Worm's Head

Highlights

This site provides an important record of climatic change from the last, Ipswichian, interglacial through the cold and periglacial phases of the Devensian. Evidence presented for the presence of an interglacial soil has provoked much research interest.

Introduction

Worm's Head [SS 396 874] records important information for changing conditions in central South Wales during the Late Pleistocene. Its raised marine sediments, periglacial head and glacigenic sediments have long been recognised (George 1932), but the site has gained further importance through the description of a possible interglacial soil (Ball 1960). The site was first mentioned by Strahan (1907b) and was subsequently described by George (1932, 1933a, 1933b). It has featured in studies by Ball (1960), Bowen (1965, 1966, 1969a, 1970a, 1974, 1977b), and more recently was mentioned by Stephens and Shakesby (1982). Aspects of the Pleistocene deposits were also studied by Tindall (1983) and Campbell (1984).

Description

Raised beach, glacigenic and periglacial head and colluvial sediments are widely distributed on the 'outer', 'middle' and 'inner' heads that make up Worm's Head, and they were mapped by George (1932). These deposits, however, are best developed on the south and west flanks of the inner head overlying a Carboniferous Limestone shore platform, where the following sequence occurs (Ball 1960):

5 Dull grey-brown sandy loam, almost stoneless (0.75m)

4 Dull grey-brown, stony sandy loam, with common Devonian and Carboniferous sandstones (glacial sediment) (1.0–2.0m)

3 Brown loam with abundant angular limestone clasts (head) (3.0m)

2 Red sandy-clay loam, with rare limestone pebbles (0.25–0.45m)

1 Cemented *Patella* raised beach deposits

Most beds from this sequence are well displayed on a small knoll or terrace separated from the inner head [SS 396 874], although sections through the raised beach, head and glacial deposits also occur on the west side of the inner head [SS 392 877].

Interpretation

The Pleistocene sequence was first described by Strahan (1907b) who recorded a succession of raised beach, head and sand bordering the inner head of Worm's Head. George (1932) mapped these deposits, and considered that the distribution of the glacial gravels was particularly significant (George 1933a). He noted that a drift terrace bordered much of the Worm, but that, on the south side of the main upstanding hills, locally derived limestone head was preserved above the *Patella* raised beach but no glacial sediments. This contrasted to the east and west margins of the hills where mixed lithology gravel occurred; which could only satisfactorily be explained, George (1933a) suggested, on the assumption that the inner, middle and outer heads had formed three buttresses protecting ground to the south from the onslaught of the ice. George (1932, 1933a, 1933b) envisaged that the *Patella* Beach had formed before the 'Older Drift' glaciation of South Wales. He noted the similarity between the glacial gravels on Worm's Head and those at Rhosili, and suggested

that they had been derived from the north and north-east during the 'Older Drift' glaciation, when confluent Welsh and Irish Sea ice masses may have affected the south and west coasts of Gower.

George (1933a) also described the upper loam (bed 5) as a loess-like deposit which had probably been derived from the underlying glacial sediments, and which had accumulated under aeolian conditions. He noted, however, that this loess-like sediment provided a flat capping to many of the sections along the Gower coast, and suggested that, like the drift terrace at Rhosili, these sediments had finally been fashioned by marine agencies. The platform was tentatively referred to as the 'Post Older Drift Platform', although its specific age was uncertain (George 1932).

Ball (1960) described what he believed to be an *in situ* interglacial soil (bed 2). The micro-fabric and mineralogy of this deposit suggested that it was transitional between *terra fusca* and *terra rossa* soils commonly found on limestone around the Mediterranean today (Ball 1960). He concluded that the soil had formed under slightly warmer summer conditions than at present, and postulated that it *was in situ* relict material, formed during interglacial (Ipswichian) conditions; moreover that together with other similar deposits, it had only survived locally in areas not glaciated by Late Devensian ice.

Accepting that the sediment described by Ball (1960) might contain elements of an interglacial soil, Bowen (1965, 1966) considered that the bed had been reworked by solifluction. Subsequently, Bowen (1969a, 1970a, 1971a, 1974, 1977b) suggested that such sediments had formed by soil erosion and sheet-washing. He classified them as colluvial silts and compared them to the 'limon rouges' of the Mediterranean. Bowen (1970a) noted that such sediments were widespread in south Gower, and that they formed an important stratigraphic unit, suggesting that they had been deposited by colluviation at the foot of the coastal cliffs, as sea-level fell towards the end of the Ipswichian Stage. At that time, an ever increasing area of sea-bed was exposed, and deflated sand from this source may also have been mixed with the colluviated remnants of interglacial soil, perhaps even with residual Keuper Marl and the fines washed from glacial deposits of pre-Ipswichian ('Older Drift') age (Bowen 1969a, 1970a). The mixed lithology drift (bed 4) on Worm's Head, and at Rhosili, had been deposited as outwash from the Late Devensian ice-sheet which may have reached its southern limit where Whitford Point now lies (Bowen 1970a).

Stephens and Shakesby (1982) suggested that drift overlying Ball's (1960) interglacial soil, might be redistributed pre-Devensian glacial sediment, or, alternatively (for example, Bowen 1970a), Late Devensian outwash.

Tindall (1983), in an examination of diagnostic sedimentary properties of the deposits on Worm's Head, noted that the fabric of bed 4 (the outwash sediments of Bowen (1970a)) showed a marked downslope orientation, and she concluded that the glacial sediments were not *in situ,* but had been soliflucted into position. She also recorded that elsewhere (for example, at [SS 396 874]) these beds were disrupted by periglacial convolutions.

Campbell (1984) concluded from Scanning Electron Microscopy studies of sediments that there was no evidence for a protracted period of *in situ* interglacial weathering as proposed by Ball (1960), and the presence of many well rounded marine-type quartz sand grains supported Bowen's view that the deposit (bed 2) contained deflated (windblown) marine sand. Ball (1985 — personal communication), now accepts that interglacial soil material on Worm's Head is probably not *in situ.* Campbell's (1984) SEM data, however, did not allow a palaeoenvironmental interpretation of the mixed lithology drift on Worm's Head, although he suggested that they were compatible with redeposited glacial material.

The raised beach deposits of both inner and outer Worm's Head (for example, bed 1) were formed during the Ipswichian Stage, as shown by amino acid geochronology (Bowen et *al.* 1985; Bowen and Sykes 1988). The colluvial sediments (bed 2) and head deposits of local lithology (bed 3) accumulated during the subsequent Devensian Stage. The origin of the gravels (bed 4), however, remains uncertain. They may represent soliflucted deposits from a glaciation that pre-dated the Ipswichian Stage, or they may have been deposited as outwash from the Late Devensian ice-sheet. The overlying silty sand (bed 5) is probably a mixture of wind-blown and colluvial sediments deposited towards the close of the Devensian Stage.

Worm's Head is important for sediments which show a sequence of changing conditions from the high sea-levels and temperate conditions of the Ipswichian Stage (Oxygen Isotope Sub-stage 5e) through cold, to fully periglacial conditions

in the Devensian Stage. The site became particularly important following Ball's (1960) description of a possible interglacial soil. This has since been shown to be a colluvial deposit. Worm's Head remains important in understanding Late Pleistocene events in south-west Gower, particularly for establishing the precise limit of the Late Devensian ice-sheet.

Conclusions

Worm's Head displays a sequence of deposits representing the last glacial cycle. In particular, it contains a colluvial (slope wash) deposit previously interpreted as a soil profile, which is important evidence for showing how the last interglacial changed into the last ice age.

References