

TRÀIGH NA BERIE

OS Grid Reference: NB103360

Introduction

Tràigh na Berie is one of the largest beach, dune and machair complexes on the Isle of Lewis in the Outer Hebrides of Scotland (Ritchie and Mather, 1970b; see Figure 9.1 for general location). Set in the rugged terrain of the ice-scoured Lewisian gneiss, Tràigh na Berie is relatively sheltered and contains a spectacular assemblage of soft coastal landforms including a wide beach, dunes, machair plain and hill machair. The coastal edge in the west and extreme east is now marked by erosion whereas the central part of the beach is experiencing accretion and embryo dunes characterize the coastal edge. Actively accreting dunes are unusual in Scotland and thus are of considerable geomorphological interest. The key geomorphological interest of Tràigh na Berie lies in the dynamism of the inter-relationships between the individual landform components of beach, dune, and machair.

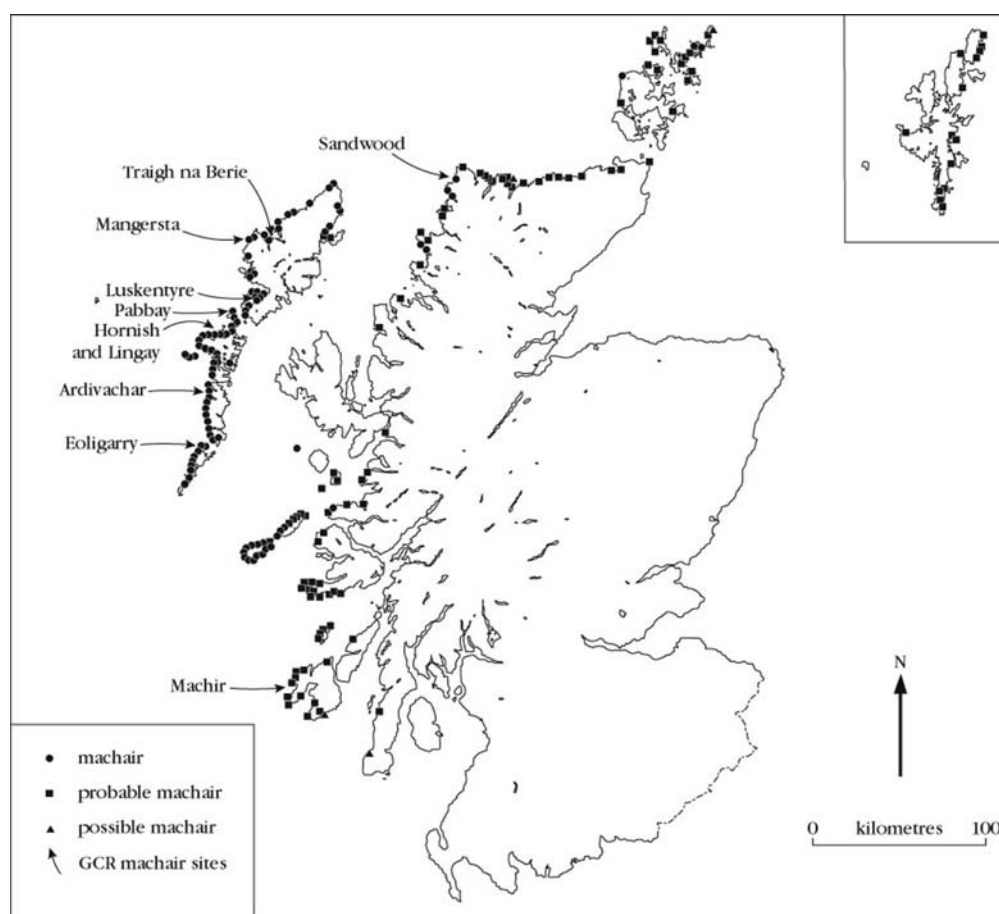


Figure 9.1: Distribution of machair in Scotland. Other than Sandwood, Torrisdale and Balta (see Chapter 7), all the sites included in the GCR fulfil both the geomorphological and vegetational definition of machair. Small vegetational differences in the above sites have resulted in the label 'probable machair'. Ongoing work that interprets the geomorphology and botany of machair aims to provide a definitive machair diagnostic test in the future and so the above classification will be subject to slight modification (Angus, 2003, pers. comm.). (After Hansom and Angus, 2001.)

Description

Tràigh na Berie, on the north-east side of the Valtos peninsula, is a wide 1.5 km-long sand beach extending in a long smooth curve between the rocky headlands of Sròn a'Chnìp to the west and Stung to the east. Both headlands and the surrounding terrain are composed of

resistant Lewisian gneiss. Behind the beach a wide dune and machair system extends inland onto steep ice-scoured slopes of gneiss. A linear depression cutting across the Valtos peninsula has been infilled with sand (Tràigh Teinish) which extends to a small beach to the south. A number of small lochs, located between the bedrock to the south and the advancing machair, are gradually being infilled by blown sand (Ritchie and Mather, 1970b; Figure 9.18). The main beach has a north-east aspect, facing into the relative shelter of Loch Roag. The adjacent coastline is highly crenulate and additional shelter is afforded to Tràigh na Berie by many small islets, the largest of which lie to the north-west and north-east (Figure 9.19). The sand at Tràigh na Berie beach is composed of fine, shell-rich sand of median diameter 0.2 mm and 47% calcium carbonate content. The upper beach, which forms the nourishment zone for the dune system, is over 50 m wide in the west but narrows to only 15 m in the east (Ritchie and Mather, 1970b). In spite of these intertidal widths, in 1970 the coastal edge in the extreme west was marked by a low sand-cliff, between 1–3 m high, eroded into machair and with no foredunes to the seaward side (Ritchie and Mather, 1970b). In contrast, the eastern end in 1970 was marked by rapid accretion with large quantities of sand accumulating in the form of broad dune ridges up to 12 m high across the mouth of the Tràigh Teinish depression. In view of this, Ritchie and Mather (1970b) suggested an easterly drift of sediment and an anticlockwise rotation of the beach arc, a view echoed by Ramsay and Brampton (2000e). However, by July 1994 most of the eastern coastal edge was undercut and showing signs of erosion. The development of embryo dunes was localized to only one central section of the beach, with little sign of coastal accretion at the east end (Keast, 1995). Figure 9.20 shows the undercut erosional edge in October 2001; it appears that the proportion of coastal edge experiencing erosion has increased greatly since it was first described in the 1970s.

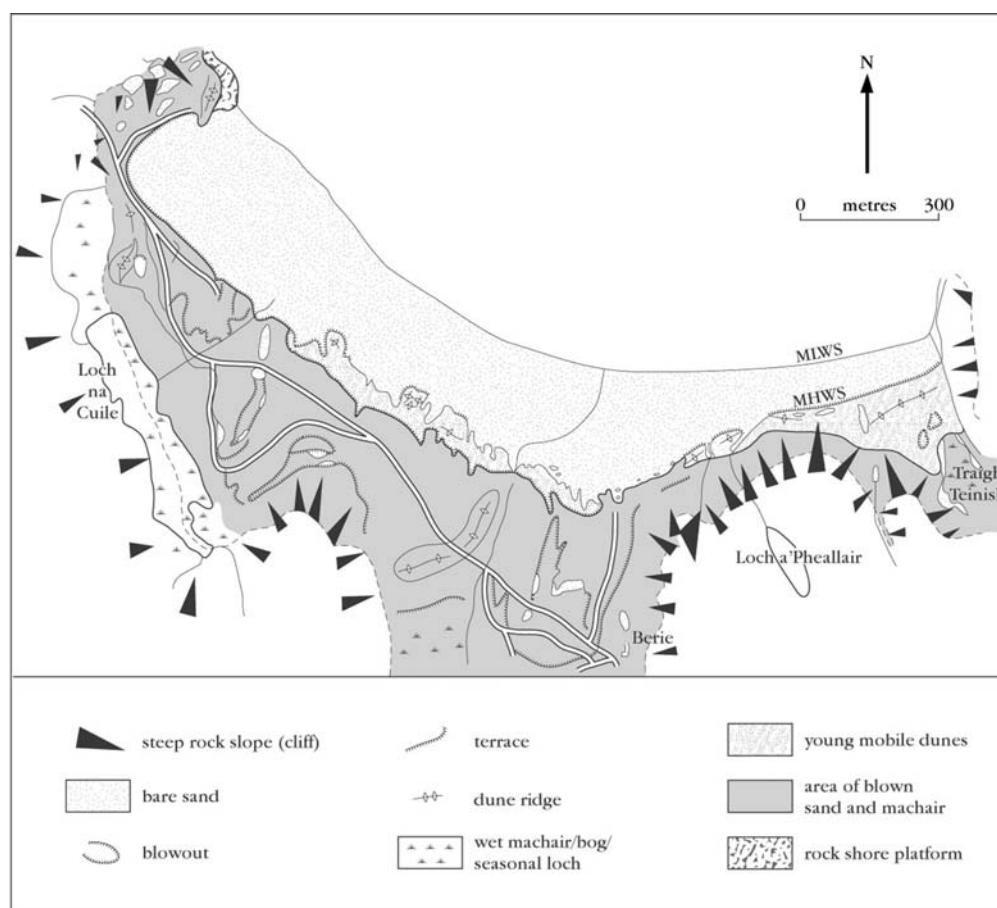


Figure 9.18: The geomorphology of Tràigh na Berie showing a mainly eroding coastal edge (see Figure 9.20). Several small lochs that lie behind the machair surfaces are subject to infill by blown sand. (Modified from Ritchie and Mather, 1970b.)



Figure 9.19: An aerial view of Tràigh na Berie from the south-west taken in the mid-1980s shows a dynamic coastal edge subject to pressure from tourist caravans and resulting in substantial wind-blow and destabilization. Caravans are now restricted to the central section of the dune and machair area. (Photo: S. Angus.)



Figure 9.20: This view of Tràigh na Berie from the east (October, 2001) shows a wide intertidal zone backed by an undercut dune cordon and machair to landward. (Photo: J.D. Hansom.)

Dune forms are best developed in the central–eastern part of the site (Figures 9.18 and 9.20) where the coastal edge is characterized by low mobile dunes, up to 5 m high but which

increase in height towards the east (Keast, 1995). Along parts of this foredune ridge, wave undercutting has exposed parts of the dune face that are now subject to wind erosion and deflation. In 1970 the dune face in the central part of the beach was accreting with embryo dunes developing into short north–south-trending dune ridges separated by stretches of bare sand that coalesce in places to form continuous, coast-parallel foredune ridges (Ritchie and Mather, 1970b). In 1970 these embryo and foredunes abutted discontinuously against an abandoned machair edge, suggesting that the period of rapid foredune accretion observed in 1970 post-dates a previous period of machair erosion (Ritchie and Mather, 1970b). However, by 1995 the ridge had eroded in several places and had been completely breached around NB 110 357 (Keast, 1995) as a result of frontal wave erosion followed by wind deflation. In the east, within Tràigh Teinish, large broad dune ridges are orientated in a north–south direction and reflect the topographical channelling of winds.

Seawards of the beach and dune zone a wide machair plain, characterized by numerous erosional edges most of which are now healed, extends inland to the steep, ice-scoured gneiss slopes. The machair impounds several small lochs, which are gradually being infilled by blown sand to form marshy depressions. A major erosional terrace lies over 400 m landward of the high-water mark and separates the machair into two major units (Figure 9.18). The larger area of machair lying to the seaward side of the scarp is flat and scarred by numerous small and low erosional edges. The smaller machair unit to landward of the edge slopes gently landwards and grades into the wet machair, marshes and impounded lochs. Farther inland considerable areas of hill machair have developed on the steep gneiss slopes. In places the hill machair is eroded and blowthroughs and exposed sand cliffs are present. At the extreme east end of the site, behind the coastal dune cordon, a level area of machair lies close to the water table.

Interpretation

Tràigh na Berie is a small basin that has become infilled with sand driven onshore by a rising sea level during the late Holocene. Since there is no evidence that gravel ridges underlie the beach, it can be assumed either that gravels were not a major constituent of the source materials or that gravel ridge development failed to occur, probably on account of the low levels of wave energy within the bay. It may also be the case that if the sand budget at Tràigh na Berie has been positive until recently, any gravel ridges still remain to be sectioned and exposed. Ritchie and Mather (1970b) described Tràigh na Berie as a relatively well-nourished and stable beach dominated in places by rapid accretion. The main source of sediment to the beach and dune system was, and still is, derived from the sand-covered seabed of West Loch Roag (Ritchie and Mather, 1970b). The high proportion of shell-derived beach sand suggests a significant offshore sand source but it is unknown whether the supply of sand at Tràigh na Berie has diminished recently. There is morphological evidence to suggest that the beach undergoes temporary changes from accretion to erosion and that the beach is currently mainly erosional (Figure 9.20).

The erosion of the machair edge in the west and rapid dune accretion in the east observed by Ritchie and Mather (1970b) led them to suggest that the beach appeared to be rotating in an anti-clockwise direction. However, when re-examined in 1995 and 2001, this tendency was not obvious and erosion of the east and west ends was reported, a graphic example of the dynamism of both beach and dune that has resulted in the inclusion of Tràigh na Berie in the GCR network. The beaches and dunes appear to undergo alternating phases of erosion and accretion, an unusual occurrence for a site that seems well-served by a sand source and so relatively sheltered from both wind and wave.

Similarly, although on a longer timescale, the numerous erosional edges that characterize much of the machair plain indicate that the seaward part of the machair plain has experienced more than one episode of wind erosion (Ritchie and Mather, 1970b). The eroded machair scarp in the centre of the beach, which was fronted by actively accreting foredunes in 1970, may be the most recent expression of an erosional system that involves not only short cycles of alternate wind-generated scarp erosion and machair deflation down to the water table, but also of wave-generated frontal erosion of the seaward edge. The relative shelter of the site, plus its apparently healthy sand source may be the main reason why this beach–dune–machair system has not yet undergone the chronic frontal erosion found elsewhere on the more exposed shores of the west coast of the Hebrides. In this respect, Tràigh na Berie conforms with the model

proposed in Figure 9.3 of the introduction to this chapter, with its dune cordon undergoing erosion but still largely intact. The sand removed from the dunes and machair edges is deposited elsewhere within the system. Although it remains to be fully investigated, the evidence of past erosional episodes within the machair is of great importance in the understanding of the way in which machair systems evolve over time.

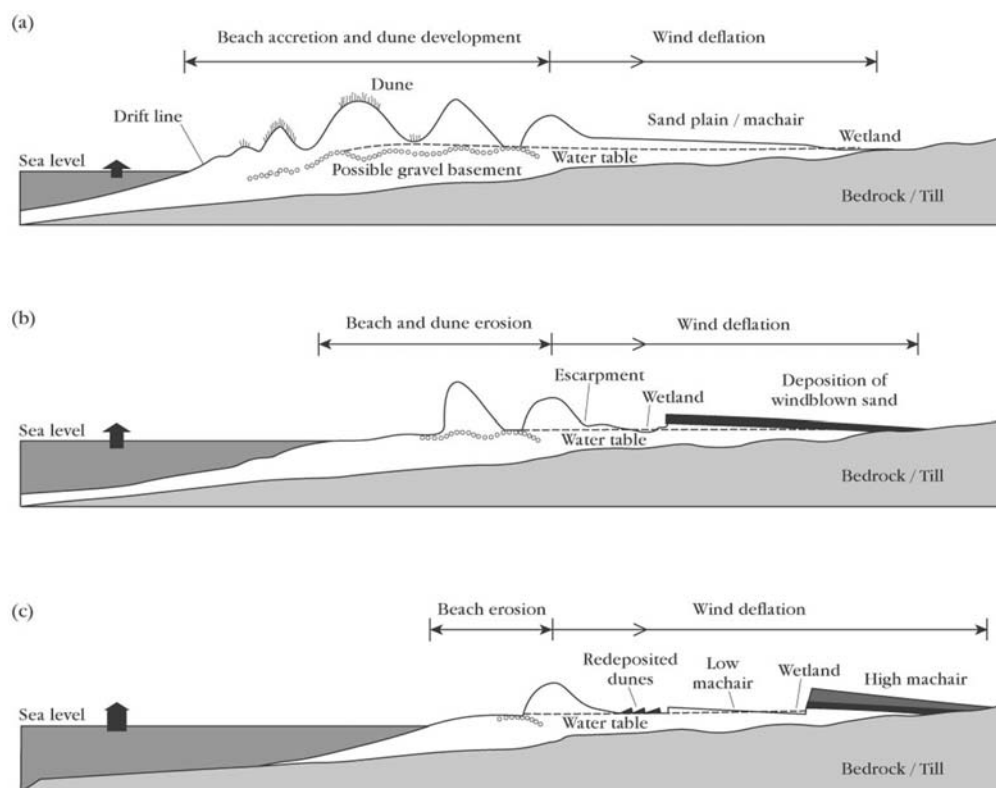


Figure 9.3: The Holocene development of machair from approximately 6500 thousand years ago to present, showing the switch from conditions of accretion of the dunes to erosion and recycling of dune sands into machair. (a) early–mid Holocene; (b) late Holocene; (c) present day. (After Hansom and Angus, 2001.)

It is possible that a contributory cause of the present instability in the central section of Tràigh na Berie is related to the impact of tourists using the beach (Angus and Elliott, 1992; Ramsay and Brampton, 2000e). Access through the dunes and machair to the beach certainly exacerbates erosion of the low machair faces at the western end of the beach. Wind erosion and re-deposition in the central section of the dune is also exacerbated by the presence of caravans within the dunes and the high density of pedestrian tracks over the dunes. However, the main cause of instability appears to be frontal erosion by waves and its subsequent effect on blowthrough development. The main drivers behind this situation are more likely to be sea-level rise and sediment supply than human impact.

Conclusions

Tràigh na Berie is a large spectacular beach–dune–machair unit set in an area of rugged gneiss upland, a very different setting from the open machair plains typical of the Uists. The geomorphology is controlled by a complex of inter-related marine and aeolian processes resulting in an extremely dynamic and variable system. The complexity of inter-relationships and vigour of processes is of very high geomorphological importance. Tràigh na Berie is of particular interest because it contains evidence of several stages of dune development as well as evidence of past erosional episodes in the machair plain. Tràigh na Berie is of outstanding importance in the context of elucidating machair evolution.

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