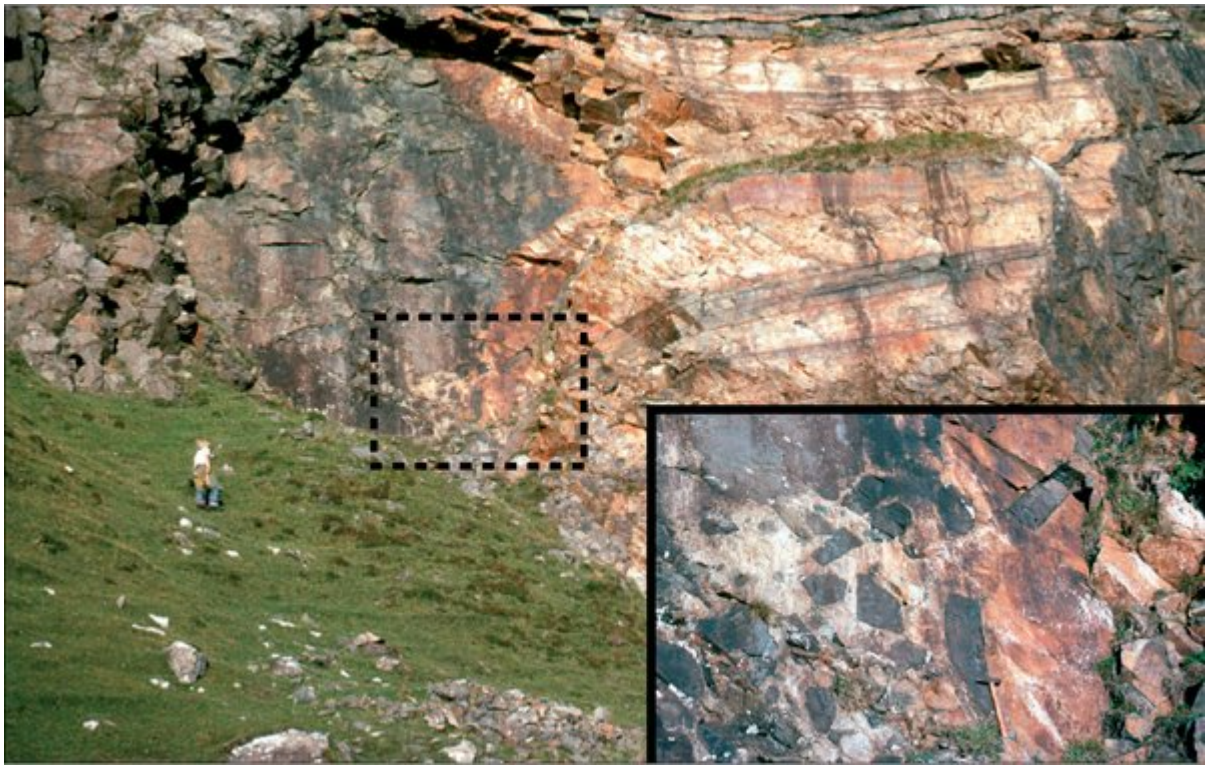
(Figure 73) Foliated outer facies of Am Màm-type breccia intruding mesobreccia. South slopes of Sgurr nan Gillean (Locality 9.3). Scale: hammer shaft c.35 cm.



(Figure 74) Diagram of the relationship between intrusive Am Màm-type breccia with porphyritic rhyodacite margins, and gneiss-dominated mesobreccia. South side of Sgurr nan Gillean (Locality 9.3).



(Figure 75) Bedded mesobreccia with alternating layers dominated by gneiss (cream coloured) and by feldspathic sandstone (pink coloured). South side of Sgurr nan Gillean. (Locality 9.4) INSET: Close-up of a lens-shaped sandstone-dominated bed (above) and a gneiss-dominated bed (below).



(Figure 76) Gabbro of the Central Intrusion (dark rock above figure) intruding bedded sandstone of the Sgorr Mhor Sandstone Member (TCSM), Aultbea Formation. Dark beds are relatively rich in heavy minerals. Note how the beds sag towards the zone of intrusion breccia along the contact. Coast south-east of Loch Papadil. (Locality 9.8) INSET: Detail of the intrusion breccia zone at the gabbro–sandstone contact. The light-coloured felsic matrix has come from the partial melting of the sandstone. Scale: hammer shaft 30 cm.