RHU POINT

J.E. Gordon

OS Grid Reference: NS264841

Highlights

Deposits exposed in the coastal section at Rhu Point provide important evidence for interpreting the glacial history of the Western Highland Boundary area and the associated changes in sea-level during the Late Devensian and early Holocene. The evidence from Rhu Point allows the nature and timimg of the Loch Lomomd Readvance to be established.

Introduction

The site (NS 264841) is a coastal section on the north side of Rhu Point, cut into the terminal moraine ridge of the Loch Lomond Readvance glacier that occupied the Gare Loch basin. The deposits are of long-standing importance for demonstrating the succession of marine and glacial episodes in the coastal areas of west-central Scotland during the Lateglacial and early Holocene (Maclaren, 1845, 1846; Anderson, 1896; McCallien, 1937; Anderson, 1949; Rose, 1980c). Excellent glaciotectonic deformation structures formed by the advancing glacier are of additional sedimentological interest. Part of the sequence is now concealed behind sea defences.

Description

Rose (1980c) provided a detailed description of the deposits at Rhu Point (Figure 13.5) noting the following succession:

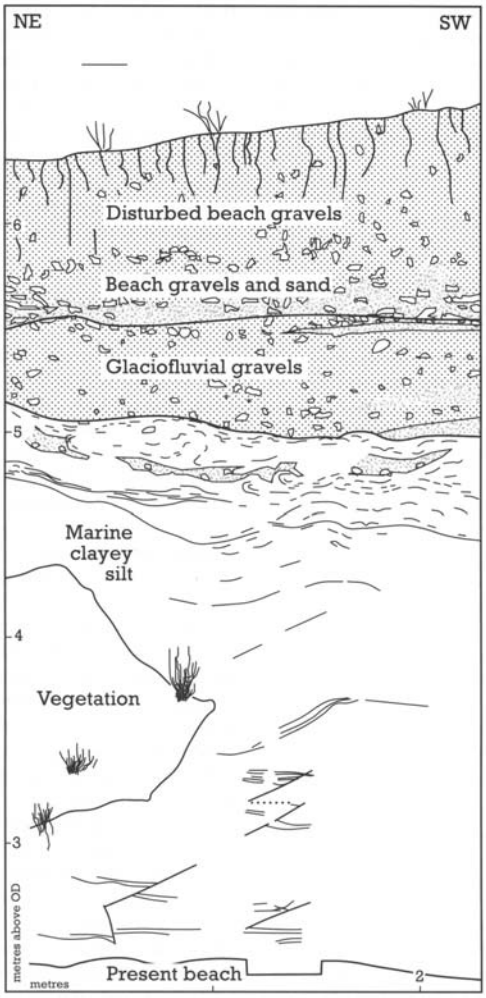

Figure 13.5: Rhu Point: section showing glacially deformed Clyde Beds, Rhu Gravels and Holocene raised beach deposits (from Rose, 1980c).

3. Raised beach gravels

2. Glaciofluvial gravels (Rhu Gravels), with included blocks of till

1. Marine, clayey silt (Clyde beds)

At the base of the section, the typical Clyde beds of the region (seeGeilston), comprise homogeneous clayey silts and clayey silts with size-graded laminations (bed 1). These deposits occur in both undisturbed and glacially disturbed states (Figure13.5). The Rhu Gravels (bed 2) are a suite of glaciofluvial sands and gravels often with current bedding and flow structures. In places they are glaciotectonically folded and sheared and sometimes contain inclusions of Clyde beds and shelly till derived from the Clyde beds. The till occurs as detached blocks interdigitated with the gravels. Radiocarbon dating of a sample of shells from the till gave an unadjusted radiocarbon age of 11,520 + 250 BP (HAR–931) (Otlet and Walker, 1979). Adjusting the radiocarbon date for the apparent age of seawater (Harkness, 1983), gives a best estimate for the age of the dated shells of*c.* 11,100 BP. The molluscan shells indicate a fauna of interstadial aspect, but also include fragments of*Portlandia arctica* (Gray) which almost certainly date from the Loch Lomond Stadial (J.D. Peacock, unpublished data). The Rhu Gravels are truncated by an erosion surface and overlain unconformably by raised beach gravels associated with successive shorelines at 14 m, 10 m and 8 m O.D.

Interpretation

The terminal moraine at Rhu Point was one of the first such features in Scotland to be comprehensively investigated and explained in terms of the presence of former glaciers. In two remarkably perceptive papers for their time, not long after the introduction of the glacial

theory to Scotland (Agassiz, 1841b; Maclaren, 1840) and before this theory was accepted, Charles Maclaren convincingly described the evidence for the former existence of glacier ice in the Gare Loch valley (Maclaren, 1845, 1846). He inferred that the moraine at Rhu Point was probably the last of a number of such features to be formed before the ice finally disappeared. Maclaren (1846) also recognised lateral moraine ridges on the east side of the valley and described the terminal moraine at Rhu as consisting of clay overlain by sand and gravel. He noted that it had been trimmed by the sea and also reported a sequence of raised shorelines along the loch side. "In short, marks of the ancient existence of a glacier in the valley are numerous and remarkably complete' (Maclaren, 1849, p. 165). Maclaren's papers represent an important development at a time when the glacial theory was still in its infancy. Although moraines had been identified elsewhere, notably by Agassiz and Buckland during their tour of Scotland (Agassiz, 1841b, 1842; Buckland, 1841a; Davies, 1968b), Maclaren's contribution was one of the first detailed local studies of this type of evidence together with that of Forbes (1846) in the Cuillin Hills.

In a subsequent account of the Gare Loch area, Anderson (1896) largely followed Maclaren's interpretation of the Rhu Point deposits. Later, McCallien (1937) described in detail sections on the north side of the promontory at Rhu, noting, in particular, raised beach sediments unconformably overlying deformed "morainic' material comprising sand and gravel which in turn rested on finely laminated clays. He interpreted the sediments as representing a readvance of ice which pushed up marine clays from the sea floor and dumped them along with morainic sands and gravels. Subsequently the deposits were trimmed by the sea. McCallien suggested that the Rhu moraine was a product of the Loch Lomond Readvance interpreted by Simpson (1933) in the Loch Lomond and western Forth valleys.

Anderson (1949) described the same sequence of deposits as McCallien, but also reported the presence of molluscan shell fragments, ostracods, foraminifera, plant seeds and beetle fragments in the marine clay, which he stated was identical with that occurring widely elsewhere in the Clyde Estuary (Clyde beds). He also traced the lateral continuation of the moraine ridge on both sides of Gare Loch and observed that the "100 foot' raised beach terminated at the moraine ridge, whereas the "25 foot' beach continued along the side of the loch inside the moraine. Anderson therefore concluded that the moraine ridge marked the limit of a late valley glacier readvance which, from its relationship with the raised shorelines, was contemporaneous with the Loch Lomond Readvance.

Charlesworth (1956) correlated the Rhu moraine ridge with his "Stage M' readvance in the Highlands which included Simpson's Loch Lomond Readvance moraines. Later, Sissons (1967a) mapped it as part of the Loch Lomond Readvance.

From the evidence at Rhu Point and in the adjacent area, Rose (1980c) interpreted the following sequence of events. As the Late Devensian ice sheet wasted, the sea flooded into Gare Loch to a marine limit at 24 m O.D. Deposition of the Clyde beds began and continued until at least 11,100 BP. A glacier then advanced along the Gare Loch valley forming a moraine ridge at Rhu Point, which consists primarily of glaciotectonised Clyde beds and sand and gravel deposited by meltwater streams flowing parallel to the icefront and towards the valley centre. The radiocarbon date on shells in the shelly till confirms that the moraine was formed during the Loch Lomond Stadial. The deformation structures in the earlier deposits indicate an oscillating icefront. Subaerial meltwater flow is suggested by the sedimentary characteristics of the sands and gravels, and this implies that sea level must have stood at or below 2.3 m O.D., the lowest elevation at which these deposits occur. Subsequently, relative sea level rose during the Holocene transgression to 14 m O.D., then fell to its present level via intermediate shorelines at 10 and 8 m O.D.

The sequence of deposits at Rhu Point provides a key stratigraphic record of Lateglacial and early Holocene environmental and geomorphological changes in western Scotland. It is particularly important in integrating both terrestrial and marine evidence in a single radiocarbon-dated succession. It demonstrates the period of incursion of "sub-arctic' seas, represented by the Clyde beds, following the recession of outlet glaciers from the main Late Devensian ice sheet. It provides clear evidence for a subsequent readvance of ice through the deformation and incorporation of Clyde beds into an end moraine ridge and the superimposition of glaciofluvial deposits with till inclusions. Radiocarbon assay constrains the date of this ice

readvance to a period after the later part of the Lateglacial Interstadial and provides a maximum date for the local maximum extent of the Loch Lomond Readvance in Gare Loch. The two lower shorelines demonstrate temporary stillstands in the fall of relative sea level to its present position.

Broadly similar sequences, but without the Holocene beach sediments, occur atSouth Shian and Balure of Shian (see above) where glacially disturbed marine sediments (Clyde beds) are overlain by outwash from a Loch Lomond Stadial glacier in the valley of Loch Creran; at Gartness (see above) where deformed marine sediments are overlain by Loch Lomond Readvance till, and in the Western Forth Valley (see below) and at Loch Spelve (Gray and Brooks, 1972) where marine sediments are incorporated into Loch Lomond Readvance moraines. The significance of Rhu Point is, first, as a key reference site demonstrating the sequence of marine and glacial events during the Lateglacial and early Holocene in west-central Scotland. Second, Rhu Point is a site of considerable historical interest as one of the first localities in Scotland where glacier theory was applied in a detailed study to explain surface landforms and deposits. Finally, Rhu Point is notable for the glaciotectonic deformation structures in both the marine and glaciofluvial deposits; these have not been investigated in detail but have significant potential for research.

Conclusions

The deposits at Rhu Point have a long history of research and have provided important information for interpreting the sequence of Late Devensian glacial events in western Scotland. They show clear evidence for glaciation during the Loch Lomond Stadial (approximately 11,000–10,000 years ago) after a phase of marine sedimentation following the wastage of the main Late Devensian ice sheet (approximately 13,000 years ago).Rhu Point forms part of the network of sites that demonstrate geomorphological processes associated with the Loch Lomond glacier readvance and provide evidence for its timing.

Reference list

Agassiz, L. (1841b) On glaciers, and the evidence of their having once existed in Scotland, Ireland, and England. *Proceedings of the Geological Society of London*, **3**, 327–32. (Also in *Philosophical Magazine*, **18**, 1841, 569–74).

Agassiz, L. (1842) The glacial theory and its recent progress.*Edinburgh New Philosophical Journal*, **33**, 217–83.

Anderson, J. (1896) Evidences of the most recent glaciers in the Firth of Clyde district. *Transactions of the Geological Society of Glasgow*, **10**, 198–209.

Anderson, J.G.C. (1949) The Gareloch readvance moraine.*Geological Magazine*, **86**, 239–44.

Buckland, W. (1841a) On the evidences of glaciers in Scotland and the north of England. *Proceedings of the Geological Society of London*, **3**, 332–7.

Charlesworth, J.K. (1956) The late-glacial history of the Highlands and Islands of Scotland. *Transactions of the Royal Society of Edinburgh*, **62**, 769–928.

Davies, G.L. (1968b) The tour of the British Isles made by Louis Agassiz in 1840.*Annals of Science*, **24**, 131–46.

Forbes, J.D. (1846) Notes on the topography and geology of the Cuchullin Hills in Skye, and on the traces of ancient glaciers which they present.*Edinburgh New Philosophical Journal*, **40**, 76–99.

Gray, J.M. and Brooks, C.L. (1972) The Loch Lomond Readvance moraines of Mull and Menteith. *Scottish Journal of Geology*, **8**, 95–103.

Harkness, D.D. (1983) The extent of natural 14C deficiency in the coastal environment of the United Kingdom. In *14C and Archaeology*. *Symposium hold at Groningen*, *August 1981* (eds W.C. Mook and H.T. Waterbolk). PACT, **8**, 351–64.

Maclaren, C. (1840) Discovery of the former existence of glaciers in Scotland especially in the Highlands, by Professor Agassiz. *The Scotsman*, **24**(**2165**), 7 October, 3.

Maclaren, C. (1845) Glaciers and icebergs in Scotland in ancient times.*The Scotsman*, **29**(**2685**), 1 October, P.2. (Also in *Edinburgh New Philosophical Journal*, **40**, 1846, 125–42; Cox and Nicol ed. 1869, 103–19).

Maclaren, C. (1846) Further evidence of the existence of glaciers in Scotland in ancient times. *The Scotsman*, **30**(**2798**) 31 October, p.2. (Also in *Edinburgh New Philosophical Journal*, **42**,

1847, 25–37; Cox and Nicol, ed. 1869, 120–30).

Maclaren, C. (1849) On grooved and striated rocks in the middle region of Scotland.*Edinburgh New Philosophical Journal*, **47**, 161–82.

McCallien, W.J. (1937) Late-glacial and early post-glacial Scotland.*Proceedings of the Society of Antiquaries of Scotland*, **71**, 174–206.

Otlet, R.L. and Walker, A.J. (1979) Harwell radiocarbon measurements III.*Radiocarbon*, **21**, 358–83.

Rose, J. (1980c) Rhu. In *Glasgow Region Field Guide* (ed. W.G. Jardine). Glasgow, Quaternary Research Association, 31–7.

Simpson, J.B. (1933) The late-glacial readvance moraines of the Highland border west of the River Tay. *Transactions of the Royal Society of Edinburgh*, **57**, 633–45.

Sissons, J.B. (1967a) *The Evolution of Scotland's Scenery*. Edinburgh, Oliver and Boyd, 259pp.