
West Angle Bay

Highlights

A unique site showing glacial sediments perhaps attributable to more than one glaciation. A pre-Devensian till may underlie Ipswichian raised beach deposits, and both overlie a rock platform which is thus not attributable to the last, Ipswichian, interglacial.

Introduction

West Angle Bay (West Angle) [SM 853 031] is important because it shows a sequence of marine and terrestrial sediments that record major changes in environmental and geomorphological conditions in south-west Wales during the Late Pleistocene. Although dating of the beds exposed has been controversial, the site is potentially one of the most important in Wales. The interpretation of the sediments at West Angle is also relevant to the establishment of local ice limits. The site attracted early studies by Cantrill *et al.* (1916), Dixon (1921) and Leach (1933) and since by John (1965a, 1968a, 1969, 1970a, 1971a, 1974), John and Ellis-Gruffydd (1970), Mitchell (1972), Bowen (1973a, 1973b, 1973d, 1974, 1977b, 1980a, 1981a, 1984), Peake *et al.* (1973) and Shotton and Williams (1973). The palynology of the site was studied in detail by Stevenson and Moore (1982).

Description

Pleistocene sediments are well exposed for about 100m at the head of West Angle Bay. The following generalised sequence occurs above a bedrock platform -

5 Sandy loam

4 Red gravel

3 Sands, silts, loams and peat

2 Cemented raised beach deposits

1 Irish Sea till

The sequence is laterally variable, and the exposures are subject to change through erosion; this has resulted in difficulties in comparing the sequences described by different workers (Stevenson and Moore 1982). A comparable sequence to that above was also noted in an old, and now infilled, brick pit behind the main cliff line (Dixon 1921).

Interpretation

At West Angle, Dixon (1921) interpreted the sequence as till overlain by raised beach sands and gravels, and head deposits. The till contained scratched clasts, including igneous rock types, in a stiff purplish clay. He suggested that the site was unique in showing raised beach deposits overlying glacial sediments; for at other localities on the Welsh coast the relationship was reversed. This indicated an interglacial rather than pre-glacial age for the raised beach deposits. Dixon noted that the till in this section was underlain by a black clay with debris of silicified Carboniferous shells. This bed, he concluded, could be Lower Limestone Shales rotted *in situ*, but was more likely an ancient estuarine mud because it contained nests of pyrite and selenite.

Although till beneath raised beach deposits was also recorded by Leach (1933), it was not subsequently seen by John (for example, 1965a, 1968a, 1969, 1974) who recognised stained and cemented raised beach deposits (bed 2) conformably overlain by a sequence of sands, silts and clays (bed 3) containing organic debris. A sharp unconformity

was noted separating these sediments from an overlying red gravelly deposit (bed 4). According to John, the red gravel was glacial in origin, being either fluvioglacial outwash or a gravelly 'land facies' of the Irish Sea ice-sheet (John 1968a, 1971a). On stratigraphic grounds, and from radiocarbon dates obtained from elsewhere in south-west Wales, he considered the till here to be Late Devensian in age; proving that the Late Devensian ice-sheet reached at least as far south as West Angle and the Milford Haven area (John 1971a).

John (1969) suggested that there had been no hiatus in deposition between the raised beach sediments and the overlying sands, silts and clays. The sediments were therefore closely related in age (John 1968a). The raised beach had been deposited close to present day high water mark, and the overlying sediments had been deposited under estuarine conditions. The site recorded a relatively comprehensive marine transgression during which the sea may have risen to 6m (20 ft) OD. The sands and silts contained abundant organic remains, including small wood fragments, leaves and marine shell fragments. A preliminary study (Field 1968) of pollen from these beds showed that the vegetation of the area probably comprised a mixed oak and alder forest with pine and hazel and salt-tolerant plants — the latter probably living close to the water's edge. John (1968a) considered that the cemented raised beach at West Angle probably dated from an early phase of an interglacial and that the overlying deposits were estuarine, representing a marine transgression towards the peak of the same interglacial. A temperate interglacial phase is clearly indicated, but the pollen data do not allow it to be correlated with the pollen sequence of any standard interglacial stage elsewhere. The raised beach sequence was, however, tentatively assigned to the Ipswichian Stage, although some pollen known to occur in Hoxnian deposits elsewhere was noted (Field 1968; John 1969; John and Ellis-Gruffydd 1970).

Bowen (for example, 1973a, 1973b, 1974, 1977b) also supported an Ipswichian age for the interglacial succession at West Angle Bay, noting, however, that the palynological evidence was equivocal.

A radiocarbon date of >35,000 BP (Birm 327) was obtained from *Alnus* wood collected by Ribbon and Bowen from the base of a peat bed at 3.6 — 3.9m OD in the interglacial succession (bed 3) (Shotton and Williams 1973). Although this age determination did not help to date the deposits any more precisely, it was important in precluding a Holocene age.

Like Dixon (1921), excavation allowed Bowen (1973a, 1973b, 1974, 1977b) to record an Irish Sea till (bed 1) at the base of the sections beneath the interglacial succession. According to Bowen, West Angle Bay provided important, if not unique, evidence for a pre-Devensian glaciation in South Wales; such a discovery was also of considerable importance because the interglacial deposits were separated from the underlying bedrock platform by till. The site demonstrated that at least one glacial period had occurred between planation of the rock platform and deposition of interglacial sediments; and therefore showed that the formation of the raised shore platform and raised beach sequence had not been contemporaneous. Bowen (1974) also suggested that the interglacial sequence (beds 2 and 3) showed clear evidence for two different stands of sea-level, probably during the Ipswichian Stage.

Bowen (1971b, 1974) reinterpreted the gravels (bed 4) at West Angle, previously described as till (John 1970a), as periglacial head deposits. Therefore, the Milford Haven and West Angle area had not been glaciated during the Late Devensian, but lay in the 'extra-glacial' zone (Bowen 1974). The red periglacial gravels were considered to have accumulated during Early and Middle Devensian times (Bowen 1977b).

An Ipswichian age for the raised beach deposits was also favoured by Mitchell (1972). The upper red gravel, however, was regarded by Mitchell as soliflucted till of Saalian age; the equivalent of the till described by Dixon (1921), but moved down into its present position by freeze-thaw processes in the Devensian Stage.

In view of the controversy and considerable interest surrounding the interglacial succession, a detailed re-investigation of the palynology of the site was undertaken by Stevenson and Moore (1982). Four pollen assemblage zones were defined (from bed 3), all dominated by temperate forest taxa, thus confirming a temperate environment during deposition. However, they were unable to correlate the sequence precisely with other British and Irish interglacial sites, although certain features of the West Angle pollen diagram, they suggested, correlated most closely with some Hoxnian pollen diagrams from eastern England. Periods of forest disturbance were noted in the profile and were considered to have been caused by local flood catastrophes. The red gravels overlying the interglacial sequence were considered to be head (periglacial).

The sequence of glacial, interglacial and periglacial sediments at West Angle Bay provides a key stratigraphic Late Pleistocene record. The nature and dating of the sediments have proved controversial and the sequence has been interpreted in a number of ways. The simplest of these interpretations recognises a sequence of Ipswichian Stage sediments overlain by Devensian glacial and periglacial sediments (for example, John 1968a). However, recent work suggests that the interglacial sediments have Hoxnian affinities (Stevenson and Moore 1982) and that they overlie an Irish Sea till (Bowen 1974, 1977b).

West Angle Bay also provides important evidence for a succession of different sea-level stands, and evidence to suggest that the shore platforms and raised beach deposits found commonly around the coast of south-west Britain are not necessarily contemporaneous: at West Angle, the raised beach is separated from a rock platform by glacial sediments.

The controversy regarding the interpretation of the sediments which overlie the interglacial sequence at West Angle has led to different interpretations of the maximum extent of the Late Devensian ice-sheet in the region. Some authors have regarded the red gravel as glacial in origin, envisaging that Late Devensian ice reached at least as far south as Milford Haven. Others, however, argued that the same deposits had a periglacial origin, placing the maximum limit of the Late Devensian ice-sheet somewhat farther to the north.

West Angle Bay displays one of the most complete Pleistocene sequences in Wales. It is important for showing what is believed to be the only known example of pre-Devensian till in Wales. Because this till rests on a presumably interglacial rock shore platform and is overlain by interglacial raised beach deposits, the evidence is important for demonstrating that the platform and raised marine sediments here and probably, therefore, elsewhere in Wales, are not contemporaneous. Although the succession shows a number of clear environmental and geomorphological changes in the region during the Late Pleistocene, dating of the sequence has proved controversial; and an Ipswichian age for the raised beach sequence is not firmly established. The disputed origin of deposits overlying the raised beach sediments, has a major bearing on reconstructing the maximum limit for Late Devensian ice in this part of south-west Wales.

Conclusions

West Angle Bay contains one of the longest sequences of ice age deposits in Wales. The lowest bed (normally only found below beach level) may be evidence for the oldest known glaciation of Wales. It is overlain by marine deposits which are thought to be 125,000 years old. The origin of the red gravel deposit overlying the marine beds is controversial.

[References](#)