An Teallach

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Highlights

An Teallach is a site of great importance for its assemblage of glacial and periglacial landforms. The interest includes a suite of moraines formed during different episodes of Late Devensian glaciation and outstanding examples of periglacial features, most notably deflation surfaces and mountain-top sand deposits.

Introduction

An Teallach [NH 038 860] is located on the south side of Little Loch Broom, about 11 km south of Ullapool. It is one of the most spectacular mountains in north-west Scotland, rising to 1062 m OD, and supports many outstanding examples of glacial and periglacial features within a relatively small area (about 35 km^2). The landforms developed on and around An Teallach are typical of those of the Torridonian sandstone mountains, and several types are among the finest examples known (Ballantyne, 1984, 1987a, 1987b). The principal publications on the site are those of Peach *et al.* (1913a), Godard (1965), Sissons (1977a), Robinson and Ballantyne (1979), Ballantyne (1981, 1984, 1985, 1986b, 1987a, 1987b), Ballantyne and Eckford (1984), Ballantyne and Whittington (1987) and Benn (1989b).

Description

Abundant striae and chattermarks on both Torridonian sandstone and Cambrian Quartzite indicate that, during the Late Devensian ice-sheet glaciation, ice moving from the east and southeast was deflected around the flanks of An Teallach. The upper slopes and plateau areas of the mountain are mantled by a thick cover of frost-weathered detritus, which contrasts with the ice-moulded surfaces of the lower slopes, and as the transition from one type of surface to the other (at around 700 m OD) is apparently too abrupt to be explained by a climatic difference, it may be that the upper part of the mountain was not glaciated at the time of the last ice-sheet maximum (Reed, 1988). However, erratics are found at altitudes of up to 900 m OD (Peach *et al.,* 1913a), including a remarkable high-level train of Cambrian Quartzite erratics on the northern plateau. Such erratics indicate glaciation from the east-south-east, and may relate to an earlier period of more extensive ice-sheet glaciation (Ballantyne, 1987b).

A sequence of three end or lateral moraines is found in the broad valley west of the massif ((Figure 6.6): a,b,c); this provides evidence that the retreat of the last ice-sheet was interrupted by local stillstands or readvances. These have been tentatively correlated with the Wester Ross Readvance by Robinson and Ballantyne (1979). A massive drift ridge over 1 km long at the northeast end of the valley ((Figure 6.6): d) has been interpreted as a medial moraine deposited when ice in this valley parted from that occupying Little Loch Broom to the north.

During the Loch Lomond Readvance six separate corrie glaciers existed on An Teallach (Figure 6.6) (Sissons, 1977a; Ballantyne, 1987b), their limits being marked by striking end moraines, rising by as much as 30 m above the adjacent bare Torridonian bedrock in one example (at [NH 092 846]) and, in the case of the former Coire Toll an Lochain glacier (Figure 6.6): 6, and (Figure 6.7), by a superb drift limit. On the north-west side of the mountain, below Mac is Mathair, one glacier ((Figure 6.6): 2) formed a sequence of five nested boulder moraines, the outermost truncating a moraine associated with the Wester Ross Readvance (Robinson and Ballantyne, 1979; Ballantyne, 1987b). Controls on moraine asymmetry and debris transport in two of the eastern corries are discussed by Benn (1989b): moraine asymmetry strongly correlates with the distribution of source cliffs which principally reflects climatic controls.

Periglacial landforms are particularly well-developed on An Teallach (Figure 6.8). The frost-weathered detritus of plateau and summit areas underlain by Torridonian sandstone rarely exceeds 1 m in depth and consists of slabs embedded in a coarse sandy matrix. The slabs were produced by frost wedging along pseudobedding planes during the Late Devensian, the sand by the granular disintegration of rock surfaces. The latter process continues today. In contrast, on summit outcrops of Cambrian Quartzite, openwork blockfields and blockslopes are composed of more angular detritus, since quartzite is generally less susceptible to granular disintegration. In places (for example, [NG 085 845]) Cambrian Quartzite blockslope material has moved downslope under the action of frost creep, completely covering the underlying Torridonian sandstone strata. The periglacial features of the upper slopes and plateaux of the massif may be subdivided into relict and active. The stability of the relict features under present conditions is illustrated by the strong contrast in the roundness of exposed and buried clasts, the former being rounded and the latter angular. There are relatively few relict periglacial landforms, though boulder lobes averaging 10 m in width occur in the southern part of the massif (for example, [NG 059 852]), shallow, though well-developed solifluction lobes occur downslope, and dubious examples of sorted circles are found on the northern plateau (Ballantyne, 1981). An example of a Loch Lomond Stadial protalus rampart exists at the foot of a relict talus slope in the north-western part of the massif at [NH 054 875] (Ballantyne and Kirkbride, 1986).

Among the active periglacial features are probably the finest assemblage of high-level aeolian and niveo-aeolian features in Great Britain. Deflation of the extensive plateau surfaces with their sandy regolith has its counterpart in the accumulation of sand-sheets on flanking slopes (Godard, 1965; Ballantyne and Whittington, 1987). The deposits are up to 4 m in thickness at the crest of lee slopes, although they rarely exceed 1.5 m elsewhere. A formerly more widespread sand cover is indicated by the occurrence of isolated sand 'islands' on high-level cols. Interbedded with the sands are organic horizons, and analysis of these for pollen content together with radiocarbon dating has indicated that the deposits began to accumulate in the early Holocene (Ballantyne and Whittington, 1987), but that deposition virtually ceased in the late Holocene following establishment of a vegetation cover on the plateau areas upwind. Recent disruption of the vegetation has resulted in renewed accumulation of wind-blown sand on lee slopes.

Modification to the sand deposits has occurred by both selective eluviation by nival meltwater and scarp erosion, the former process producing large sand hummocks like thidur (earth hummocks) (Ballantyne, 1986b), and the latter producing small nivation hollows. However, Ballantyne (1985) found that the effects of nivation were confined to localized erosion and transport of the unconsolidated niveo-aeolian sands. Despite some contrary evidence from northern England (Tufnell, 1971; Vincent and Lee, 1982), the present geomorphological role of nivation in the British uplands appears to be limited or at least localized (Ballantyne, 1985, 1987a).

Frost creep is active on unvegetated debris slopes on the Torridonian sandstone, producing an average downslope movement of surface stones around 0.01 m a^{-1} on the 30° slopes of travelled downslope by Cambrian Quartzite clasts Glas Mheall Mor [NG 076 854]. Such rates are, from summit outcrops, implying that rates of however, insufficient to account for the distance creep have been greater in the past. A combination of wind action and frost creep has resulted in the formation of outstanding examples of oblique and horizontal turf-banked terraces on slopes of between 5° and 25° (see also Ward Hill). The sparsely vegetated 'treads' range in width from 0.5 m to over 5 m downslope and from 2 m to over 100 m in length, size being closely correlated with the size of clasts in the 'riser'. On north- and south-facing slopes such terraces dip westwards, into the direction of the dominant winds; on steep slopes such as the south slope of Glas Mheall Mor, this has produced a series of remarkable oblique terraces.

Within the corries the most active processes today are rockfall and debris flow. Stonefalls from the glacially steepened cliffs of the eastern corries are fairly frequent, and a rockfall during the winter of 1976–77 on to a well-developed active talus cone [NG 845 075] displaced boulders over 100 kg in mass. Talus slopes produced by rockfall during the Holocene (that is those within the limits of the Loch Lomond Readvance) show less mature profiles than the relict talus slopes formed during the Lateglacial (Ballantyne and Eckford, 1984) although rockfall activity is, after solute transport, the process responsible for the highest rate of erosion on the mountain today (Ballantyne, 1987b). Innes (1983b) has shown that there has been an increase in debris flow activity in recent centuries, which he has attributed to the effects of overgrazing or possibly burning of vegetation to improve the quality of rough pasture.

Interpretation

An Teallach is a site of great importance for Quaternary geomorphology. It not only supports a remarkable range of high-level periglacial phenomena developed on Torridonian sandstone, but has also been the focus of the most detailed investigation of upland periglaciation in Great Britain (Ballantyne, 1981). Furthermore, individual types of periglacial feature are exceptionally well developed, particularly in the case of aeolian and niveo-aeolian features and oblique terraces. The scientific work that has been carried out on An Teallach has also demonstrated the fragility of the mountain summit environment and how it has been disturbed in recent years. Such disturbance may have been due partly to climatic change (the Little Ice Age), but Man's activities, particularly the introduction of sheep and consequent degradation in the vegetation, has more probably had the major impact.

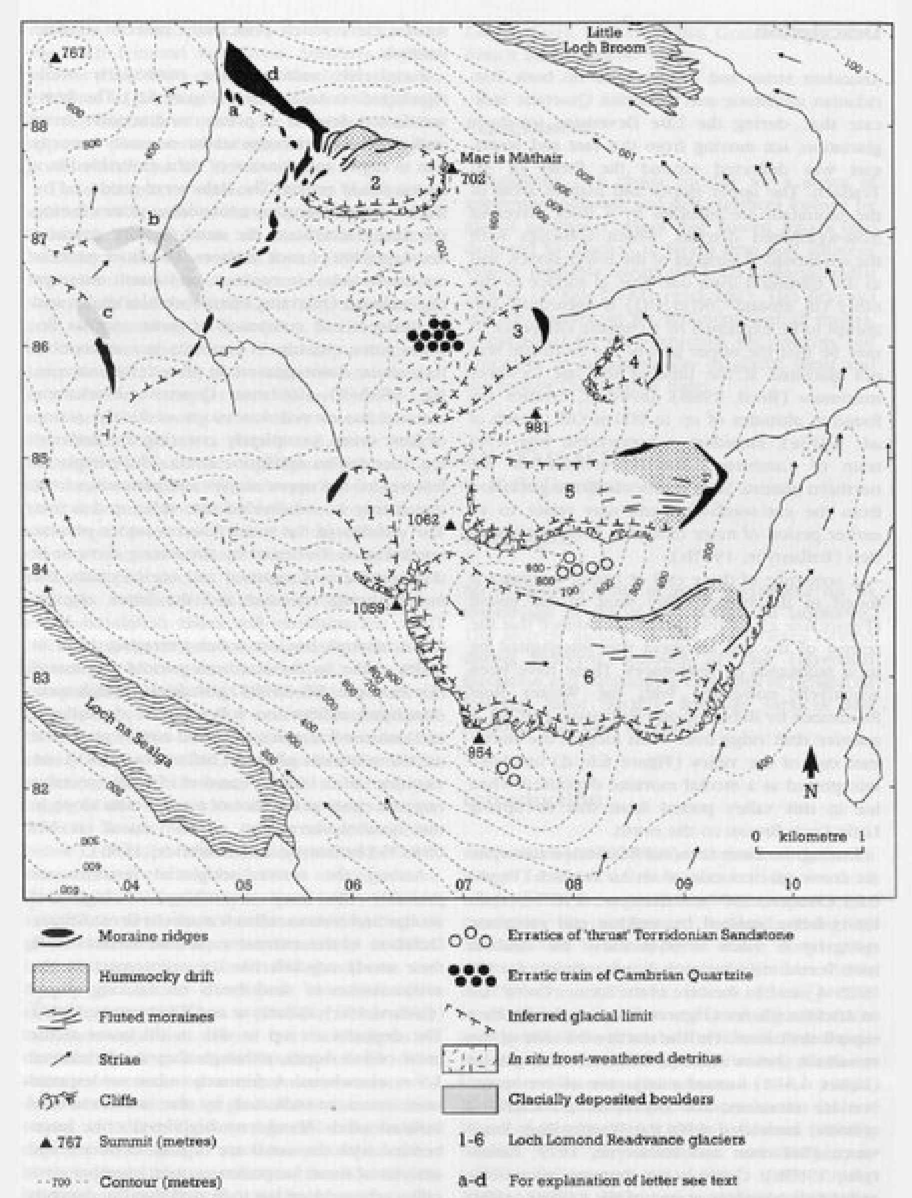
The assemblage of periglacial phenomena on An Teallach is outstanding not only in its own right, but also because it complements features of interest at a range of other sites on different rock types and in different mountain environments (see Ronas Hill, Ward Hill, Ben Wyvis, the Cairngorms, Sgùrr Mòr·, and the Western Hills of Rum), which together represent most major facets of the periglacial geomorphology of upland Scotland. An Teallach demonstrates better than any other mountain the range of landforms developed on a sandstone substrate.

An Teallach is of significant scientific interest in a second respect. It is exceptional in demonstrating, in a small area, evidence relating to several glacial phases. This includes high-level erratics that reflect the former passage of an ice-sheet over much of the mountain, periglacial trimlines that may represent the upper level of the last (Late Devensian) ice-sheet, and moraines of both the Wester Ross Readvance and the Loch Lomond Readvance. It provides key evidence showing Wester Ross Readvance moraines truncated by Loch Lomond Readvance moraines, thereby establishing their stratigraphic relationship (see also Ballantyne, 1986a). In at least two cases, the Loch Lomond Readvance moraines and drift limits are outstanding examples of their type.

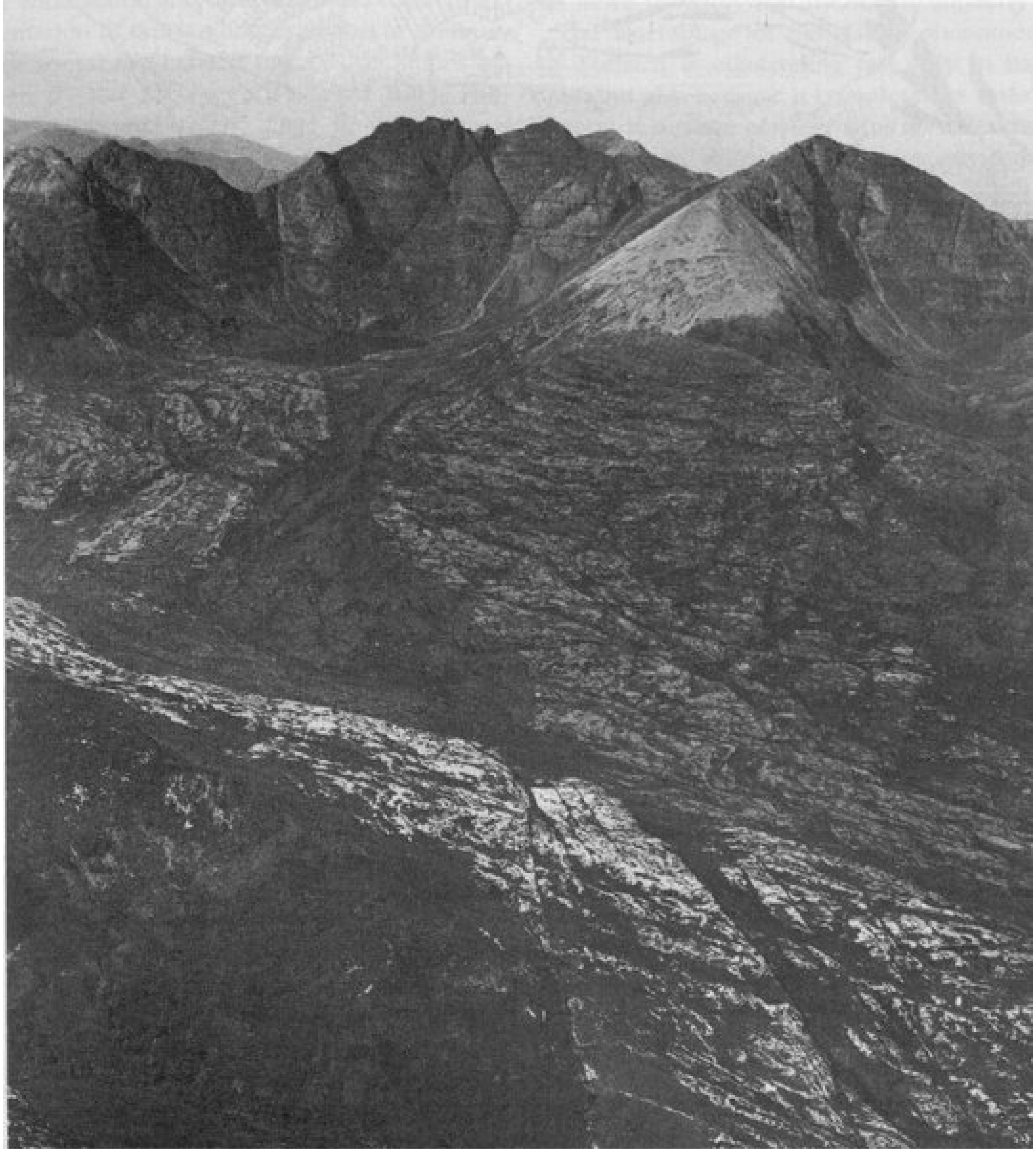
Conclusion

An Teallach is outstanding for its assemblage of glacial and periglacial landforms. The former include an exceptional range of features, including deposits and moraines associated with the Late Devensian ice-sheet at its maximum, the Wester Ross Readvance and the Loch Lomond Readvance. The latter include both fossil and active forms, most notably a series of features formed by wind erosion, which is probably the finest of its kind in Britain. An Teallach is a key reference site for periglacial landforms developed on Torridonian sandstone mountains and is the most intensively studied site in upland Britain.

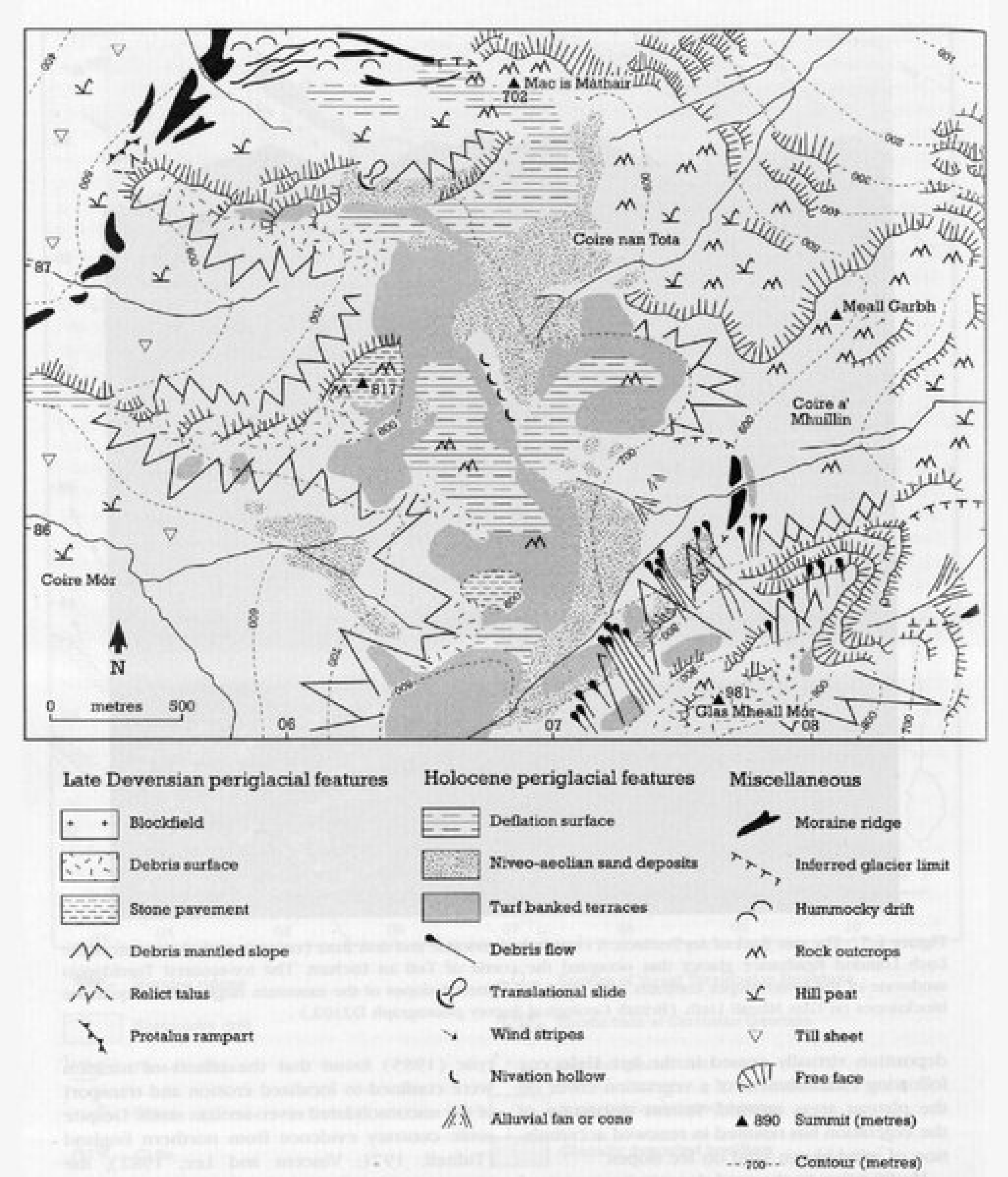
References



(Figure 6.6) The An Teallach area, showing principal glacial features and the limits of former glaciers (from Ballantyne, 1987b).



(Figure 6.7) The east flank of An Teallach. A clear lateral moraine and drift limit (centre) mark the extent of the Loch Lomond Readvance glacier that occupied the corrie of Toll an Lochain. The ice-scoured Torridonian sandstone of the lower slopes contrasts with the frost-shattered slopes of the mountain ridge and the quartzite blockslopes on Glas Mheall Liath. (British Geological Survey photograph D2102.)



(Figure 6.8) Periglacial landforms and deposits on the northern plateau of An Teallach (from Ballantyne, 1984).