Red Wharf Bay

Introduction

This locality provides rare evidence in North Wales of interglacial conditions. Its possible Ipswichian raised beach occurs beneath till deposited by Irish Sea ice during the subsequent and last glacial phase.

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Red Wharf Bay [SH 532 816] and Porth Oer are the only two sites in northern Wales where raised beach sediments have been recorded. As such, they provide a basis for lithostratigraphical correlation with sequences in South Wales. Red Wharf Bay shows evidence for a sequence of environmental changes from temperate interglacial conditions, as inferred from the high sea-level shown by the raised beach, to colder, and then to fully glacial conditions. The Pleistocene sequence at Red Wharf Bay was first noted by Edwards (1905) and was later described by Greenly (1919). The site has been discussed by Whittow and Ball (1970), Bowen (1973a, 1973b, 1974, 1977b) and Peake *et al.* (1973).

Description and interpretation

Two separate exposures of Pleistocene sediments occur at Red Wharf Bay. At Trwyn Dwlban [SH 532 820] in the northernmost part of the bay, a low cliff consisting of up to about 4m of red Irish Sea till overlies a fine example of a grooved and striated Carboniferous Limestone shore platform. To the south, beneath Castell Mawr Quarry [SH 532 816], raised beach and head deposits overlie a raised shore platform of Carboniferous sandstone at about 3m OD. The lowest member of the Pleistocene succession is a calcite-cemented limestone head deposit up to 7m thick (Whittow and Ball 1970). A thin development of raised beach sediments occurs as a wedge within this limestone head; this is also cemented with secondary calcite. Occasionally, this deposit rests directly on the rock platform but mostly it occupies what Whittow and Ball described as a wave-cut notch in the head, some of which is incorporated into the raised beach wedge. The raised beach is composed entirely of local, Carboniferous rocks. Overlying the head is a red-brown Irish Sea till, much of which is disturbed and mixed with quarry spoil. The relationship of the head to the till is obscured by slumping, but in nearby sections red till clearly overlies the head (Whittow and Ball 1970).

A brief description of the site was given by Edwards (1905) who recorded the red till resting on an ice-scratched limestone surface. Indeed, it was the striated and furrowed bedrock surface at Red Wharf Bay rather than the overlying sediments that attracted most of the early interest in the site. Greenly (1919) referred to the "large glaciated floors of limestone" at Trwyn Dwlban with "the remarkable deflections and under-cuttings". Although striae on the pavement generally trend north-east to south-west, Greenly remarked on the deflected striae that occurred in the trumpet-shaped hollows (palaeokarstic pits) found on the platform. These large hollows up to 2m diameter are plugged with pipes of Carboniferous sandstone. Around the plug margins, where the edges of the pits are clearly visible, the striae can be seen to curve into the pits resuming their normal direction where they emerge. Greenly described one particular example where the striae swept completely round the moat-like hollow surrounding a plug, until on its south-west side, the striae pointed 20° north of west, having therefore undergone a deflection of nearly 90° within the space of about 2m. Undercut furrows were also recorded, and Greenly noted that the ice "must have adapted itself as a practically plastic body to every irregularity in the surface of the rock". He also recorded about 4m of red till resting on the ice-worn limestone, with in places a little blue till visible beneath; the latter, however, has not been relocated.

Whittow and Ball (1970) also described the sequence at Red Wharf Bay and considered that the rock shore platform was representative of the most widespread geomorphological feature pre-dating the Pleistocene drifts in North Wales, although of uncertain age. The fact that the raised beach was separated from the platform by a limestone head indicated that the platform had been fashioned during an earlier period of high sea-level. The red till was assigned to their Liverpool Bay Phase of the Late Devensian (Whittow and Ball 1970).

Bowen (1973a) noted that exposures similar to those at Red Wharf Bay, with head in close association with the raised beach gravels, also occurred in south Pembrokeshire and Gower. It seemed likely that they represented cliff fall material which accumulated contemporaneously with the beach sediments, and were therefore broadly Ipswichian in age. By analogy with the Pleistocene deposits in Gower, it would appear likely that head overlying the raised beach at Red Wharf Bay was formed during some part of the Devensian Stage prior to the ice advance that deposited the red Irish Sea till. These chronostratigraphic assignments were also followed by Bowen (1973b, 1974, 1977b) and Peake *et al.* (1973).

From the foregoing, it is clear that Red Wharf Bay is an important site for a number of different reasons. It is only at one or two sites in North and north-west Wales that raised beach deposits are found; these not only provide a record of interglacial conditions during times of high sea-level, but allow lithostratigraphic correlation with sequences in South Wales. Although an Ipswichian age has been suggested for the raised beach at Red Wharf Bay, its precise age is uncertain. Amino acid geochronological studies in South Wales and southwest England have shown that a complicated sequence of raised beaches occurs. An Ipswichian age for the raised beach at Red Wharf Bay would help to constrain the age of the overlying Irish Sea till to some part of the Devensian Stage, but correlations are at present tentative.

The Irish Sea till at Red Wharf Bay demonstrates the incursion of ice from the Irish Sea Basin onto eastern Anglesey, and with GCR sites at Hen Borth and Lleiniog, and those in Ll■n, helps to establish regional patterns of ice movement by use of diagnostic clast lithology and till fabric measurements. Although a Late Devensian age for the till at Red Wharf Bay is likely, it is not clear if it is the product of the main thrust of Late Devensian ice or a later readvance.

The shore platform at Red Wharf Bay is an excellent example of a widespread geomorphological feature. It is very likely to be composite in age, having been fashioned during a number of high interglacial sea-levels. It is clear from the evidence at Red Wharf Bay that the shore platform and raised beach cannot date from the same high sea-level event because they are separated by head.

Red Wharf Bay demonstrates the finest example of a striated shore platform in north-west Wales. The clear relationship between the striated platform and the overlying glacigenic sediments at the site was important in establishing the Glacial Theory in North Wales. It also shows the close association between erosional and depositional processes in certain subglacial environments, and is therefore important for the study of glacier rock bed forms.

Finally, the sequence of head, raised beach, head and till resting on a striated shore platform at Red Wharf Bay, provides a level of sedimentary and palaeoenvironmental detail rarely found elsewhere in North and north-west Wales. The succession is therefore one of the most complete Pleistocene records in the region and allows a sequence of palaeoenvironmental changes to be reconstructed including the interglacial conditions and high sea-levels shown by the raised beach and the fully glacial conditions shown by the till.

The important stratigraphic reference site of Red Wharf Bay, records some of the best evidence currently available for the Late Pleistocene glacial and interglacial history of North Wales. The sequence contains three chief elements which make the site of special interest. Apart from raised beach deposits at Porth Oer in Ll■n, those at Red Wharf Bay are unique in North Wales and they provide an important record of high sea-levels probably during the Ipswichian Stage; and they enable a degree of stratigraphic correlation with reference sites in South Wales. The till at Red Wharf Bay provides a clear indication of the passage of Irish Sea ice onto the coast of eastern Anglesey. Finally, the shore platform here bears unusually fine deflected glacial striae important in studies of erosion in subglacial environments.

Conclusions

The sequence of deposits at Red Wharf Bay provides evidence for the last interglacial to glacial cycle from about 125,000 years ago. The last interglacial is recorded by a raised beach which provides evidence for a global sea-level higher than at present. Above it, scree deposits provide evidence for a cold (periglacial) climate. The glacial deposits at the site provide evidence for the movement of an Irish Sea ice-sheet onto eastern Anglesey. Only two sites in North Wales provide detailed evidence of this kind.

References