Strathbeg, Aberdeenshire

[NK 075 595]

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Introduction

The dune forms of Strathbeg, north-east Scotland (contain some of the most impressive parallel linear dunes in Scotland. The aeolian processes that created this suite of linear dunes remain active in parts of the beach today. Former coastal progradation has resulted in the isolation of the Loch of Strathbeg, one of the largest freshwater lochs in Britain (Bourne *et al.,* 1973), which now lies *c.* 1 km inland and is separated from the open coast by the spectacular dune field. The landward dunes lie on top of a series of Holocene emerged gravel beaches, the initial deposition of which resulted in the enclosure of an inlet now occupied by the Loch of Strathbeg (Walton, 1956; Ritchie *et al.,* 1978). In addition, Strathbeg contains spectacular examples of wind erosional processes in large-scale coastal dune ridges. Large blowthroughs and deflation plains have been excavated naturally down to the underlying gravel ridges in the southern part of the dune system.

Although the general evolution of Strathbeg has been described (Walton, 1956; Ritchie *et al.,*1978; Ritchie, 1983), no detailed recent research has been undertaken concerning either the processes operating or the chronology of its geomorphological evolution.

Description

The GCR site of Strathbeg covers a total coastal length of *c.* 7.1 km between Rattray Head in the south and Inzie Head in the north, this northeastern facing coastline marking the transition between the open North Sea and Moray Firth coasts (see (Figure 7.1) for general location and (Figure 7.32) for detailed geomorphology). In the north the beach is fronted by a low intertidal rock platform and in the south, at Rattray Head, by offshore rock and banks of boulders. In both the north and south, the beach and dune complex is backed by a relict cliff cut in glacial deposits, although in the central section, the cliff lies inland and the beach and dunes are backed by the loch (Figure 7.33)a-c. The sandy intertidal beach is relatively narrow (on average *c.* 90 m wide) with a slightly steeper backshore zone. The beach widens at the mouth of the stream that drains the inland Loch of Strathbeg and an extensive intertidal lagoon with a small salt-marsh has developed. Elsewhere the beach has a regular profile but is characterized, especially in the south, by a series of beach ridges and sub-parallel beach depressions. Strathbeg beach is highly dynamic experiencing many short-term changes in both longshore and offshore-onshore sediment transport (Ritchie, 1983; Rendel Geotechnics, 1995). Ritchie (1983) notes an offshore complex of sand-bars lying just below low-water mark and that the beach shows evidence of accretion, particularly to the south of the stream outlet. This outlet appears to form an important transition zone. To the north, the coastal edge consists of a steep sand-cliff (4–7 m high) which is undergoing active erosion (Ritchie, 1983). For several hundred metres on either side of the tidal sand-floored lagoon and meandering stream channels of the outlet, the coastline is prograding with fine examples of embryo and young foredune ridges, probably as a result of local sand feed from the lagoon. South of the outlet there is a large asymmetric dune ridge rising to over 8 m OD (Ritchie, 1983), which encloses the long narrow tidal lagoon and small, sandy saltmarsh associated with the loch outlet (Figure 7.33)b. There is evidence of active sand accumulation on the dune crest and slopes (Ritchie, 1983).

Landwards of the beach there is an extensive and complex series of dune ridges backed by low dune grassland. At least seven parallel linear dune ridges, with a relatively regular summit altitude of 6–9 m above beach level and separated by shallow depressions occur in the north and central part of Strathbeg (Figure 7.33)a. This general pattern of parallel dune ridges is broken in places by irregular dune topography as represented by areas of hillocky and transverse dune ridges. The dune morphology close to the loch outlet is particularly complex and 18 separate dune crests occur between the outer beach and the loch margin some 1.2 km inland (Figure 7.33)b (Ritchie *et al.,* 1978). A marked change in dune morphology occurs farther south where a series of large blowthroughs cut deeply into the dune system (Ritchie *et al.,*

1978). High residual dune ridges create a spectacular, active coastal landscape and large deflation features have formed where major blowthroughs have coalesced (see (Figure 7.36)). Deflation processes affect the entire dune system (Ritchie *et al.,* 1978) and the surface morphology has extensive low-altitude flat sand plains flanked by a wide zone of dune hillocks associated with re-depositional activity. There are excellent examples of re-depositional processes with sand spilling from dunes onto the flatter adjacent areas. These flat areas are also subject to extensive winter flooding and are locally described as 'winter lochs'.

Prominent emerged gravel ridges can be traced intermittently throughout the area and underlie the landward part of the dune system. The gravel ridges appear to be hinged to the higher ground at St Combs and in the past extended southwards to progressively enclose a former inlet whose position is now occupied by the Loch of Strathbeg (Walton, 1956; Ritchie *et al.,* 1978). At the northern end, a number of parallel gravel ridges terminate, sometimes with recurved ends, a short distance to the south-east of the present outlet of the loch. South of this point the gravel bars coalesce to form one main ridge. Farther south the gravel forms the southeast margin of the loch and recurves at the southern distal end terminate in the loch itself (Walton, 1956).

The freshwater Loch of Strathbeg is shallow (1–2 m deep) approximately 3 km long and 1 km wide (Bourne *et* W., 1973). The loch is bounded by gravel bars, dune plain and dunes in the east and by a 5–9 m-high relict cliff cut in till in the west (Figure 7.32). The loch has a high nutrient level (Forteath, 1977) and is an important staging post for thousands of migratory wildfowl, particularly geese (Ritchie *et al.,* 1978) and is of international ornithological and ecological importance.

Interpretation

Walton (1956) first interpreted the complex evolution of Strathbeg, suggesting that the present coastline was the 'result of the gradual enclosure of a deep indentation of the coast in Late-glacial times, culminating in a smooth dune-fringed littoral behind which is now impounded the freshwater Loch of Strathbeg'. Walton (1956) identified two higher relative sea levels in the area by using remnants of degraded relict cliffs cut in till and now draped in vegetated blown sand deposits. Higher sea levels following deglaciation resulted in inundation possibly to a height of *c.* 16 m OD (Walton, 1956) and at this time (15 000–14 000 years BP), the Strathbeg area was a large inlet, possibly with several offshore islands (Figure 7.34). Relative sea level then fell to below present before rising again sometime possibly around 7000 years BP A distinctive lower relict cliff forms the western margin of the present Loch of Strathbeg and Walton (1956) interprets this cliff as representing the margin of a later, possibly mid-Holocene, sea level at 5 m. The ridges of a gravel spit began to extend from the north to partially enclose a tidal lagoon with a narrow inlet (*c.* 45 m wide) between the southernmost limit of the gravel bar and the relict cliff near Old Rattray (Figure 7.32) (Walton, 1956; Ritchie *et al.,* 1978). The later arrival of sand encouraged the development of the sand-dune complex.

Archaeological and historical evidence documents the final closure of the bay of Strathbeg. The tidal inlet of Strathbeg, sheltered from the open coast by the extensive gravel spit and overlying dunes, provided an obvious natural harbour and it is not surprising that a small coastal fishing village developed (Figure 7.35). The earliest evidence of settlement at Rattray dates to around the end of the 13th century (Walton, 1956) and during the 16th and early 17th centuries the harbour at Strathbeg flourished (Walton, 1956). However, the inlet was almost certainly shallowing over time and as early as 1654 there is evidence that the exit was threatened by sand deposition (Gordon, 1843). The final closure of the bay is thought to have occurred by the deposition of windblown sand during a storm in the 1720s (Walton, 1956). The final sealing of the inlet was apparently so sudden that a vessel is reputed to have been trapped within the harbour and its impounded cargo of slates then used to roof a nearby house at Mains of Haddo (Walton, 1956). Roy's map of 1747–1755 shows the enclosed Loch of Strathbeg with a new outlet at the north end of the lagoon (Figure 7.35). The decline of the settlement of Rattray followed and it had ceased to exist by the middle of the 18th century (Walton, 1956). At the end of the 18th century the high water-level of the Loch of Strathbeg threatened inundation of agricultural land and led to an artificial outlet channel being cut through the gravel bar (Walton, 1956). Since then this artificial cut has been maintained.

Since the final closure of the Loch of Stathbeg there has been over 1 km of sand accretion to seaward, involving the development of an extensive dune system consisting of numerous parallel linear dune ridges (Walton, 1956; Ritchie *et*

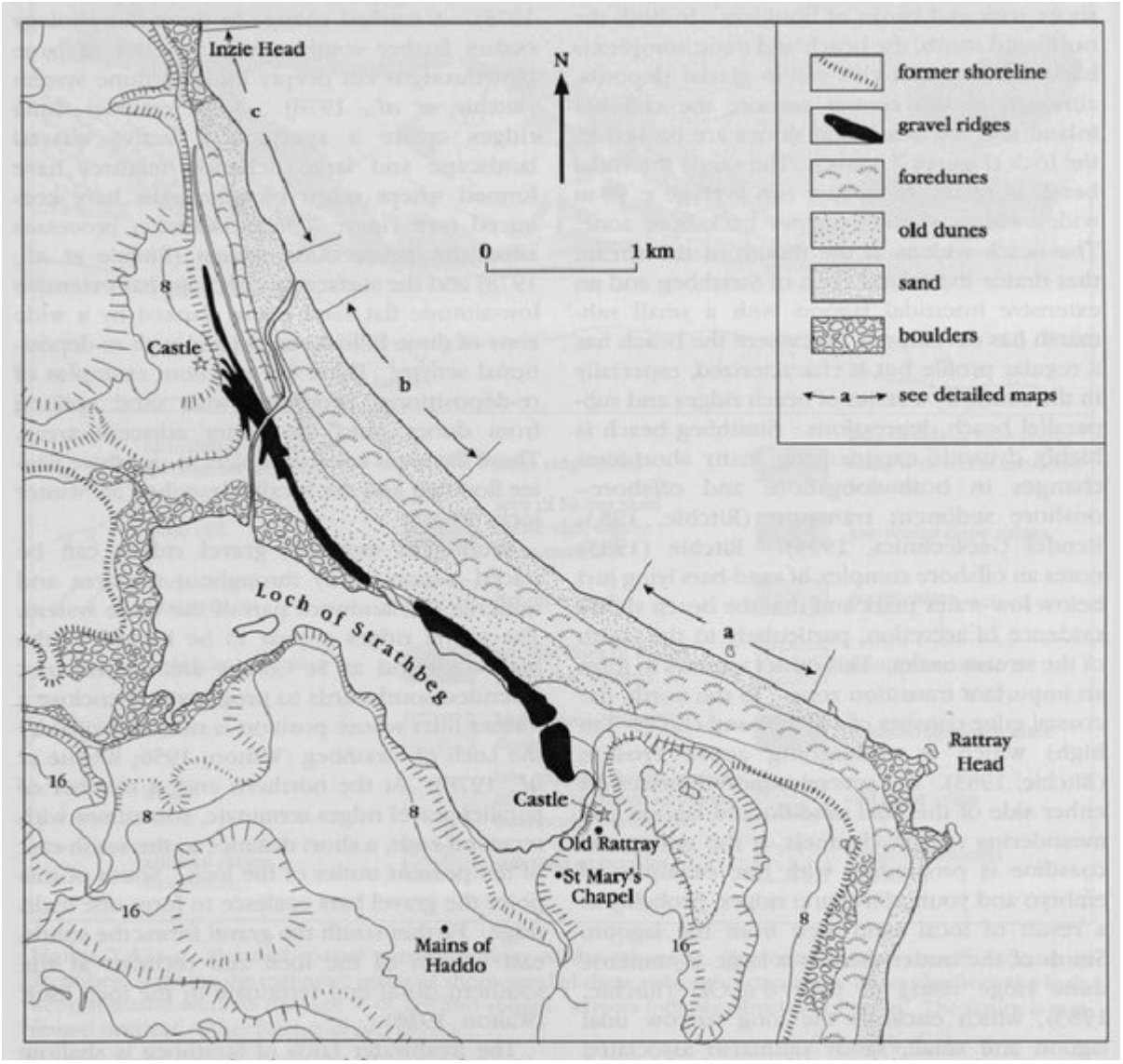
al., 1978; Ritchie, 1983). Dune morphology suggests that the dune ridges developed at the rear of a wide beach, which then abutted the emerged gravel bar and spit features (Ritchie *et al.,* 1978). Such processes have their modern counterparts, particularly at the outlet of the loch in the north-centre part of the bay, where young embryo and foredune ridges are developing seawards of the main dune ridge, although net sand drift is now considered to be low (Ramsay and Brampton, 2000d). Dune face erosion is largely confined to the north end of the beach although there is also a zone of active wave undercutting in the extreme south where erosion has produced high sand cliffs (Ritchie *et al.,* 1978). Elsewhere, the coastal edge tends to undergo cyclic seasonal effects of dune undercutting in winter and accretion in summer (Ramsay and Brampton, 2000d). Away from the major blowthrough corridors and deflation areas in the south (Figure 7.36), there is either minor aggradation or stability, as occurs on the inland dune surfaces (Ritchie *et al.,* 1978).

Strathbeg provides one of the best examples in Scotland of a suite of parallel linear dune ridges with intervening depressions produced by progradation. These progradational processes also contributed to the final isolation of the Loch of Strathbeg and remain active today, particularly around the loch outlet. It is apparent from the above discussion that although the general evolution of this area has been interpreted (Walton, 1956) there remain substantial gaps in our knowledge and the exact sequence and chronology of the geomorphological evolution of Strathbeg remains uncertain. In addition, the spectacular erosional forms in the southern part of the dune system present a valuable opportunity to assess the processes and forms of erosion in a large-scale dune system.

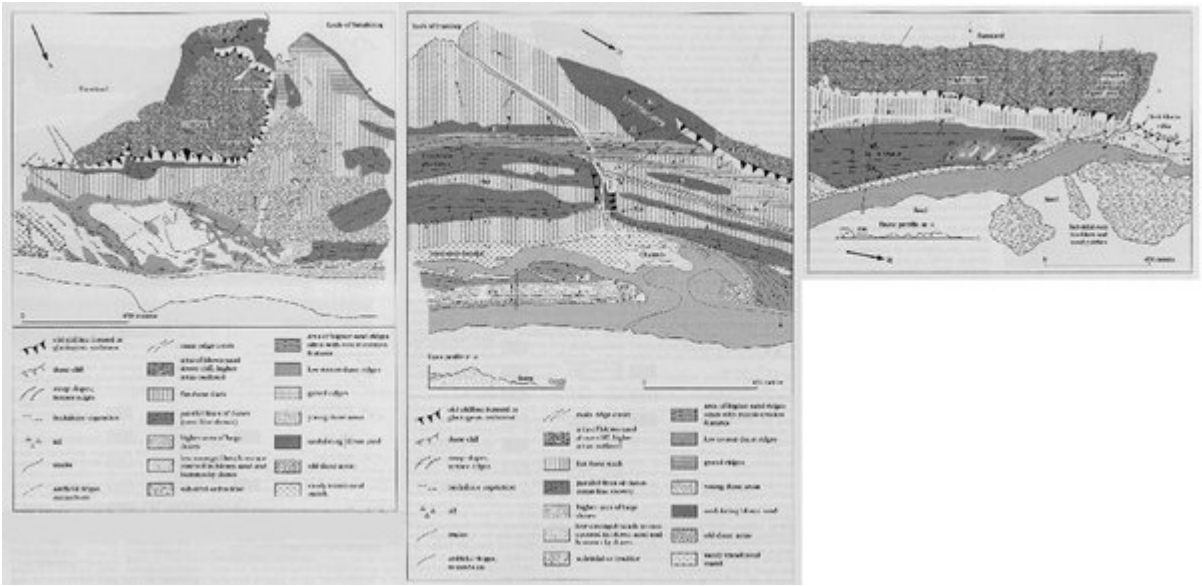
Conclusions

The extensive and varied dune morphology of Strathbeg is of outstanding geomorphological interest. The site contains excellent examples of parallel linear dune ridges, with up to 18 separate dune crests and intervening depressions between the outer beach and the freshwater Loch of Strathbeg some 1.2 km inland. The progradational processes that created this suite of linear dunes remain active today. The dune system overlies a base of emerged gravel ridges, which were originally responsible for the partial closure of the inland loch. The southern part of Strathbeg contains spectacular examples of wind erosional processes in large-scale coastal dunes, and the relatively undisturbed nature of the Strathbeg dunes enhances the scientific interest of the site.

(Figure 7.1) Great Britain sandy beaches and coastal dunes, also indicating the location of GCR machair–dune sites (see chapter 9) and other coastal geomorphology GCR sites that contain dunes in the assemblage.

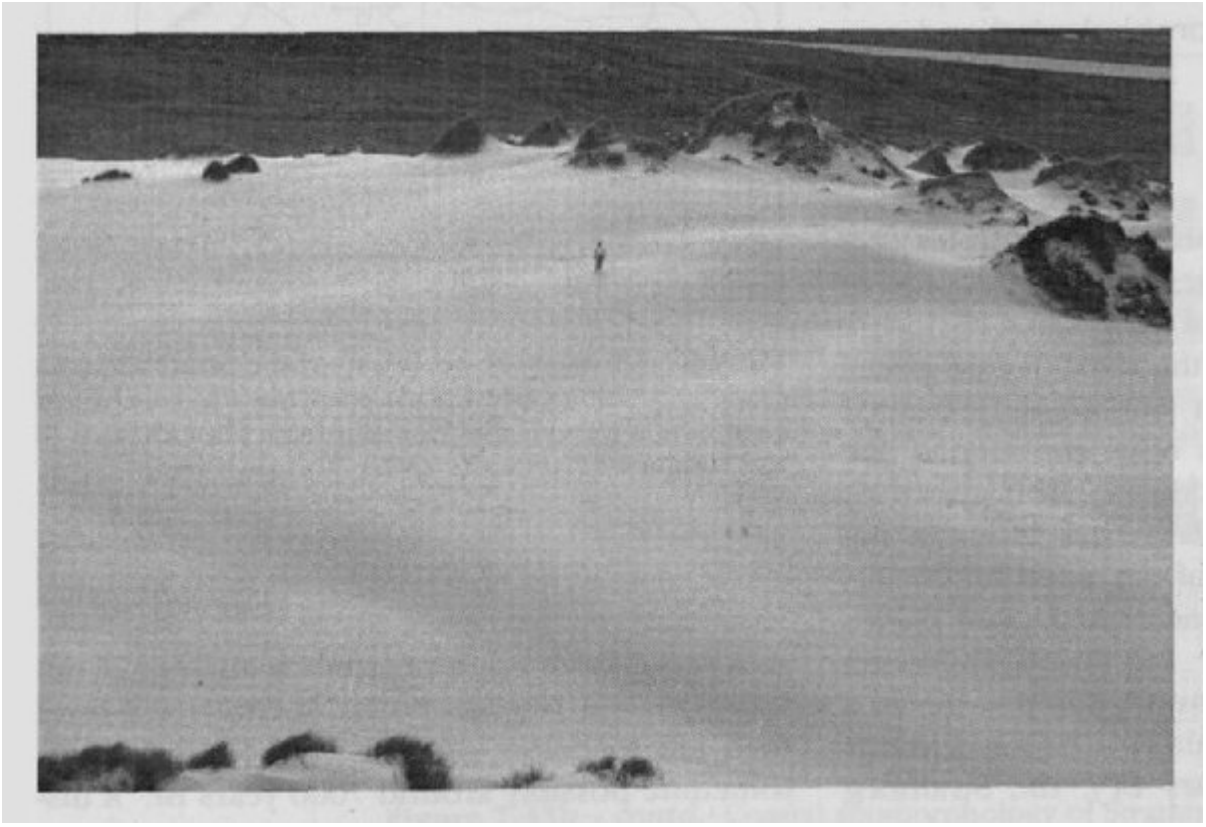


(Figure 7.32) Generalized coastal features of Strathbeg, showing enclosure of the Loch by gravel ridges and a series of old dune ridges fronted by lower foredunes. Heights are in metres OD. The detailed sections a-c are shown in Figure 7.33a-c. (After Walton, 1956.)

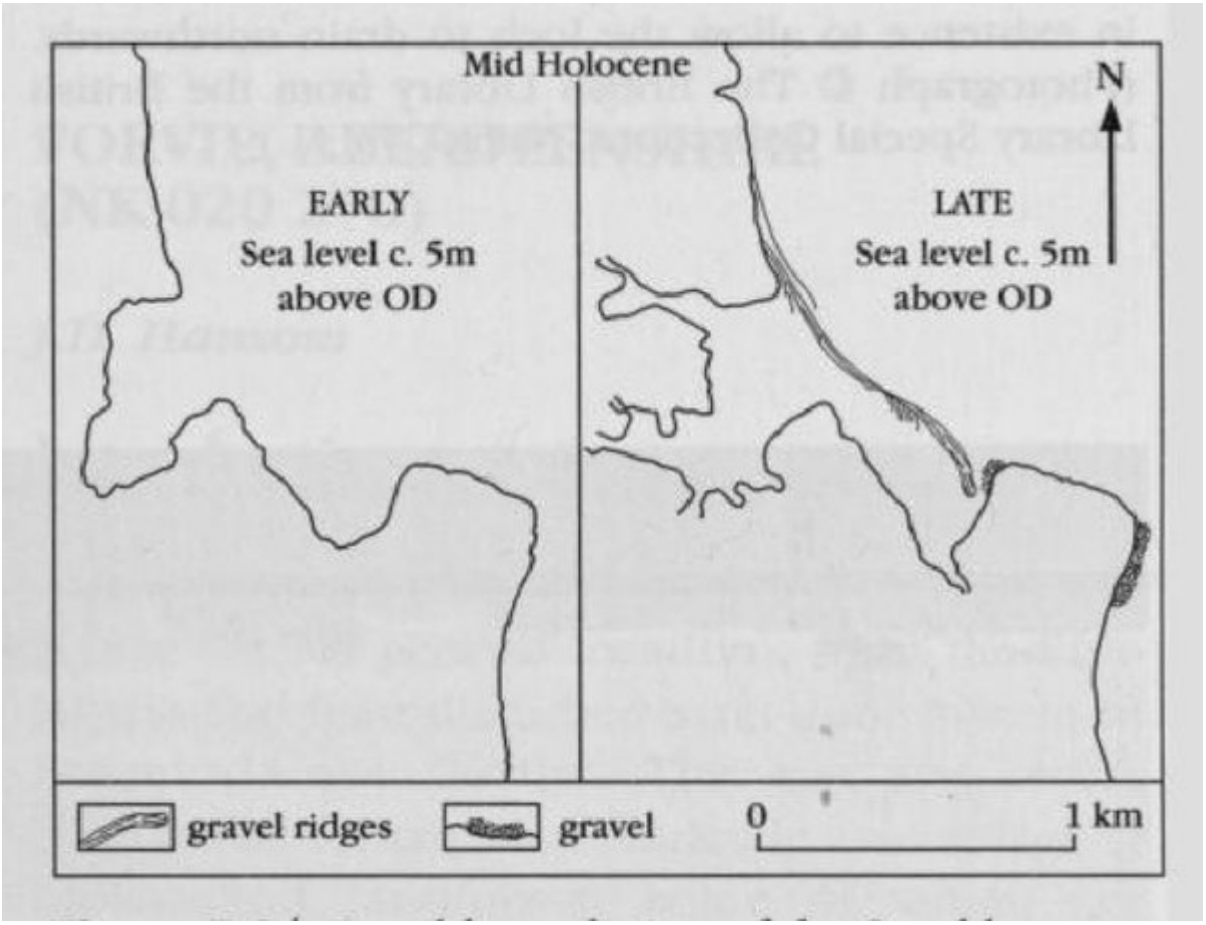


(Figure 7.33) a–c Detailed coastal geomorphology of the (a) south, (b) central and (c) north sections of Strathbeg, showing the extensive series of shore-parallel dune ridges punctuated by the outlet from the loch. Representative sections through x–x are also shown. Arrows indicate direction of slope. The figure is continued overleaf (After Ritchie et

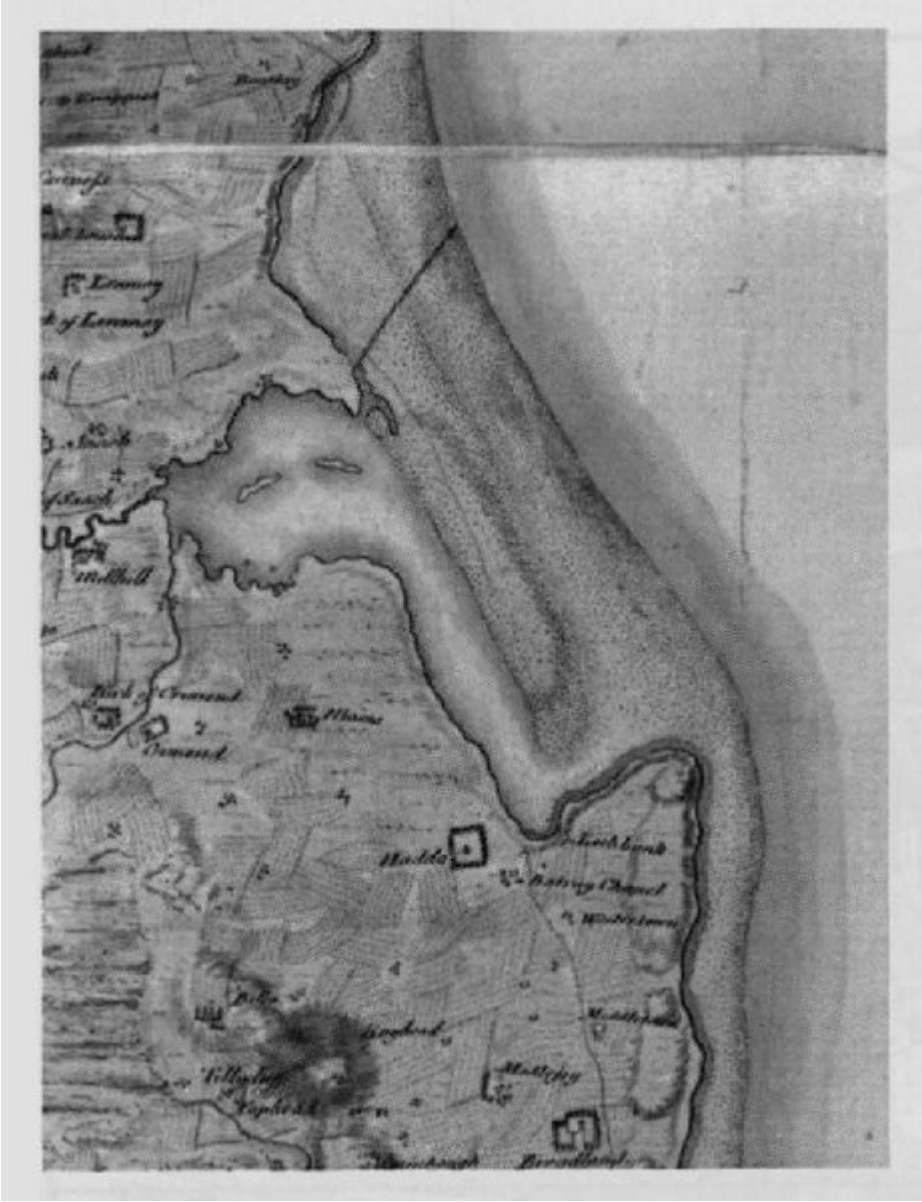
al., 1978.) Figure 7.33b.Coastal geomorphology of Strathbeg.



(Figure 7.36) A large coalesced blowthrough in the southern part of Strathbeg. The loch is visible in the top right. The figure provides the scale. (Photo: J.D. Hansom.)



(Figure 7.34) Possible evolution of the Strathbeg area during the Holocene Epoch showing the southward extension of gravel ridges and progressive closure of the former embayment. (After Walton, 1956.)



(Figure 7.35) The Loch of Strathbeg, as mapped in 1755 by the military surveys of William Roy. Note the loch exit is located in the south, but also that an artificial channel across the north end of the beach was in existence to allow the loch to drain northwards. (Photograph © The British Library from the British Library Special Collections, Maps C9b 31.)