Pendower

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Highlights

This site provides a textbook example of a compound shore platform. Its Pleistocene succession of raised marine deposits and periglacial head and loess is one of the finest in Cornwall.

Introduction

Coastal exposures at Pendower typify the south Cornish Pleistocene succession, and show one of the finest examples of a compound shore platform overlain by raised beach sediments anywhere in south-western Britain. First described by Boase (1832) and later by Whitley (1866) and Reid (1907), the site has also featured in studies by Rogers (1909, 1910), Davison (1930), Robson (1944), Everard *et al.* (1964), Mottershead (1977b), James (1974, 1994) and Stephens and Sims (1980). The most detailed accounts of the site are those of James (1981b, 1994) and Scourse (1985a, 1996c).

Description

Pleistocene sediments are exposed more or less continuously for a distance of 8 km in Gerrans Bay, on the south Cornish coast. Perhaps the best exposures, however, are found between [SW 899 381] and *c.* [SW 910 380], a stretch of coast along Pendower Beach, through Spire Point to beyond Giddleywell in the east. The sequence at the western end of these exposures is shown in (Figure 6.4). The following succession can be generalized from field observations and the descriptions given by Stephens and Sims (1980), James (1981b, 1994) and Scourse (1985a, 1996c) (maximum bed thicknesses in parentheses):

4. Silty sand (loess) (0.5 m)

3. Breccia (head of various facies) (*c.* 12 m)

2. Sand (coastal dune sand) (2.5 m)

1. Pebbly conglomerate (raised beach deposits) (3.0 m)

Compound shore platform

The shore platforms in Gerrans Bay can be traced almost continuously from St Anthony Head in the south-west to east of Pendower Beach (James, 1974, 1981b). They cut across south-east-dipping slates, shales and sandstones with interbedded quartz veins of the Portscatho and Veryan series. Stephens and Sims (1980) and James (1974, 1981b) divided the platform into a lower surface (coincident with the modern beach) and an elevated surface of limited extent, frequently obscured by Quaternary sediment.

The ubiquitous lower platform is notched into a small cliff below the higher platform surface at a maximum level of 4.4 m OD (James, 1974, 1981b; Mottershead, 1977b), and extends to below high water mark. The upper platform also notches a fossil cliff which, in many places, is obscured by Pleistocene sediments. The lower platform is at times more than 10 m wide (James, 1974, 1981b) and both platform surfaces are remarkably flat. Large boulders are stranded on the platform surfaces (Stephens and Sims, 1980): some may be erratics (Stephens, 1970a), but others consist of local quartzite, chert, conglomerate and spilitic lava.

Deposits immediately overlying the lower raised shore platform consist of a clast-supported conglomerate of pebbles and cobbles (bed 1) with occasional, larger, and more angular blocks of local derivation (Figure 6.5). For the most part, this

bed consists of small rounded quartz pebbles with some of slate in a sandy matrix. It is strongly cemented with oxides of iron and manganese. In places, fragments of material from bed 3 (head) are also incorporated into the upper layers of the raised beach deposit. Although considered unfossiliferous (Reid, 1907; James, 1981b), shells from the raised beach deposit were reported by Rogers (1910). Scourse (1985a, 1996c) and James (1994) record that bed 1 is overlain by cross-bedded sands (coastal dunes), although James (1994) notes that this unit is locally obscured by slope-wash materials.

The succeeding breccia (bed 3) is a variable deposit consisting almost entirely of angular clasts of local shales, slates, grits and vein-quartz fragments. In places, this bed comprises a breccia of fine shale fragments showing faint stratification: in others, it is a blocky deposit consisting of large, angular cobble- and boulder-sized fragments. Finer lenses of silt and sand also occur within this bed. In most of the sections at Pendower, the head is banked against a steep cliff and, where the deposits have fallen away, the old, apparently water-worn slate cliff (Reid, 1907) is seen. The upper layers of the head (between *c.* 0.5–1.0 m) consist of fine, sharply angular, comminuted shale and slate fragments; cryoturbation features (involutions) and fossil ice-wedge casts are also common in the upper parts of this bed (Stephens and Sims, 1980; James, 1981b, 1994). Stephens and Sims recorded one locality where the head (bed 3) was divisible into two beds, separated by sand containing only occasional rock fragments. For much of the site, however, they recognized a coarse blocky head overlain directly by a finer head.

Finally, the Pleistocene sequence is capped by a thin (up to 0.5 m) silty sand with occasional pebbles, either a loess (Scourse, 1985a) or a slope-wash deposit (Stephens and Sims, 1980; James, 1981b). Submerged forest beds are also present along this stretch of the coast (Robson, 1944).

Interpretation

Boase (1832) referred to the 'head' in Gerrans Bay as 'Diluvium'. Reid (1907) regarded the head (bed 3) as ' … a mass of angular rubble shattered by frost, swept down the slopes, and deposited on the lowlands when arctic conditions prevailed in Cornwall … ' (Reid, 1907; p. 58). The climatic conditions under which the raised beach deposits accumulated were not known, the bed being unfossiliferous and there being no clear evidence for penecontemporaneous ice-carried erratics unlike other examples of raised beach sediments elsewhere in Cornwall (Reid, 1907).

Although referred to briefly by Davison (1930), James (1974) and Mottershead (1977b), the sections at Pendower were not studied again in any detail until the work of Stephens and Sims (1980), James (1981b) and Scourse (1985a). The beds were described in detail by Stephens and Sims (1980) who, apart from interpreting bed 1 as a raised beach deposit formed during temperate, high sea-level conditions in the Pleistocene, and the head (bed 3) as a periglacial solifluction deposit, were noncommittal about the possible chronostratigraphic attribution of the beds.

James (1981b) used the thermoluminescence (TL) evidence of Wintle (1981) to provide a relative dating scheme for the beds at Pendower. Wintle (1981) gave TL determinations which supported a Late Devensian age for loess deposits (stratigraphically equivalent to bed 4 at Pendower) at locations in southern England, including south Cornwall and the Isles of Scilly. James (1981b) argued that the various facies of head (bed 3) underlying the silty sand (bed 4) at Pendower, were thus probably Devensian in age, with the upper layers and cryoturbation structures almost certainly belonging to the coldest part of that stage — the Late Devensian. He argued that the raised beach conglomerate (bed 1) was therefore most probably ascribable to the Ipswichian Stage. Where raised beach (bed 1) and head (bed 3) material was mixed at the site, he argued that marine and terrestrial deposition had taken place in latest Ipswichian or earliest Devensian times. The underlying shore platform was believed by him to have been re-trimmed, if not comprehensively formed, during the Ipswichian Stage.

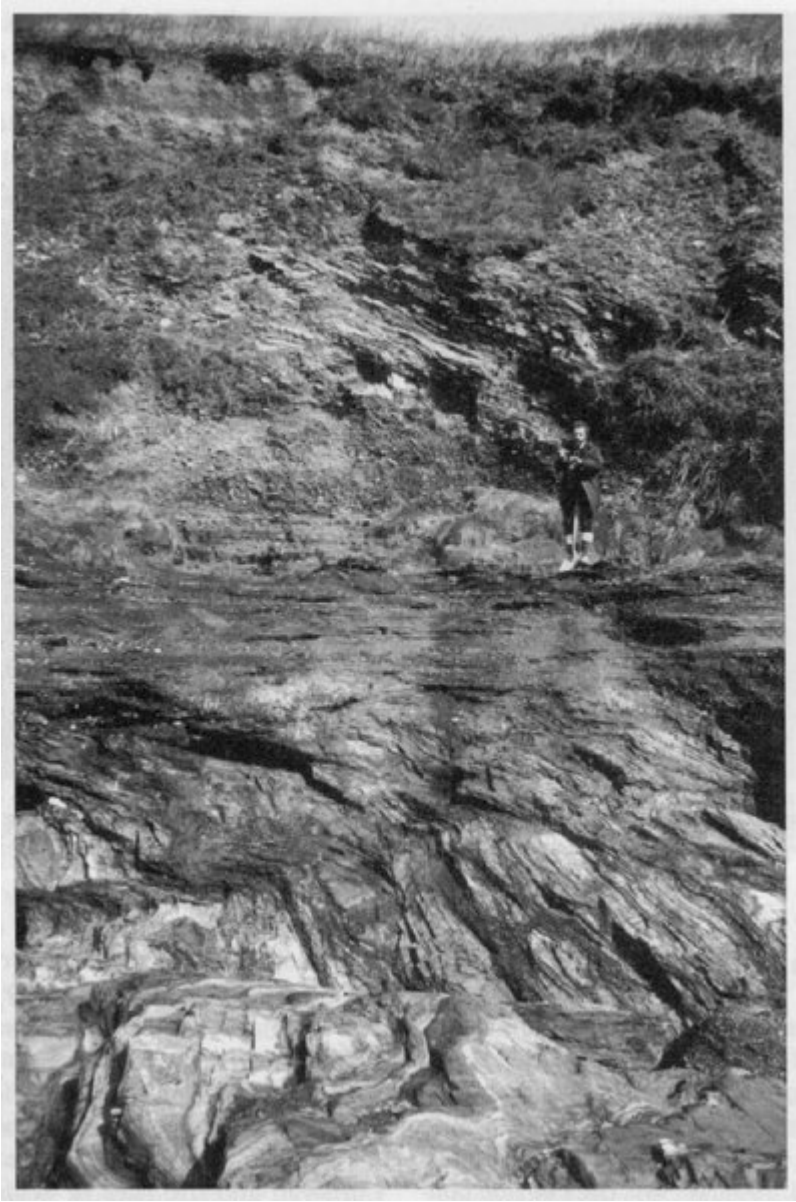
Scourse (1985a, 1996c) correlates bed 1 at Pendower with the raised beach deposits at Godrevy (Godrevy Formation). He regards bed 2 as an aeolian coastal dune deposit. A TL date of between 165 ka and 252 ka BP (QTL-466; Southgate, 1984; unpublished data) from sand in bed 2 was used as evidence by Scourse to show that the underlying raised beach conglomerate was older than Ipswichian in age (Oxygen Isotope Stage 5). He regarded the head (bed 3) as a periglacial solifluction deposit (Penwith Formation), formed substantially, although not necessarily exclusively, during the Devensian Stage (Scourse, 1985a, 1996c).

In summary, the elevated shore platform is likely to be composite in age (e.g. Mitchell, 1960; Kidson, 1971; Stephens, 1973), although it was probably re-trimmed during the Ipswichian (James, 1981a, 1994). Likewise, the precise age of the raised beach sediments at Pendower is not established. The II, dating from the site, although tentative, might suggest that the raised beach deposit here may be older than many of the other examples in South-West England and Wales which have been ascribed to the Ipswichian Stage (Oxygen Isotope Stage 5e *c.* 125 ka BP). It is relevant that preliminary amino-acid data (Bowen *et al.,* 1985) similarly indicate a pre-Ipswichian age for the raised beach deposits at Godrevy: these sites may therefore provide crucial evidence to demonstrate that not all of the raised beach deposits in the region are ascribable to the Ipswichian Stage. Whether they can be ascribed to Oxygen Isotope Stage 7 is unproven at present, although a distinct possibility (see Portland Bill; Hope's Nose and Thatcher Rock). The firm attribution of these raised beach beds to a pre-Ipswichian high sea-level event would be crucially important for interpreting Pleistocene successions throughout the region: some elements of the complex head and solifluction sequences, therefore, may have accumulated in cold conditions prior to the Devensian Stage. A cautionary note, however, must be added. The *Patella vulgata* shell from Godrevy which yielded the Stage 7 age, came from an isolated conglomerate 'bridge' some distance from the main Godrevy raised beach exposure (James, 1997). James regards this 'bridge' as a Stage 7 remanie section, but notes that the rest of the Godrevy raised beach section is likely to date from Stage 5e. Indeed, a recent reassessment of the geochronological evidence (James, 1995) suggests that many of the raised beach deposits in South-West England contain remanie material of earlier interglacial events (e.g. Stage 9 and/or 7), but that most of the locations were last occupied during Stage 5e.

Conclusion

Although the precise ages of the beds at Pendower are far from certain, the site provides one of the most detailed Pleistocene records in Cornwall. It is particularly notable for the fine development of the compound shore platform with its associated marine cliffs and notches. These features, together with the closely associated Pleistocene sediments (large erratics, raised beach, head and possible loess deposits), reveal an unusually complete record of the complex and protracted evolution of the south Cornish landscape.

References



(Figure 6.4) Coastal exposures at the western end of Pendower Beach, showing a compound shore platform cut across steeply dipping slates, overlain by cemented raised beach deposits and head. (Photo: S. Campbell.)

(Figure 6.5) A striking unconformity between the shore platform and overlying, cemented raised beach deposits at Pendower, viewed by members of the Quaternary Research Association in 1980. (Photo: S. Campbell.)