Ben Wyvis

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Highlights

Ben Wyvis is outstanding for an assemblage of periglacial landforms developed on Moine schist, most notably non-sorted, patterned ground features and solifluction sheets and lobes.

Introduction

The Ben Wyvis massif in Easter Ross, 30 km north-west of Inverness, is composed of Moine schists and gneisses and rises to 1046 m OD at the summit of Glas Leathad Mòr [NH 463 684]. The summit ridge and upper slopes of the mountain are notable for a range of periglacial landforms formed during the Lateglacial and Holocene. These were first studied by Galloway (1958, 1961a) in the course of his pioneering work on the periglaciation of Scotland, and his map of the solifluction phenomena in this area, although somewhat misleading, has been reproduced in several texts (for example, Sisson, 1965; Embleton and King, 1968, 1975b; Curtis *et al.,* 1976). The features described by Galloway have subsequently been investigated in detail by Ballantyne (1981, 1986b).

Description

The periglacial landforms developed on Ben Wyvis include solifluction lobes and sheets, 'ploughing boulders', nivation hollows, turf hummocks and non-sorted stripes (Figure 7.23). During the Late Devensian glaciation, ice from the west flowed around the flanks of the mountain, but there is no direct evidence to indicate whether the main ridge, which generally exceeds 900 m, was ice-covered (Peach *et al.,* 1912). Romans *et al.* (1966) concluded that the smooth, vegetation-covered regolith that mantles most of the massif is till of pre-Devensian age. The presence of silt droplets in the soils of the main ridge was interpreted by Romans *et al.* (1966) and Romans and Robertson (1974) as evidence of former permafrost and indicative of periglacial modification of the regolith. However, Ballantyne (1981, 1984) has argued that the whole thickness of the regolith, which varies in depth from 0.7 m on the plateau to over 2 m on the slopes, was produced by frost weathering. Where underlain by schists and gneisses, the regolith consists of pebbles and boulders embedded in a mica-rich, silty sand matrix, this being typical of the frost-susceptible soils developed on schistose mountains in the Highlands. As indicated by Ballantyne (1981, 1987a), the nature of the regolith represents a primary control on the range of periglacial landforms that develop on a particular mountain summit.

Lobes and sheets of debris are outstandingly well-developed on the steep (25°–30°) northwest flank of Ben Wyvis (Figure 7.23), where Galloway described 'stone-banked' (actually turf-banked) and smaller 'turf-banked' (actually vegetation-covered) lobes. He explained the distribution of the two types in terms of lithological differences. Ballantyne (1981) found that the vegetation-covered features had encroached on the turf-banked lobes, burying the relict block-slopes on which the latter were developed. He concluded that the fossil turf-banked lobes, which show pronounced evidence of vertical frost sorting, had moved downslope by a combination of frost creep and gelifluction, probably under permafrost conditions. The vegetation-covered features show a transition from sheets with straight-fronted scarps on gentle slopes near the crest of the slope, through lobe-fronted sheets, to individual lobes that descend to an altitude of about 750 m OD. These forms are non-sorted and have developed by gelifluction *sensu stricto,* and are currently moving downslope at a rate of a few millimetres per year. The vertically sorted, turf-banked lobes are apparently inactive, apart from the washing out of interstitial fine material, evident in places in the form of spreads of sand in front of lobe 'risers'. However, in one excavation a buried podsol was found containing Holocene pollen assemblages (Ballantyne, 1984), implying movement under climatic conditions not dissimilar from those of today. Both types of feature are also developed on the east side of the massif, as are relict, vegetation-covered boulder lobes, active ploughing boulders and, on sheltered slopes, active turf-banked terraces produced by frost creep (Figure 7.23). Nivation benches on the higher eastern slopes of the mountain are relict features (Ballantyne, 1985).

On the plateau area and the surrounding gentle slopes, Galloway (1961a) identified 'ring' and 'stripe' patterns in the vegetation. The former take the form of turf hummocks 0.06–0.44 m high and 0.28–1.27 m in diameter; on very gentle slopes these tend to form lines downslope which, in turn, grade into a well-developed, non-sorted ridge-and-furrow stripe pattern of similar dimensions (Ballantyne, 1986b). Transitions between these types occur at 1–6° and 6–11°, respectively and relief stripes are poorly developed on slopes greater than 20° and absent from slopes above 25°. The hummocks are clearest to the north of the main summit and the stripes are superbly developed south-east of Tom a'Choinnich [NH 464 700]. Excavation of these patterned ground features revealed mature podsols underlying both the up-raised portions and the depressions, but no evidence of lateral frost sorting (Ballantyne, 1986b). The origin of these features is uncertain. Galloway (1958, 1961a) interpreted them as being inherited from fossil sorted polygons and stripes formed under climatic conditions more severe than at present (see also Chattopadhyay, 1982). Ballantyne (1986b) offered the alternative explanation that the features are the product of modification by mass displacement of non-sorted, vegetation-defined patterns similar to those found in the high arctic at present (see Washburn, 1979, pp. 151–153).

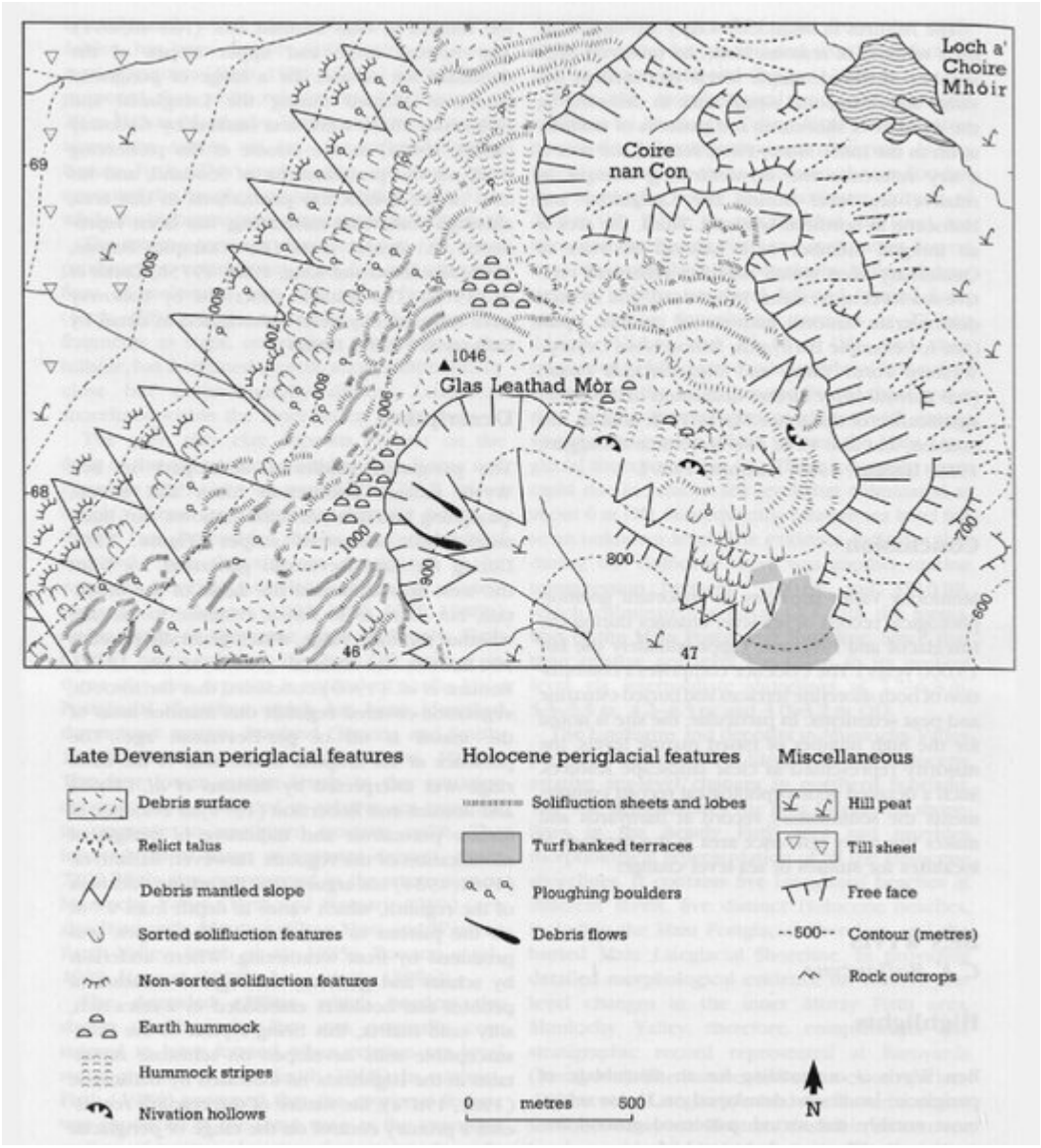
Interpretation

Ben Wyvis is an important locality for its range of types and degree of development of relict and active periglacial features. In particular, the massif supports the most extensive known area of non-sorted relict stripes in Scotland, together with some of the finest examples of active non-sorted solifluction sheets and lobes. The presence of the undisturbed podsols within the inactive features suggests that they are of Lateglacial age (Ballantyne, 1986b). The frost-susceptible nature of the regolith derived from the Moine schist and gneiss bedrock is a fundamental control on the development of these features, and hence the periglacial landforms found on Ben Wyvis contrast with those found on mountain summits underlain by different lithologies and therefore regoliths (see Lochnagar, An Teallach, Ward Hill, Ronas Hill and the Cairngorms). Particularly striking is the contrast between the assemblage of periglacial features on Ben Wyvis and that on An Teallach, a nearby mountain of Torridonian sandstone of similar altitude and relief. Active solifluction features, 'ploughing boulders', earth hummocks and non-sorted stripes are absent from the coarser regolith of the latter, which supports instead a wide range of wind-related forms, such as deflation surfaces and niveo-aeolian sand deposits (Ballantyne, 1984, 1987a).

Conclusion

Ben Wyvis is important in the network of localities for periglacial landforms, providing an exceptionally good range of active and fossil features developed on Moine schist. It is particularly noted for the fine development of an assemblage of patterned ground forms that comprise vegetated hummocks and vegetated ridges and furrows; these originally formed under more severe climatic conditions than at present. Ben Wyvis also displays excellent examples of sheets and lobes of debris, moved downslope by slow mass movement of the soil; some of these features are still active.

References



(Figure 7.23) Periglacial landforms and deposits on the summit ridge of Ben Wyvis (from Ballantyne, 1984).