Ward Hill, Enegars Corrie and Dwarfie Hamars

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Highlights

This site is notable for its assemblage of periglacial and glacial interests. The periglacial landforms and deposits include a range of wind- and frost-related features on Ward Hill that provide a record of slope activity and soil movements both at the present day and earlier during the Holocene. The end moraines at Enegars Corrie and Dwarfie Hamars are thought to have formed during the Loch Lomond Stadial and provide important evidence for palaeoclimatic reconstruction.

Introduction

Ward Hill [HY 229 023] is located in the north of the island of Hoy. It is the highest hill in Orkney at 479 m OD and is separated from the immediately neighbouring hills, Cuilags (433 m) and Knap of Trowieglen (399 m), by two valleys each over 200 m deep (Figure 4.3). The summit area of the hill forms a broad, approximately north–south aligned ridge some 1.6 km long with secondary ridges extending eastwards and westwards at its northern and southern ends. Over 2.5 km^2 of ground lie above 300 m OD, of which slightly under 1 km^2 is at over 400 m OD. The hill is fully exposed to winds from the open sea.

Ward Hill is important for periglacial geomorphology and demonstrates a fine assemblage of active and fossil landforms. By virtue of its northern location, it is a prime site in a network of mountain summits for studying the distribution of upland periglacial features in Scotland. It is particularly noted for landforms associated with wind activity, described by Goodier and Ball (1975). Additional interest in the hills of North Hoy is provided by end moraines at Enegars Corrie [HY 200 043] on Cuilags and at Dwarfie Hamars [HY 245 005] on Knap of Trowieglen, which are tentatively ascribed to the Loch Lomond Readvance. The moraine at Enegars Corrie has been described by A. Geikie (1877), Peach and Horne (1880), Wilson *et al.* (1935) and Rae (1976).

Description

The hills of northern Hoy are underlain by Hoy Sandstones of the Upper Old Red Sandstone (Mykura, 1976). These Devonian sandstones are medium-grained and generally well sorted, in keeping with their fluvial origin. They are near-horizontally bedded, but slight variations in lithology are reflected in their resistance to weathering. The harder beds form prominent crags and steps on the hillsides, whereas the softer beds weather to a loose sand.

Four main types of periglacial feature have been described from Ward Hill by Goodier and Ball (1975). These they termed turf-banked terraces, wind stripes, hill dunes and composite stripe/terrace features. Although they do not include them as a separate category, it is apparent from the descriptions that deflation surfaces are also well-developed.

The turf-banked terraces (Figure 4.4) have typical dimensions of 2–3 m across the 'treads', with slopes of about 15°, and the 'risers' have widths of 3–5 m and slopes of 25–35°. The 'treads' are vegetation-free, and the long-axis of the terraces is either parallel to the contours or aligned obliquely across the slope. According to Goodier and Ball (1975), in the former case, the principal influence in the formation of the terraces is frost action, whereas in the latter, the action of wind on the vegetation has orientated the features towards the effective wind direction, forming composite stripe/terraces.

Wind stripes are strikingly developed on Ward Hill. Goodier and Ball (1975) distinguished three separate types. The first comprises regular, continuous stripes in which the vegetated parts are generally straight-sided and parallel; the second, regular continuous stripes with non-uniform widths and curving margins; and the third, scattered crescentic vegetated areas on deflation surfaces. The first type occurs on the exposed southern face of the hill, and here the stripe alignment is generally parallel to the contours. The vegetated stripe widths in this area are from 0.2 to 1.7 m and the inter-stripe zones are 0.52–0.78 m wide. The wind-cut stripe faces average 0.14 m in height. These regular features merge

along-slope with wind-formed vegetation waves where vegetation cover is complete, but elongate zones of growing *Calluna vulgaris* alternate with zones of dead *Calluna* stems and lichens (see Bayfield, 1984).

The features termed hill dunes by Goodier and Ball (1975) consist of areas in which eroded sand-sheets capped by vegetation stand as remnants above deflation surfaces. The name is therefore somewhat misleading, as the 'dunes' are not constructional features. The sands have a distinct stratification: a surface horizon of about 0.1 m of grey sand overlies a yellowish-brown sand to a depth of 0.7 m, with a buried surface horizon between 0.7 m and 0.84 m, a second bed of brown sand to 0.94 m and then a further buried surface horizon at 0.9 m–0.95 m, with underlying sand to 1.2 m. Below the sands is a diamicton consisting of weathered sandstone clasts in a sandy clay matrix. A similar diamicton also underlies the deflation surfaces. The stratification of the sand deposits is indicative of alternating periods of stability and sand move ment, but no studies have been carried out on the age of the deposits. Similar sand-sheets and interbedded soil horizons have been described on Ronas Hill (Ball and Goodier, 1974) and on An Teallach (Ballantyne and Whittington, 1987). At the latter locality it was demonstrated that sand deposition began in the early Holocene but was much reduced by the establishment of vegetation cover during the Holocene. However, recent disruption of the vegetation due either to climatic deterioration or to overgrazing has resulted in a renewed phase of sand erosion and redeposition. A similar history may apply to the Ward Hill sands, with the lower slopes of Ward Hill also providing clear evidence of former slope activity in the form of gullied drift and fan deposits.

The slopes of Ward Hill are covered in a debris mantle and there is no clear evidence within the corrie-like recesses flanking the hill for local glaciation post-dating the last period of ice-sheet glaciation. However, to the north in Enegars Corrie and to the south below Dwarfie Hamars, clear end moraines can be observed. The Enegars moraine is a single ai cuate ridge, up to 6–8 m high, descending to approximately 100 m OD and associated with a former glacier with a northeast aspect. The Dwarfie Hamars landforms comprise at least three distinct arcuate moraines, the outermost reaching down to about 50 m OD. The famous Dwarfie Stone is an erratic boulder resting on one of the moraines. The age of these moraines has not been established, but there is a notable difference in the degree of development of screes and slope debris mantles within the moraines compared with those on the adjacent slopes outside them. This suggests that the small glaciers that formed the moraines developed in favoured localities during the Loch Lomond Stadial. If this attribution is correct, it suggests that the debris mantles on the slopes of Ward Hill developed in major part during, or prior to, the Loch Lomond Stadial.

Interpretation

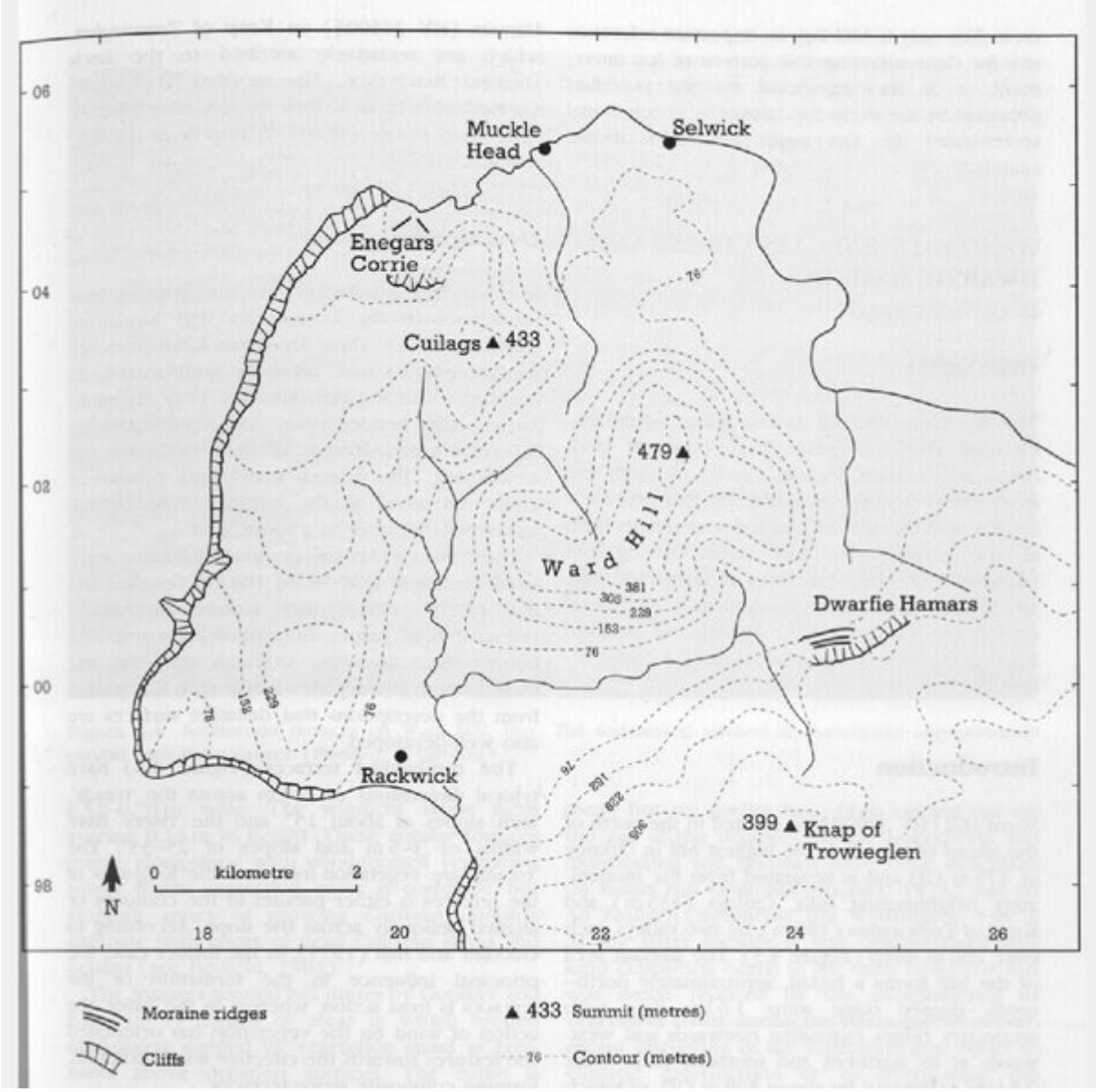
Periglacial deposits occur on the summits of most Scottish mountains. It is possible to divide these deposits into two broad age-groups: those formed during the cold phases of the Late Pleistocene and those formed under the milder conditions of the Holocene (Ballantyne, 1984, 1987a). The processes responsible for the formation of the latter periglacial features are normally still operative on Scottish mountains. The types of both fossil and active periglacial landforms and sediments that may be encountered on particular summits are related to the underlying bedrock and the climatic conditions, especially the temperature regime and the degree of exposure. As the above conditions vary throughout the country, understanding of the development of the dif ferent types of periglacial deposits is dependent upon the study of summits in different areas. In this context, Ward Hill occupies a critical position because of its location in the Orkney Islands and the range of periglacial features developed on it. Initial studies have emphasized the role of wind in the landform development, a feature that Ballantyne (1981) considers important in understanding the unique periglacial environment of Scottish mountain tops. There is considerable potential for the further study of the sand deposits on Ward Hill. Their present erosion, together with the evidence from their stratification of episodic stability in the past, indicates the fragile nature of the balance between formation and disruption of these hill-top deposits.

The moraines of Enegars Corrie and Dwarfie Hamars are significant in a national context. If they are of Loch Lomond Stadial age, then they represent some of the northernmost glaciers at this time in Britain and therefore have a significant bearing on reconstructing the palaeo-climate of the stadial. In particular, they suggest glacier equilibrium line altitudes of about 150 m OD, which compares with values of 319 m for Skye (Ballantyne, 1989a) and 357 m OD for Rum (Ballantyne and Wain-Hobson, 1980) on the western seaboard of Scotland (see also Sissons, 1979d).

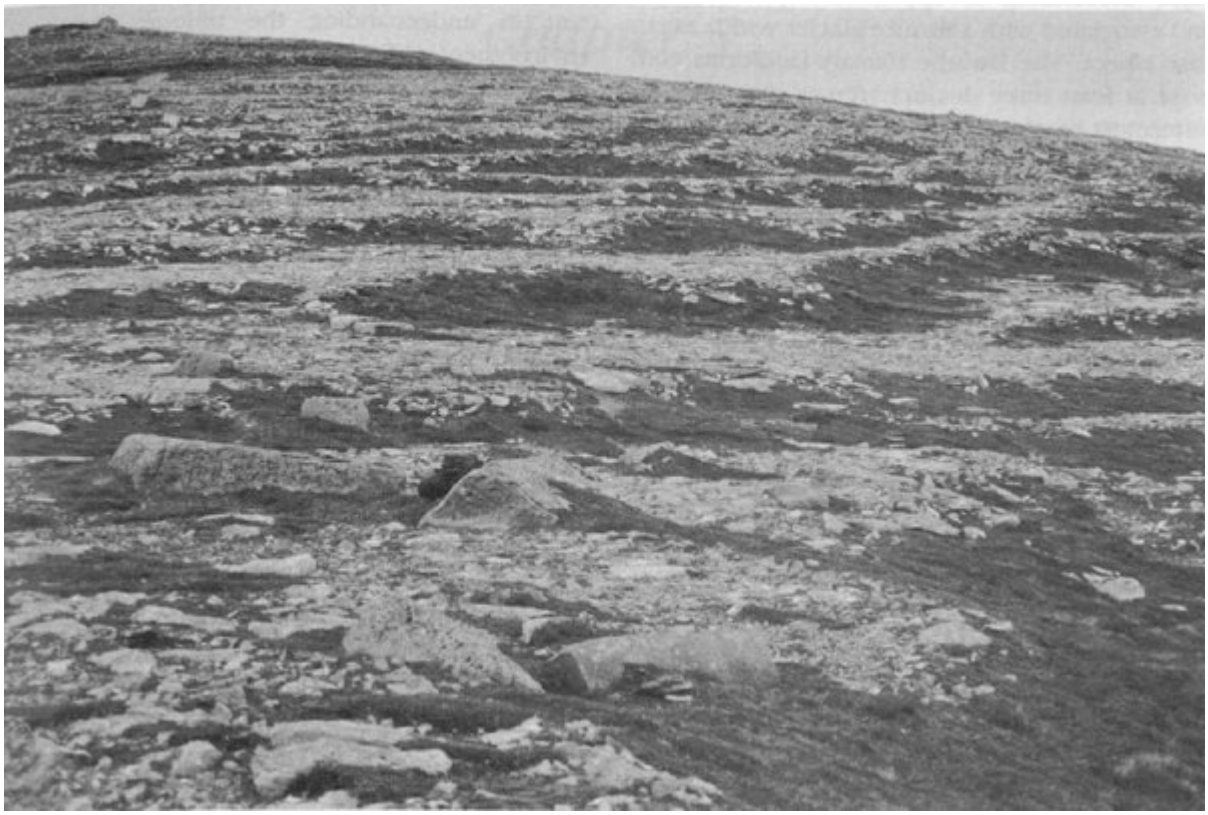
Conclusion

This area in the north of Hoy is important for its assemblage of landforms created by periglacial and glacial processes. It is particularly noted for a series of deposits formed principally by wind action, but also includes others modified by the combined action of wind and frost. These periglacial deposits provide a vital record from this northern locality of the history of past episodes of slope stability and erosion. There is significant potential for further research to establish the timing and causes of the erosion. The interest of the site also includes moraines believed to have been formed by glaciers, about 11,000–10,000 years ago, during the cold period known as the Loch Lomond Stadial. As such, they are the northernmost features of their kind in Britain and therefore are significant for reconstructing the climate of the stadial.

References



(Figure 4.3) Location map of North Hoy.



(Figure 4.4) Solifluction terraces on Ward Hill, Hoy. The turf-banked terraces are orientated approximately parallel with the contours. (Photo: J E. Gordon.)