Ronas Hill

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Highlights

The periglacial landforms and deposits at Ronas Hill include a range of active and fossil features formed by wind- and frost-related processes. On account of its northern location and relatively low altitude, Ronas Hill is a key locality for the study of periglacial activity in Scotland.

Introduction

Ronas Hill [HU 316 835] is the highest summit (453 m OD) in Shetland. It is important for periglacial geomorphology and demonstrates an outstanding assemblage of both active and fossil patterned-ground landforms which are developed at relatively low altitudes. Combined wind and frost effects are particularly striking and include turf-banked terraces, wind-blown sand deposits and vegetated stripe features. The landforms of Ronas Hill have been described principally by Ball and Goodier (1974), Goodier and Ball Interpretation (1975) and Veyret and Coque-Delhuille (1989).

Description

Ronas Hill is formed of granophyre, part of the Ronas Hill Granite intrusion of Devonian age, which is itself cut by a series of north–south trending felsitic dykes (Mykura, 1976). Galloway (1958, 1961a) recorded the presence of block-fields and boulder terraces at 365–427 m OD on Ronas Hill similar to those on the Cairngorms at altitudes between 1067 and 1219 m OD. He posed the question whether the blockfields in such an oceanic environment as Shetland might derive in part from deep chemical weathering of the granite.

Ball and Goodier (1974) later identified four main groups of periglacial landforms developed on the granite regolith of Ronas Hill: turf-banked terraces, wind stripes, 'hill dunes' (wind-blown sand deposits) and composite stripe-terrace features. They also noted, but did not describe, large, fossil boulder terraces and blockfields, and small, active stone circles.

Turf-banked terraces include features aligned parallel to the ground surface contours, reflecting solifluction processes operating in a relatively mobile surface soil layer. A second type of terrace aligned obliquely to the contours probably reflects the combined influence of wind and solifluction activity. Wind stripes take the form of narrow strips of vegetation, with steeper windward and gentler leeward faces related to the effective wind direction. They occur both as continuous stripes and as fragmented crescents of vegetation. 'Hill dunes' appear as vegetated areas of sand rising up to 1 m above adjacent deflation surfaces. They are relics of a formerly more extensive soil and vegetation cover, but the presence of buried humic horizons indicates episodic accumulation. Composite features occur where terraces intersect wind stripes. Overall, however, it is important to emphasize the total assemblage of wind, frost and mass-movement features present and their spatial interactions according to local conditions of slope and exposure (Veyret and Coque-Delhuille, 1989); for example, terrace treads support wind stripes and bare areas between vegetated stripes show the effects of frost sorting. Ball and Goodier (1974) considered that the large-scale relict landforms are probably of Late-glacial age and that the wind-blown material accumulated during the early Holocene. They also argued that erosion of the 'hill dune' vegetation cover and development of the turf banked terraces occurred possibly during the Little Ice Age between about AD 1550 and 1750. Although possible wider correlations are premature in the absence of firm dating, it is worth noting that elsewhere in Scotland radiocarbon dating has indicated that there was active solifluc-tion during the late Holocene (Sugden, 1971; Mottershead, 1978; Ballantyne, 1986c). Elsewhere, aeolian sand and silt deposits are represented on Ward Hill (see below) and mountain summits of north-west Scotland (Sissons, 1976b; Birse, 1980; Pye and Paine, 1984; Ballantyne, 1987a). On An Teallach (see below), Ballantyne and Whittington (1987) established that accumulation of niveo-aeolian sands began during the early Holocene, before about 7900 BP, and was reactivated more recently,

possibly either during the 17th and 18th centuries when the Little Ice Age weather conditions were most severe in Scotland, or during the 19th century following overgrazing. In County Donegal in Ireland, Wilson (1989) identified two periods of Holocene sand-sheet accumulation, with the most recent erosion commencing before the late nineteenth century. Recognition and correlation of widespread climatic or anthropogenic causes, however, must await more detailed site-specific studies of sediments, palynology and dating. Ballantyne (1991a), in particular, has sounded a note of caution in ascribing late Holocene erosion to climatic deterioration, as the connection is based entirely on inferred coincidence of timing.

The assemblage of wind- and frost-related, patterned ground features has developed at a relatively low altitude on Ronas Hill under the subarctic, oceanic climatic conditions of the area (for details see Spence, 1957, 1974; Birse, 1971, 1974). Similar features typically occur at much higher altitudes in the mountains of mainland Scotland (see An Teallach, Sgùrr Mòr, Ben Wyvis, and the Cairngorms) (Crampton, 1911; Peach *et al.,* 1913a; Crampton and Carruthers, 1914; Galloway, 1958, 1961a; Godard, 1965; Kelletat, 1970a, 1972; King, 1971b; Goodier and Ball, 1975; Ballantyne, 1981, 1987a; Pye and Paine, 1984). Ronas Hill is also distinguished by the range and quality of the features present in a relatively compact area, and Ball and Goodier (1974) noted that the interaction of wind and frost effects was more clearly demonstrated than at any other site in Britain known to them. Further, the combined effects of wind and frost can be readily investigated and evaluated in an area of uniform geology and with a range of slopes and aspects. Although Ward Hill in Orkney is similar in its range of landforms to Ronas Hill, active frost processes there are less evident, so that the two hill masses essentially complement each other in their periglacial interests.

In a national context Ronas Hill forms a northern end member of a network of sites representing past and present periglacial activity. It is a key site for studies of spatial variations in periglacial processes in Britain and the essential controlling variables (see Ballantyne, 1987a). Considerable potential exists for studies of current periglacial processes, landform history and dating of the buried soils. As yet no investigation has been undertaken of the larger relict landforms, their palaeoclimatic significance and their relationships to the active features. Ball and Goodier (1974) highlighted two important results that would arise from a comprehensive study of the wind- and frost-related features on Ronas Hill together with those on Ward Hill — 'on the one hand, it should help to elucidate the complex post-glacial and recent history of changing stability, wind erosion, and frost-induced disturbance and movement in the northern climatically stressed hill areas and, on the other, provide a sensitive long term monitor of regional climatic change'.

The fossil periglacial features form part of a network of such sites in Scotland (for example, An Teallach, the Cairngorms) which have attracted recent attention for their possible significance in delimiting the vertical dimensions of the last ice-sheet (Ballantyne *et al.,* 1987; Reed, 1988; Ballantyne, 1990). Those on Ronas Hill have not been studied in detail but merit investigation particularly in relation to their age or ages of origin and possible relationships to the limit of the last ice-sheet (Veyret and Coque-Delhuille, 1989). There appear to be three possibilities: such features may pre-date the last ice-sheet but were preserved beneath cold-based or inactive ice; they may have developed if Ronas Hill remained as a nunatak above the surface of the Shetland ice-cap; or they may have been formed or reactivated during the Loch Lomond Stadial.

Conclusion

Ronas Hill is outstanding for its assemblage of landforms developed under periglacial (cold climate) conditions, particularly those formed by the combined effects of wind and frost activity. It represents the northernmost occurrence of such features in Scotland and is notable for their development at relatively low altitudes. Ronas Hill has significant potential for research both on contemporary periglacial processes and on the history of upland geomorphological changes during approximately the last 13,000 years.

References