Loch Gruinart, Islay, Argyll and Bute

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J. D. Hansom

Introduction

The saltmarshes within Loch Gruinart, Islay (see (Figure 10.1) for general location), demonstrate particularly well the geomorphological attributes of the type of saltmarsh found at the head and fringing the sides of long inlets such as the Scottish sea lochs. Such loch-head and fringing saltmarshes appear to be confined mainly to Scotland and Norway and develop in response to the exceptional shelter offered by long inlets and the constricted tidal dynamics found in such sites. They also differ from many saltmarshes elsewhere in Great Britain since they occur on an emerging coast. The saltmarshes of Loch Gruinart display distinct zoned drainage patterns with linear and narrow creeks and saltpans that are largely confined to the upper marsh. The saltmarshes not only form an integral part of the assemblage of coastal forms on Islay, but are nationally important for studies of saltmarsh geomorphology. The saltmarshes are the only GCR site to have developed in this setting. They are also distinctive in the coarseness of much of the substrate, a mixed gravel and sand, quite unlike its muddy counterparts in England and Wales. Other than recent work related to sea-level change (Dawson *et al.,* 1997), the coastal geomorphology of Loch Gruinart has not attracted any detailed attention.

Description

Loch Gruinart, sited on the north coast of Islay, is 2 km wide and 7 km long and is a mesotidal sea loch with a mean spring tidal range of 3.1 m (MacTaggart, 1998d). It faces due north towards Colonsay and Mull and so, in spite of the generally stormy nature of the Minch, the entrance to the loch benefits from the sheltering influence of these islands. As a result, Loch Gruinart contains the largest area of sand deposition on Islay (about 77% of all sand area; Ritchie and Crofts, 1974) (Figure 10.21). The low-lying area of Loch Gruinart is backed on all sides by a prominent emerged cliff whose foot lies at about 8 m OD. The topographic depression occupied by the loch continues inland as a low marshy depression and extends south where it is occupied by Loch Indaal, a sea loch on the south coast of Islay.

The western and southern side of the loch is composed of Torridonian Sandstone whereas the east is mainly Dalradian quartzite, grit and schist. The Loch Gruinart fault runs along the western shore and is paralleled by a fault that runs along the eastern shore of the loch a few kilometres to the east (Ritchie and Crofts, 1974). The Holocene sea-level history of Islay is rela tively well known, and was characterized by submergence until between 6500–5000 years BP as a result of the main Holocene transgression. This was followed by emergence to the present time as a result of isostatic uplift (Dawson *et al.*, 1997).

The extensive intertidal sandflats and saltmarshes of Loch Gruinart lie in the shelter provided by a low rocky headland capped by low sand dunes at Ardnave Point on the west side and a large beach and dune complex that has developed on the east side at Killinallan (Figure 10.21). The beach of Tràigh Baile Aonghais, which fronts Killinallan, is wide and low-angled and fed by large amounts of sand from nearshore adjacent sandbanks. As a result the beach shows signs of recent accretion and embryo dune development. Ardnave Point and Killinallan Point, together with a relatively wide and shallow intertidal zone, have provided a sheltered environment within which sedimentation has resulted in the development of saltmarshes.

Extensive intertidal sandflats lie within Loch Gruinart, although there are also areas of gravels in the centre of the loch and along its margins (Figure 10.21). The surface of the intertidal flats are marked by mega-ripples at the mouth of the loch as a result of strong tidal streams. Along the margins of the loch, extensive areas of sandflats are colonized by algal mats and other primary colonizers. The occurrence of pioneer species suggests ongoing accretion, particularly to the north of the current areas of fringing saltmarsh. Landward of these sandflats are areas of fringing saltmarsh. On the western side, the saltmarsh surface is broken by low terraces that separate the lower marsh from the upper marsh

surface, although in places the terrace edge is buried by later deposition. The saltmarsh surface is also punctuated by a range of different shapes of salt-pan. Some of these are circular in form, others are linear and several are littered with stranded debris. In some areas in the mid-intertidal, small mounds of gravel and boulders have provided the nucleus for colonization by saltmarsh communities and mid-estuarine saltmarsh islands (a sub-type of fringing marshes) have developed.

Loch-head saltmarsh has developed across a 0.5 km-wide stretch of the southernmost part of the loch (Ritchie and Crofts, 1974; (Figure 10.21)). MacTaggart (1998d), using recent aerial photography together with the presence of pioneer species along the seaward edge of this stretch, suggested that progradation was ongoing. Distinct drainage patterns have developed over the saltmarsh surface. The narrow and linear creeks carry tidal flows over the upper and lower marsh surface and some of these join with artificial drainage ditches carrying freshwater from the adjacent hillsides across the upper marsh. Several of the creek sides show erosional undercutting and bank collapse. Saltpans are largely confined to the upper marsh where examples of circular and debris pans are common. The landward extent of the saltmarsh is constrained by an artificial embankment behind which are areas of reclaimed saltmarsh. A roadway crosses the southern part of the salt-marsh and emerged shoreline terrace (carse).

Interpretation

From the viewpoint of shelter, the loch-head and fringing saltmarshes of Loch Gruinart are quite normal in that they have developed in the benign wave environment offered by the presence of the rocky headland of Ardnave Point and the beach and dune complex at Killinallan. However, the saltmarshes are unusual in the British context in that they have developed, and continue to develop, on an emerging coast that is now characterized by a regional lack of coastal sediment supply. Nevertheless, the low-lying structural depression now occupied by lochs Gruinard and Indaal has been the focus for local deposition over much of the Holocene Epoch as a result of a combination of a supply of glaciogenic material from the adjacent low-gradient slopes and sea-level changes that have resulted in the inundation of the area at least twice in the last 10 000 years. Although the initial cutting of the prominent cliff probably took place soon after deglaciation, re-occupation and re-trimming occurred most probably at several times over this period before its final abandonment and the accretion of beaches and terraces at its foot later in the Holocene Epoch.

Detailed coring, biostratigraphy and dating indicates that marine-brackish-freshwater and marine-freshwater transitions occur in the diatoms that occur within the Gruinart subsurface sediments. Based on this evidence, Dawson *et al.* (1997) argue that the Rhinns of Islay were separated from the mainland of Islay by a marine inlet that formed following deglaciation about 13 000 years BP (Figure 10.22). Subsequent sea-level fall in the Lateglacial resulted in emergence for a period between 11 000–9000 years BP However, the culmination of the Holocene transgression then resulted in the subsequent inundation of the Loch Gruinart area. Although Holocene sea-level rise in much of Scotland is generally thought to have been completed by *c.* 6000 years BP, the age of the sediments within Loch Gruinart appear to be young, dating from 2000 years BP, and suggest that a tidal strait may have existed between the Rhinns of Islay and the mainland of Islay between 8000–2000 years BP (Dawson *et al.,* 1997). Whatever the date of separation, ongoing isostatic uplift resulted in an increasingly shallow marine environment within Loch Gruinart that has been conducive to sedimentation and the resulting infill of the margins and heads of both lochs Gruinart in the north and Indaal in the south.

Set within the context of its Holocene sea-level history, the depositional regime of Loch Gruinart locally reflects progressive shallowing, shelter from waves at its entrance and the availability of locally derived sediments. As a direct result of its provenance the intertidal flats and saltmarshes are dominated by sandy sediments with little silt and mud, unlike the saltmarshes elsewhere in Britain. The underlying sediments include locally derived gravels that have become lag deposits that are undergoing encroachment by saltmarsh vegetation. It is also possible that ongoing uplift is reflected in the marked terracing that occurs on the fringing saltmarsh. Elsewhere, Pye and French (1993) describe seasonal erosion and accretion in saltmarshes resulting from storm waves or channel migration leading to terracing that may become obscured where conditions favour further accretion. At Loch Gruinart, channel migration may well be a function of ongoing shallowing, leading to abandonment of some upper saltmarsh surfaces and the relocation of accretion to lower surfaces at the rear of the intertidal sandflat. Such downmarsh migration of sedimentation has almost certainly been exacerbated by the rapid uplift experienced by this part of the Islay coast and indicates that this would be an ideal

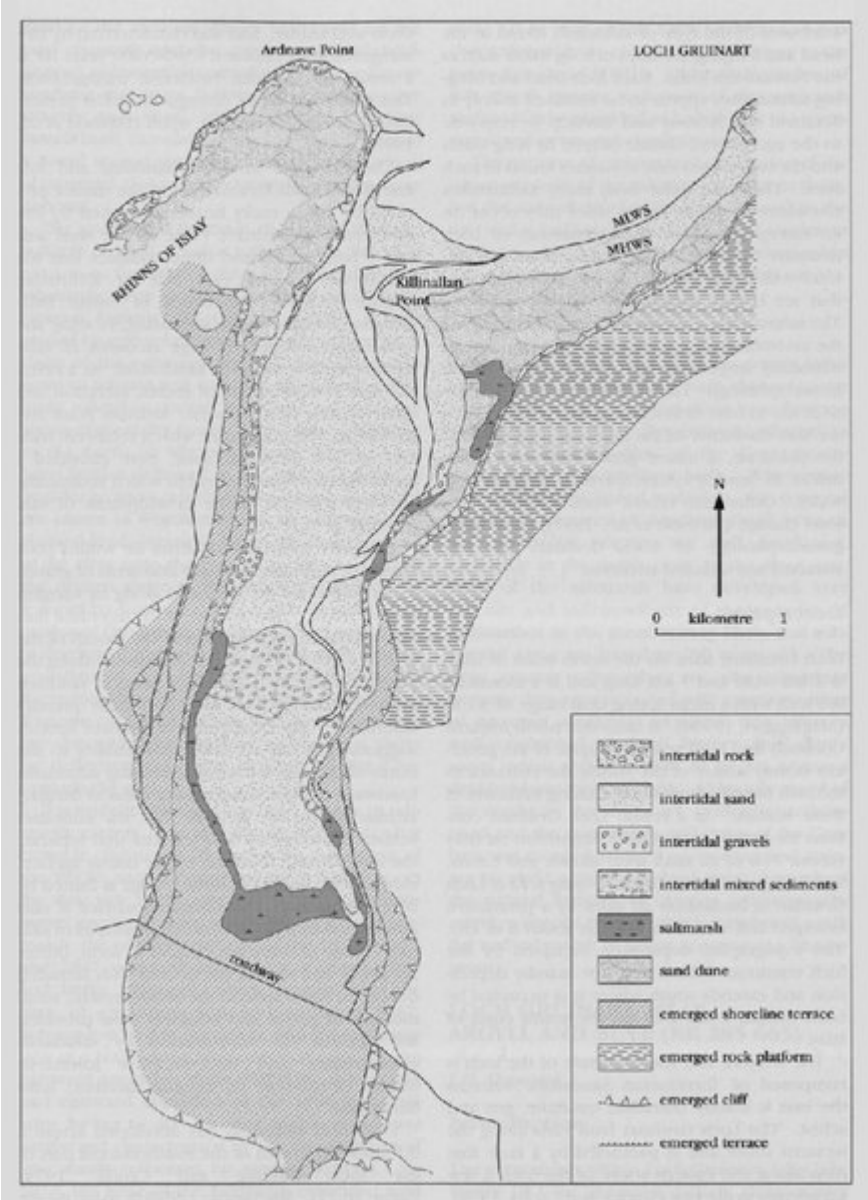
site in which to study the effects of emergence on accreting saltmarshes.

It is possible that the distribution of saltpans solely on the upper levels of the marsh may be related to recent and rapid uplift of the upper marsh. However, it is equally likely that the development of saltpans requires a fairly dense and continuous cover of vegetation and this is found only on the upper marsh at Loch Gruinart. The occurrence of several collapsed pans may be related to the failure of subterranean pipe networks similar to those that exist elsewhere on Scottish saltmarshes (Leafe and Hansom, 1990).

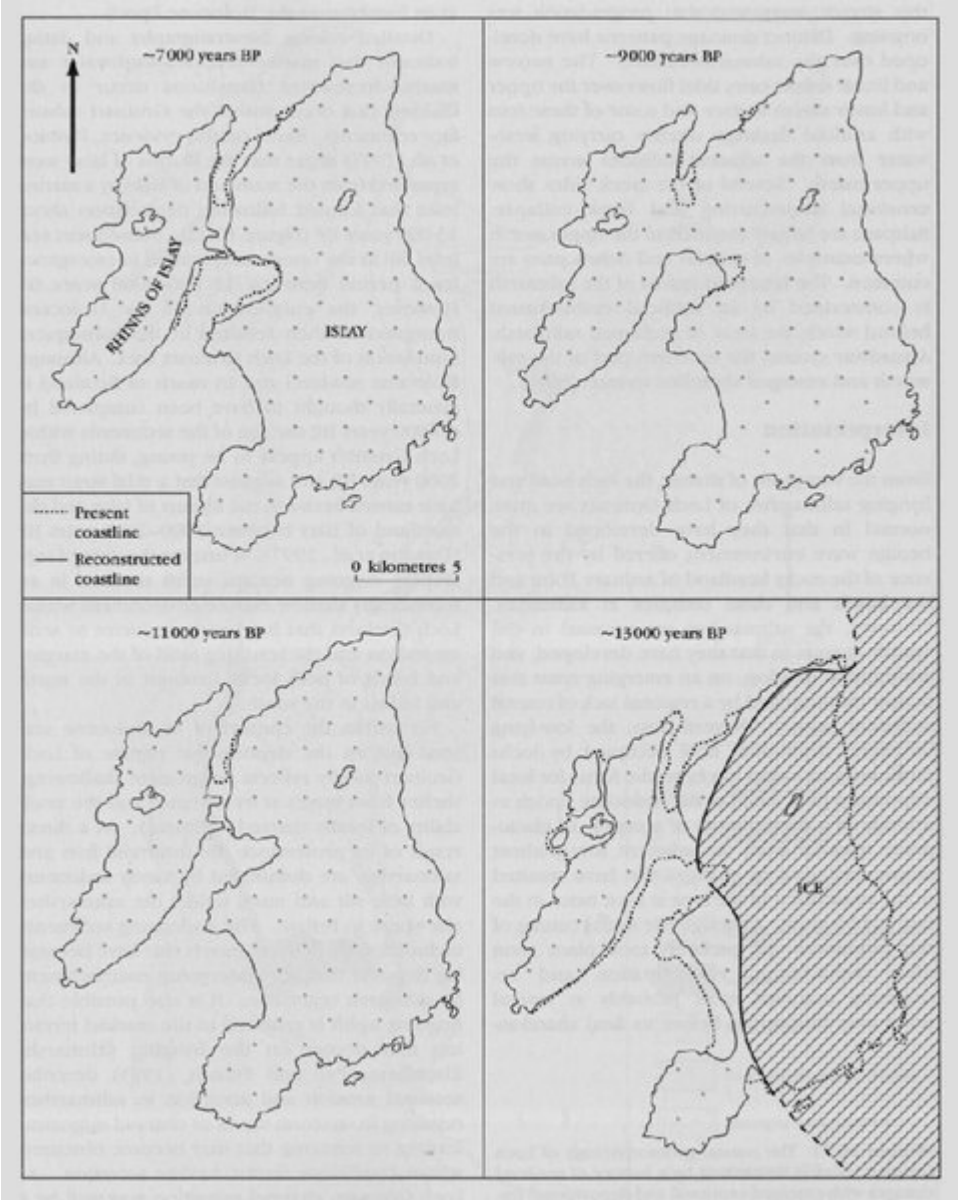
Conclusions

The saltmarshes of Loch Gruinart are typical of the type of saltmarsh found at the head and fringing the sides of the Scottish sea lochs. Found in Scotland and Norway, they have been influenced by the ongoing emergence of the host coastline and so are nationally important for studies of saltmarsh geomorphology on emerging shores. The saltmarshes of Loch Gruinart display drainage patterns with linear and narrow creeks and saltpans that are largely confined to the upper marsh. In spite of being suited to the study of the effects of emergence on saltmarshes, the coastal geomorphology of Loch Gruinart has not yet attracted any detailed attention other than work related to sea-level change.

(Figure 10.1) The generalized distribution of active saltmarshes in Great Britain. Key to GCR sites described in the present chapter or Chapter 11 (coastal assemblage GCR sites): 1. Morrich More; 2. Culbin; 3. North Norfolk Coast; 4. St Osyth Marsh; 5. Dengie Marsh; 6. Keyhaven Marsh, Hurst Castle; 7. Burly Inlet, Carmarthen Bay; 8. Solway Firth, North and South shores; 9. Solway Firth, Cree Estuary; 10. Loch Gruinart, Islay, 11. Holy Island. (After Pye and French, 1993.)



(Figure 10.21) The coastal geomorphology of Loch Gruinart, Islay is dominated by a history of sea-level changes with emerged erosional and depositional features flanking the north-south axis of the loch. In the shelter provided by Ardnave and Killinallan Points, extensive linear and loch-head saltmarshes have developed, some of which are extending onto intertidal gravels. (After Ritchie and Crofts, 1974.)



(Figure 10.22) The changing coastline of the Loch Gruinart–Loch Indaal area, Islay, at 7000, 9000, 11 000 and 13 000 years BP showing phases of marine inundation and land emergence. Since 7000 years ago the relative sea level has shown a more or less constant falling trend towards the position of the present coastline. (After Dawson and Dawson, 1997.)