Horton

Highlights

This is a key site for the study of periglacial head, colluvial and loessic sediments dating from the Devensian Stage. Below these occur remnants of marine raised beaches probably formed in two separate interglacial periods, allowing the elucidation of a long and complex climatic and sea-level record.

Introduction

Exposures of superficial deposits near Horton [SS 482 856] show evidence of changing environmental conditions in south Gower. Until recently, it was held that head and colluvial deposits of Devensian age overlay raised beach deposits of Ipswichian age at Horton. Recent work, however, indicates that the raised beach deposits date from two separate sea-level events, which poses a question about the age of the sediment overlying the earlier beach (Bowen *et al.* 1985). Loessic deposits which are common around the South Wales coast are particularly well exposed at Horton. The site was first described by George (1933a), and subsequently by Wirtz (1953). The interpretation is attributed to Bowen (1966, 1969a, 1970a, 1971a, 1973a, 1973b, 1974, 1977a, 1977b), and references to the site have also been made by Mitchell (1972), Peake et *al.* (1973), Stephens and Shakesby (1982) and Case (1977). More recently, detailed studies at Horton were undertaken by Case (1983, 1984), Davies (1983), Henry (1984a, 1984b) and Bowen et *al.* (1984, 1985).

Description

The 200 ft (61m) coastal platform between Port-Eynon and Oxwich is terminated seawards by a fossil cliff, partly buried by superficial deposits which were marine trimmed during the Holocene. At Horton [SS 479 856], Western Slade [SS 483 856] and Eastern Slade [SS 487 857] fault-guided dry valleys run inland to a plateau which is mantled by glacial deposits. The valleys are infilled with Pleistocene sediments which form terraces at the foot of the old cliffs (Bowen 1971a, 1977a; Henry 1984b). At Horton, the exposures are laterally variable (Figure 7), but they show the following generalised sequence above a Carboniferous Limestone shore platform at *c.* 10m OD. (Stratigraphic terminology of Henry (1984a, 1984b) and Bowen et *al.* (1985) in parenthesis) —

5 Colluvium, blown sand and silt (Port-Eynon Silt)

4 Limestone head (Hunts Breccia)

3 Colluvial silts and boulders (Horton Boulder Bed)

2 Colluvial silts (Pwll Du Red Beds)

1 Raised beach deposits, largely uncemented with red silt (Horton Upper Beach)

Fragments of cemented raised beach, lithologically distinct from bed 1, occur in patches cemented on the walls of gullies in the exposed limestone shore platform (Horton Lower Beach; Davies (1983), Bowen *et al.* (1985)).

Interpretation

The Pleistocene deposits at Horton were first described and interpreted by George (1933a) who noted a coarse breccia containing massive limestone blocks overlying bedrock. Pockets of glacial material and solitary erratics, including several igneous rock types from outside the local area, were scattered through the breccia. He therefore concluded that the deposit was 'not merely a local talus' and 'had undergone some measure of transportation by ice' (George 1933a).

Wirtz (1953) referred to raised beach deposits at Horton, which he considered to be of Holstein age (Hoxnian Stage). These were overlain by cold-climate 'frost-shattered rubble' attributable to one or more phases of glacial climate. In a series of papers, Bowen (1966, 1969a, 1970a, 1971a, 1973a, 1973b, 1974, 1977a, 1977b) described and interpreted the stratigraphy at Horton. The raised beach (bed 1) differed from the typical *Patella* Beach (George 1932) around Gower in its uncemented character, its matrix of colluvial material and its high erratic content, both from South Wales and the Irish Sea Basin sources. He suggested that the anomalous matrix may have been translocated downwards or accumulated contemporaneously with the beach. He referred to the boulder bed described by Wirtz (1953) as 'frost-shattered rubble', and noted that the boulders did not have the angular edges characteristic of periglacial material. Rather, they were subrounded and compared with 'joint-bounded weathered limestone' from 'the fossil cliff at the rear of the exposure'.

From the evidence at Horton, Bowen (1969a, 1970a, 1971a, 1977a, 1977b) proposed the following sequence of events:

1. During the 'Older Drift' glaciation, glacial sediments were deposited in Gower. Erratic and stratigraphic evidence from South and west Wales suggested that this 'early' glaciation was probably multiple in nature and from both Irish Sea Basin and local Welsh sources.
2. During high relative sea-levels in the succeeding Ipswichian Stage, raised beach deposits (bed 1) accumulated at Horton, and erratics became incorporated into the beach from the earlier 'Older Drift' glacial deposits. During this interglacial phase, temperate soils formed locally and weathering occurred on the limestone cliffs. The red, probably colluvial matrix of the raised beach shows that it may have accumulated late in the Ipswichian. Bowen (1970a) tentatively correlated this phase of formation with the Neritoides Beach at nearby Minchin Hole Cave.
3. As sea-level began to fall and climate deteriorated in the succeeding cold Devensian Stage, reduced vegetation cover promoted sheet-wash and colluviation. Soils from the plateau and weathered limestone from the local cliffs moved downslope to form the colluvial silts (bed 2) and boulder beds (bed 3) at Horton. The dominance of weathered limestone blocks in the latter bed and the lack of appreciably angular material strongly suggests that these deposits did not form under periglacial conditions (Bowen 1971a, 1974).
4. However, probably during the Late Devensian, periglacial conditions were experienced at the site, limestone head (bed 4) accumulated and elsewhere, for example, Western Slade, 'Older Drift' glacial deposits were reworked from the plateau, along fault-guided valleys to the coast.
5. Case (1977, 1983) suggested that head formation at Horton was succeeded, without hiatus, by deposition of sand and silt (bed 5). This largely wind-blown deposit formed at the end of the Devensian, with proglacial outwash from the Late Devensian ice-sheets as a source for the aeolian silt (Case 1977, 1983). Cryoturbation of the upper head deposits (bed 4) at Horton may also have occurred at this time (Bowen 1966) and loess and colluvial deposits (bed 5) may well have continued to form into the Holocene (Bowen 1971a). The entire sequence of cold-climate and periglacial deposits (Beds 2–5) at Horton was thus considered by Bowen (1973b) to represent the whole of the Devensian Stage (but see Bowen et al. 1985). During the Holocene, the drift sequence was marine trimmed.

In addition to the sequence described by Bowen (1970a), Stephens and Shakesby (1982) noted a sub-horizontal bed of well rounded limestone cobbles in the head sequence at Horton, the origin of which was uncertain. One possible interpretation, however, is that the limestone pebbles are from reworked (that is soliflucted) raised beach sediments.

Case (1983, 1984) examined the Port-Eynon Silt (bed 5) as part of a detailed study of Quaternary airfall and coversand deposits in South Wales. He confirmed the origin of the sediment as a loess and concluded that it had accumulated during dry, cold and windy conditions at the end of the Devensian Stage. The mineralogy of the deposit, however, showed that the loessic silt had probably been derived from Irish Sea glacial deposits to the west, and not from proglacial Welsh outwash as he had previously suggested (Case 1977). A thin layer of sand capping the loess at Horton was also described (Case 1983, 1984) and was considered to be the product of Holocene dune formation.

Henry (1984a, 1984b) described the lithological characteristics of the deposits at Horton and proposed formal lithostratigraphic units (see site description). She showed that two raised beaches at Horton (Horton Upper Beach (bed 1) and Horton Lower Beach (isolated on the limestone platform); Bowen *et al.* 1985) could be distinguished on lithology, texture, clast roundness and foraminiferal assemblage. She concluded, however, that in both beaches, the forams indicated temperate shallow marine conditions, and that the beaches represented sea-level stands at least as high as at

present.

Davies (1983) had already, in an amino acid geochronological study of the raised beaches of Gower, presented data which suggested that the two raised beach deposits at Horton were of different ages. She suggested that the largely uncemented raised beach deposits (bed 1; Horton Upper Beach) could be correlated with Oxygen Isotope Stage 7 of the deep-sea record (*c.* 210,000 BP). The Horton Lower Beach, only found cemented to the limestone bedrock and not in a stratigraphic context, was correlated with Oxygen Isotope Sub-stage 5e (c. 125,000 BP): in common with many other raised beach deposits in Gower. Bowen *et al.* (1985) and Bowen and Sykes (1988) presented further amino acid geochronological data for the raised beach deposits at Horton, using an improved measurement technique. The ascription of the beaches, however, remains unchanged, but fauna from two separate events is contained in the Upper Beach.

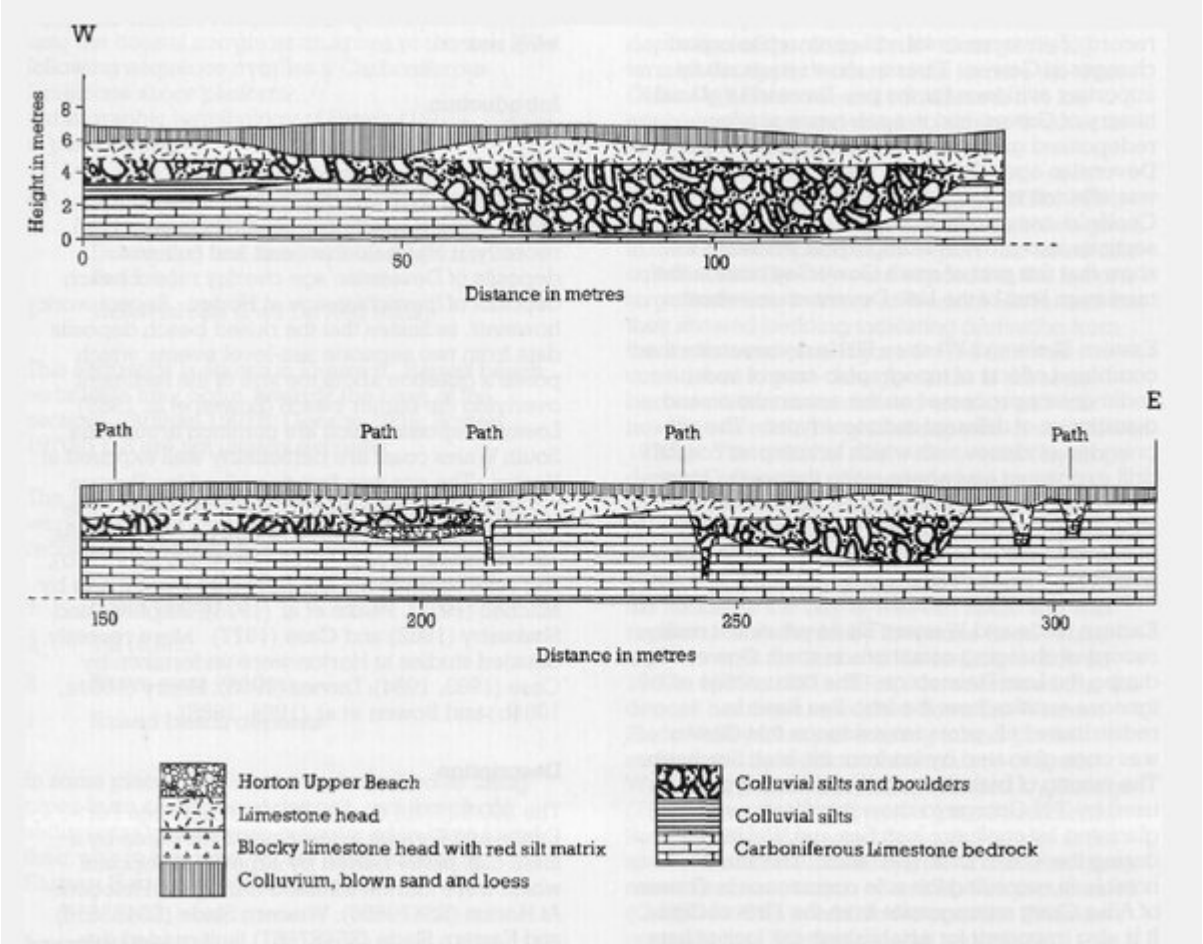
The occurrence at Horton of raised beach sediments of different ages, causes problems in interpreting the overlying beds (Henry 1984a, 1984b; Bowen *et al.* 1985). The Horton Lower Beach was deposited during Oxygen Isotope Substage 5e. The terrestrial deposits overlying the Horton Upper Beach (bed 1), however, are all thought to have been deposited in the Devensian Stage. Henry (1984a, 1984b) proposed that the colluvial silts (bed 2) and colluvial silts with boulders (bed 3) accumulated during the Early and Middle Devensian: as sea-level fell and climate deteriorated, vegetation cover was reduced and sheet washing of previously weathered deposits occurred. During ensuing periglacial conditions in the Late Devensian frost-shattered limestone head (bed 4) accumulated (cf. Bowen 1970a, 1971a). Case (1977, 1983, 1984) has shown that head formation was followed without a break by deposition of wind-blown sand and loess (bed 5).

Horton is, therefore, an integral member of a network of sites in Gower that shows evidence for changing conditions during the Late Pleistocene.

The occurrence of raised beach deposits of different ages makes the site especially important, but causes problems in interpreting the ages of the deposits which overlie the oldest beach. Horton is a reference site for the colluvial deposits and associated boulder beds. It may be regarded as a standard section for the loess in South Wales.

Conclusions

Horton displays two adjacent raised beaches of different ages. One is about 200,000 years, and the other 125,000 years old. It is also important because it is the type-site for loess in South Wales. Loess is a wind-blown silt which was deposited from large dust storms towards the end of the ice age. Loess is extensive in South Wales, but rarely is it seen to such advantage as at Horton. Loess is an important element in South Wales soils, and provides the loamy character of many of the most productive soils in the region.



[References]

(Figure 7) Quaternary sequence at Horton (after Bowen and Henry 1984)