Port of Ness

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Highlights

The sediments exposed in the coastal section at Port of Ness form part of a complex sequence deposited as the Late Devensian ice-sheet melted. They provide important evidence for interpreting the sedimentary environments associated with ice wastage.

Introduction

The site [NB 537 636] is a coastal section located immediately to the south of Port of Ness, in north Lewis. It is important for glacial stratigraphy and sedimentology. The exposures show a complex sequence of interbedded shelly tills, sands, silts and gravels which has provided significant evidence for interpreting the Pleistocene succession in the Outer Hebrides for over one hundred years (Geikie, 1873, 1878; Baden-Powell, 1938; von Weymarn, 1974; Peacock, 1981a, 1984a).

Description

In an early account, MacCulloch (1819) referred briefly to the superficial deposits in north Lewis, which he believed were derived from the 'waste of the gneissic mountains'. Later, J. Geikie (1874) presented a general stratigraphy for the same area based on sections in north-west Lewis and at Port of Ness, which essentially comprised a tripartite succession of two till units with interbedded layers of stratified sand, gravel and clay. At Port of Ness the lower till contained shells and lenses of sand incorporated from the sea floor. The stratified sediments above consisted of coarse gravel with shell fragments. The upper till, which also contained shell fragments, was capped by a further layer of stratified gravels and sands.

Baden-Powell (1938) provided additional details of the Port of Ness succession, in particular noting the lateral variability of the deposits. At the southern end the entire section comprised a massive purple-coloured silt with occasional stony layers. Mollusc shell fragments (e.g. of *Chlamys islandica* (Müller), *Astarte borealis* (Chemnitz), *Macoma calcarea* (Gmelin) and *Mya truncata* (L.) were taken by him to represent a 'cold'-water marine assemblage, and on this basis Baden-Powell correlated the silt deposit ('Glacial Marine Bed') with the upper till of the tripartite sequence at Swainbost on the north-west coast of Lewis (see above). The stone content of the silt increased northwards, merging into boulders and gravel with a silty matrix. At one locality, a hollow in the underlying bedrock showed a layer of till interbedded with sands and gravel. The sands and gravel were correlated with the 'interglacial' marine deposits (the middle bed of the tripartite sequence) identified by Baden-Powell in north-west Lewis.

At Port of Ness, von Weymarn (1974) recorded the following sequence:

5.	sand and silt	*c.* 0.8 m
4.	till	*c.* 5.4 m
3.	sand, silt and gravel	*c.* 1.9 m
2.	till	*c.* 1.8 m
1.	gravel	up to *c.* 1.6 m

Later Peacock (1981a, 1984a) provided further details of the complexity of the sequence and its lateral variability. At the north end of the section, he recorded about 8 m of crudely-bedded, bouldery gravel in which clast imbrication suggested deposition towards the north-west. The gravel is overlain by a brown diamicton, possibly a till. Southwards, the gravel passes laterally into an interbedded sequence, about 10 m thick, of tills or debris-flow deposits and sands and gravels.

Until recently the age of the Port of Ness deposits was unconfirmed. However, the work of Sutherland and Walker (1984), together with unpublished results of amino acid analysis of shells in the glacial deposits of north-west Lewis (see above), suggests that the multiple drift sequence at Port of Ness may be correlated with that on the north-west coast of Lewis and therefore is of Late Devensian age.

Interpretation

J. Geikie (1874) interpreted the stratified deposits at Port of Ness as representing an interglacial marine submergence. This idea was also developed by Baden-Powell (1938). According to von Weymarn (1974), however, the sand, silt and gravel (bed 3 of his succession) could not be correlated with the raised beach gravels on the north-west coast of Lewis, and their characteristics suggested that they might be part of a complex depositional sequence. This suggestion was later supported by Peacock and Ross (1978). Neither von Weymarn nor Peacock and Ross ascribed specific origins to the individual beds or the succession as a whole. Subsequently, however, Peacock (1981a, 1984a) tentatively identified the succession as representing a complex proglacial debris fan from an ice source lying to seaward. Therefore, although the sequence of deposits appears to be established in outline, the site has significant potential for sedimentological study to clarify in detail the lateral variability of the different beds and to provide the basis for a better understanding of their depositional environments.

Port of Ness is important in several respects. It is of historical interest, having been recognized for over one hundred years as a key section providing evidence for the Pleistocene history of northern Lewis, and complementing the interest of the sections on the north-west coast of the island. Formerly it was thought to show both interglacial and glacial marine deposits, but recent studies suggest that the sequence of sediments represents a complex ice-marginal depositional environment. By virtue of its location, the Port of Ness succession also has a direct bearing on interpreting the pattern of the last glaciation and deglaciation in the northern part of the Outer Hebrides. The conventional view, as set out by J. Geikie (1873, 1874, 1877, 1878), that during the last glaciation the whole of the Outer Hebrides was covered by ice moving across the Minch from the Scottish mainland, has now been reassessed and the concept of an extensive local ice-cap firmly established (von Weymarn, 1974, 1979; Flinn, 1978b; Peacock and Ross, 1978; Peacock, 1984a; Sutherland and Walker, 1984). However, a key question, still not fully resolved, is whether ice from the mainland reached and crossed northern Lewis (see Peacock, 1984a; Sutherland and Walker, 1984). Evidence of onshore movement of ice is suggested by the drift deposits in northern Lewis. As first noted by Geikie and later by Baden-Powell (1938) these deposits are distinguished from the drift of the rest of Lewis by their complex stratigraphy, glaciotectonic deformation and their sandstone (ascribed to the Torridonian) erratic and shell content. However, the erratics could possibly have been derived from the Mesozoic sedimentary rocks that underlie the floor of the North Minch close offshore and then transported on land by local Hebridean ice recurving onshore on to north Lewis (Sutherland and Walker, 1984).

Further research on the Port of Ness succession, together with other sites in north Lewis, should help to clarify this issue, which has potentially significant implications for the extent of the Late Devensian ice-sheet, the ice sources and ice-movement patterns and therefore the associated palaeoclimatic conditions in north-west Britain (see also North-west coast of Lewis).

Conclusion

Like the deposits in north-west Lewis, those at Port of Ness have been much studied, featuring in early interpretations of the glacial history of the Outer Hebrides. Recent investigation suggests that they form part of a complex fan of sediments deposited from the margin of an ice-sheet lying to the east. The site has significant research potential for achieving a better understanding both of the pattern of development and melting (deglaciation) of the last ice-sheet in the Outer Hebrides, and of the depositional processes that accompanied ice wastage (about 18,000 years ago).

References