Allt nam Bà–Beinn nan Stac

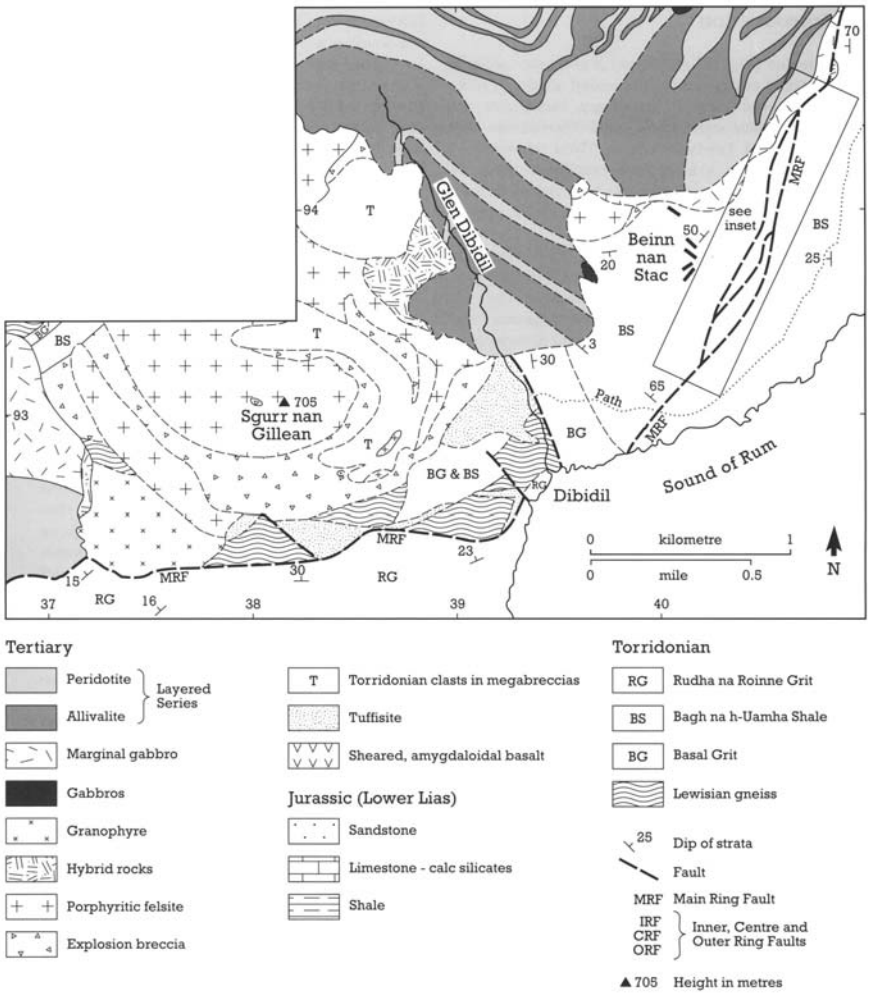
OS Grid Reference: NM405943

Highlights

The juxtaposition of Lewisian gneisses and basal Torridonian rocks with Jurassic sediments and Palaeocene lavas gives this site particular importance since it demonstrates both subsidence and uplift on the Main Ring Fault which bounds the Rum central complex. The site also contains one of the few examples in the British Tertiary Volcanic Province of a chilled margin to a gabbro–ultrabasic complex.

Introduction

The site (Fig. 3.7 and inset) is characterized by a tectonic collage of fault-bounded slivers of metamorphosed Jurassic limestones, sandstones and shales, Palaeocene lavas, basal Torridonian sediments and Lewisian gneiss. These components occur within a fault zone coincident with the Main Ring Fault and provide a record of tectonic activity during the emplacement of the central complex.



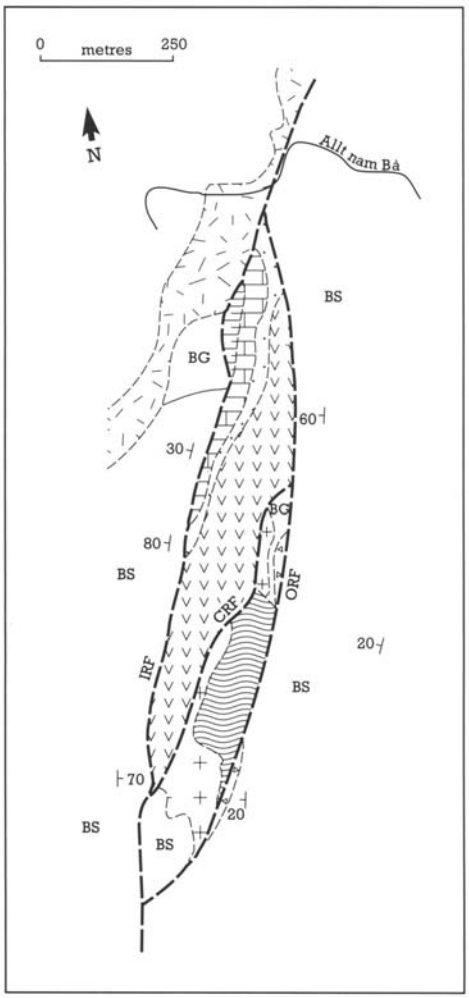


Figure 3.7: Geological map of the Dibidil-Southern Mountains and Allt nam Bà-Beinn nan Stac sites, Rum. Inset (on opposite page) shows detail to the south of Allt nam Bà. Main figure after Emeleus (1980) with subsequent modifications (Greenwood, 1987). Inset after Smith (1985, fig. l)

Marble and calc-silicate rocks were discovered close to Allt nam Bà byHughes (1960b) who proposed them to be of Lewisian age and recognized that their presence, together with Lewisian gneiss, could be attributed to movement along the Main Ring Fault. Subsequently, the discovery of poorly preserved fossil bivalves led to the recognition that the calc-silicate rocks were of Mesozoic age (Dunham and Emeleus, 1967). Smith (1985, 1987), in a detailed study of the fault zone, recorded fairly well-preserved fossils of bivalves, corals and belemnites of Lower Lias age in these rocks. These and other investigations have stimulated fresh interpretations of the Tertiary tectonics of Rum (Emeleus *et al*., 1985).

Description

A variety of lithologies of strikingly contrasting ages occur as fault-bounded slivers and intrusives in a wide lensoid fault zone coincident with the Main Ring Fault at Allt nam Bà and extending to the south-east slopes of Beinn nan Stac (Fig.3.7).

In the northern part of the fault zone a wedge of Mesozoic strata crops out. Metamorphosed calc-silicates have long been recognized at Allt Nam Bà (Hughes, 1960b) and Smith (1985, 1987) has mapped associated fossiliferous sandstones, sandy limestones and shales of early Jurassic age. The succession of Mesozoic strata is up to 35 m thick and is highly inclined to the west and inverted. Palaeontological evidence suggests that they are probably an extension of the Lower Lias Broadford Beds (Smith, 1985).

Highly metamorphosed calc-silicate rocks within the marginal Layered Series are found in the Allt nam Bà valley (Fig. 3.7 inset; NM 4060 7945). They consist of various assemblages of

calcite, grossularite, diopside, vesuvianite, leucoxene and tilleyite. Where they are cut by a narrow syenite vein they additionally contain wollastonite and pyrite (Hughes, 1960b). A further narrow strip of limestone, about 100 m to the south, is separated from the northern outcrop by Torridonian sediments and a minor intrusion of hybrid acid rocks. Two hundred metres to the south along the line of the same fault zone, a homogeneous, dull, coarse-grained marble is composed almost entirely of calcite (NM 404 942) and contains poorly preserved belemnite and bivalve remains (Emeleus and Forster, 1979). These calc-silicates and related sediments, together with limestones recently rediscovered by Smith on the south-western slopes of Beinn nan Stac (Smith, 1987) are the only Jurassic outcrops known on Rum. They are of early Jurassic age, comparable with the Broadford Beds on Skye (Smith, 1985). Younger Jurassic rocks are, however, well exposed on Eigg less than 10 km to the south-east.

The Main Ring Fault zone crosses to the eastern side of Beinn nan Stac about 1 km south-east of the summit where it is over 100 m wide. On the inner side it is bounded by Torridonian Basal Grit and Bagh na h-Uamha Shale (see Black and Welsh, 1961, for divisions of the Torridonian strata). On the outer, south-eastern side a thin strip of Rudha na Roinne Grit overlying Bagh na h-Uamha Shale occurs and dips steeply towards the fault zone. Within the fault zone, a variety of rocks are found including an elongate lens of Lewisian gneiss, a small area of Basal Grit and a strip of flinty, sheared amygdaloidal basalt. Smith (1985) has shown the basalts to be far more extensive than previously established; they are fault-bounded to the east and south-east with an unconformable contact between basalt and Mesozoic strata to the north. These lavas predate those at Fionchra in northern Rum and may be a faulted wedge of more extensive Tertiary lava fields which now cover much of Eigg and Muck and with which they have geochemical similarities (Smith, 1987).

Undeformed porphyritic felsite and an explosion breccia are also found within the fault zone and have probably exploited the lines of weakness along the faults.

The prominent cliff feature which extends from near the summit of Beinn nan Stac SSE along the crest of the ridge towards Allt nam Bà is formed by baked, resistant Torridonian sediments (Bagh na h-Uamha Shales) and probably owes its origin to the contact effects of the Marginal Gabbro of the ultrabasic/basic complex. At a locality about 450 m ESE of the summit (NM 4007 9403), the marginal olivine gabbro becomes fine grained and contains skeletal olivine phenocrysts in a variolitic matrix. This is one of the few places on Rum where there is a clear indication of a chilled facies to the rocks rimming the ultrabasic–gabbro complex (Greenwood, 1987; Greenwood *et al*., 1990). At this locality overlain it is by up to 7 m of hybrid rock which is in turn overlain by baked shale. The field relationships here suggest that the baked shales, explosion breccias and felsite of Beinn nan Stac form a SE-dipping roof to the later gabbros and ultrabasic rocks, similar to the roof seen at the east end of Cnapan Breaca (see below).

Interpretation

Smith (1985, 1987) has shown that the Jurassic sediments on Rum are closely comparable with the middle Broadford Beds of Skye and do not correlate with the nearby Great Estuarine sediments of Eigg. Eigg and Rum are separated by the southern extension of the Camasunary Fault (Binns *et al*., 1974) which on Skye shows a considerable pre-Palaeocene downthrow to the east (Peach *et al*., 1910). On Skye, only the lowermost Jurassic beds occur west of the Camasunary Fault and it is likely that this situation pertained on Rum at the start of Tertiary volcanism.

The wide fault zone in south-east Rum contains several individual, distinct, fault planes related to different stages of movement along the Main Ring Fault. Smith (1985) mapped the following faults which are shown on Fig. 3.7 inset.

Outer Ring Fault (ORF)	easternmost boundary fault.
Centre Ring Fault (CRF)	separating sheared Palaeocene basalts from felsites and gneisses.
Inner Ring Fault (IRF)	westernmost fault; responsible for the juxtaposition of stratigraphically low-level Jurassic sediments and Palaeocene basalts against Torridonian sediments.

The proposed model for the movement of the Main Ring Fault is discussed for the Cnapan Breaca and Dibidil sites. According to Smith (1985, 1987) the initial diapiric uplift and ring fracturing is thought to have occurred along the ORF, bringing Lewisian and basal Torridonian to higher stratigraphic levels. The ensuing caldera subsidence occurred along the CRF, evidence for which is the presence of Mesozoic sediments downfaulted against Torridonian and Lewisian rocks. Renewed uplift of about 2 km along the IRF is required to bring stratigraphically low Torridonian to the structural level that it now occupies within the Main Ring Fault. A more detailed discussion of the proposed movements within the fault zone is presented in Smith (1985). The occurrence of chilled picritic rocks at the edge of the layered ultrabasic rocks provides evidence for the existence of ultrabasic, or strongly picritic basaltic, liquids in the complex (Greenwood *et al.*, 1990).

Conclusions

The juxtaposition of basement Lewisian and Torridonian rocks and stratigraphically high Jurassic sedimentary rocks and Palaeocene basalts within the fault zone can be explained by movement along the different fault planes; the presence of Mesozoic strata provides crucial evidence for early subsidence during which the felsite and explosion breccia probably formed.

The exposed Main Ring Fault complex in south-east Rum is therefore of considerable importance in the study of the tectonic evolution of the Rum Complex in providing a comprehensive record of different stages of movement during its emplacement. Recent studies within this site have made an important contribution to the understanding of the Tertiary geology of Rum, in the overall context of the British Tertiary Volcanic Province. It is now evident that marginal complexes, such as that present here, merit further careful scrutiny both on Rum and elsewhere.

A chilled contact facies of the Layered Ultrabasic rocks provides evidence supporting the view that ultrabasic liquids played a role in the formation of the central complex.

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