
Porth Seal, St Martin's

J.D. Scourse

Highlights

Mitchell and Orme (1967) defined Porth Seal as the type-site for the younger of the two raised beach deposits they identified on Scilly. Organic beds found within the head at this site have yielded pollen consistent with deposition under periglacial conditions, and the beds have been radiocarbon dated to the late Middle and early Late Devensian. These absolute dates are critical for establishing a chronology of Pleistocene events on Scilly.

Introduction

Mitchell and Orme (1967) recognized two distinct raised beach deposits on the Isles of Scilly. An erratic-free deposit, the Chad Girt Raised Beach, was assigned a Hoxnian age, while an erratic-rich deposit, the Porth Seal Raised Beach, was believed to post-date the proposed Gipping (= Wolstonian/Saalian) glaciation of the northern islands, and was accordingly assigned to the Eemian (= Ipswichian). Mitchell and Orme were unable to identify a site where both beach deposits could be seen unambiguously in stratigraphic superposition, although they believed that two separate raised beach deposits were present at Porth Seal (Mitchell and Orme, 1967; p. 73). However, the sequence at Porth Seal was subsequently depicted by Stephens (1970a; (Figure 8.8)), based on an unpublished field sketch made in 1965 by F.M. Synge, as showing two raised beach deposits separated by periglacial head ((Figure 8.8); Section 3). The lower raised beach deposit was correlated with the 'erratic-free' Chad Girt Raised Beach, the upper being the 'erratic-rich' Porth Seal Raised Beach.

Bowen (1981) suggested that the Porth Seal Raised Beach was not marine in origin, but that instead it comprised soliflucted granite corestones. Scourse (1991) re-interpreted the upper beach as a soliflucted facies of the lower (= Chad Girt Raised Beach) (Figure 8.8). Similar stratigraphic relationships were also described at Northward Bight. He correlated this raised beach with the Watermill Sands and Gravel (Figure 8.3).

Description

Porth Seal [SV 918 166] lies on the north-west coast of St Martin's (Figure 8.1), and the most complete sections occur on the south side of the bay. Scourse (1991) records the critical section described by Mitchell and Orme (1967) and Stephens (1970a), and demonstrates the stratigraphic relations between this sequence and organic materials at the site (Figure 8.8) and (Figure 8.9). Scourse's (1985a, 1991) composite sequence from Sections 1 and 2 (Figure 8.8) can be summarized thus:

9. Coarse, granitic solifluction breccia
8. Fawn granular sand
7. Organic silty sands with granite clasts and quartz granules
6. Coarse, white granular sand
5. Black, richly organic fine silt
4. Coarse, white granular sand
3. Soliflucted raised beach deposits (= Porth Seal Raised Beach of Mitchell and Orme (1967))
2. Solifluction breccia

1. Raised beach deposits (= Chad Girt Raised Beach of Mitchell and Orme (1967))

Matrix-supported, rounded, raised beach cobbles (bed 3) are exposed towards the western end of the described section overlying a unit of granitic blocky head (bed 2). A complex unit (beds 4–8), including organic materials, overlies these beach cobbles laterally to the east. This metre-thick deposit consists of several distinct, internally stratified, beds. The lowest (bed 4) consists of coarse white granitic sand and granules, and rests directly on the underlying (soliflucted) beach cobbles. This sand lenses out to the west such that the overlying bed of black, richly organic, fine silt (bed 5) also rests directly on the beach cobbles at its western limit. In places the matrix of the cobble deposit (bed 3) comprises this organic silt. Bed 6 is similar to bed 4, and is overlain by bed 7, a relatively thick deposit of internally variable, dark brown, organic silty sand with granite clasts and quartz granules. Beds 4–8 are overlain by up to 5 m of coarse granitic head (bed 9).

The granitic head (bed 2) can be traced to the west as the Gipping (= Wolstonian) 'head without erratics' of Mitchell and Orme (1967) ((Figure 8.8); Section 3). At this point, in a small gully within the basal granite bedrock ((Figure 8.8); Section 2 = Porth Seal C), the head is underlain by another unit of raised beach cobbles (bed 1). Mitchell and Orme (1967) describe this section as follows: '... at one point on the south of the bay there is a channel about 15 yds long and 2 yds deep in the shore-platform. The bottom of the channel has 6 inches of beach shingle on its floor, and the channel itself is filled with coarse head' (Mitchell and Orme, 1967; p. 73).

Interpretation

Mitchell and Orme (1967) correlated the lowermost raised beach deposit (bed 1) at Porth Seal with the Chad Girt Raised Beach (Hoxnian). The overlying head was regarded as the Gippingian (= Wolstonian) Lower (or Main) Head. They inferred that a shore platform was then trimmed across both the Lower Head and the bedrock, and the main unit of cobbles (the Porth Seal Raised Beach; bed 3) deposited. They defined bed 3 as the stratotype for the Porth Seal Raised Beach, which they suggested was equivalent to the Upper Belcroute Bay Beach of Jersey (Mourant, 1933, 1935) and of Eemian (= Ipswichian) age. They identified the head covering the Porth Seal Raised Beach as Upper Head of Weichselian (= Devensian) age.

Bowen (1981) suggested that the Porth Seal Raised Beach might not be a raised beach at all, but rather a body of soliflucted granite corestones. Scourse (1991) alternatively interpreted the Porth Seal Raised Beach as a soliflucted facies of the underlying (= Chad Girt) raised beach. Rather than the direct lithochronostratigraphical interpretation offered by Mitchell and Orme (1967), he identified only one *in situ* raised beach deposit at Porth Seal, represented by bed 1 or the 'Chad Girt Raised Beach'. He suggested that the upper parts of this deposit have become entrained within the overlying solifluction flow and appear in section as an upper, younger, raised beach deposit (bed 3). Such tongues of incorporated beach material occur at many sites in South-West England where beach sediments have been overridden by solifluction lobes and sheets. These often appear in two-dimensional cliff sections as stratigraphically distinct raised beach units. Sedimentological criteria invoked at Porth Seal by Scourse (1991) to support this interpretation include the matrix- rather than clast-supported character of bed 3, and the clearly soliflual rather than littoral origin of this matrix.

Scourse (1991) correlates bed 1 (the Chad Girt Raised Beach of Mitchell and Orme) with the Watermill Sands and Gravel (Figure 8.3), and beds 4–9 with the Porthloo Breccia. Beds 2 and 3 are classified as facies Aa 'deformation breccia' (Scourse, 1987).

Pollen analysis of samples from organic materials in beds 4–8 have yielded spectra very similar to those described from comparable sequences at Carn Morval and Watermill Cove (Scourse, 1991; see above). Important elements include Gramineae, *Solidago* type and Rubiaceae, with Cyperaceae, *Achillea* type and *Plantago* spp. as minor contributors. A low but consistent presence of the obligate aquatic taxon *Sparganium* type, with *Potamogeton* and *Typha latifolia* in some samples, supports a lacustrine origin for this organic material. These spectra are consistent with open grassland vegetation. The organic sediments probably accumulated in a basin on the exposed shore platform during the onset of active solifluction (Figure 8.9).

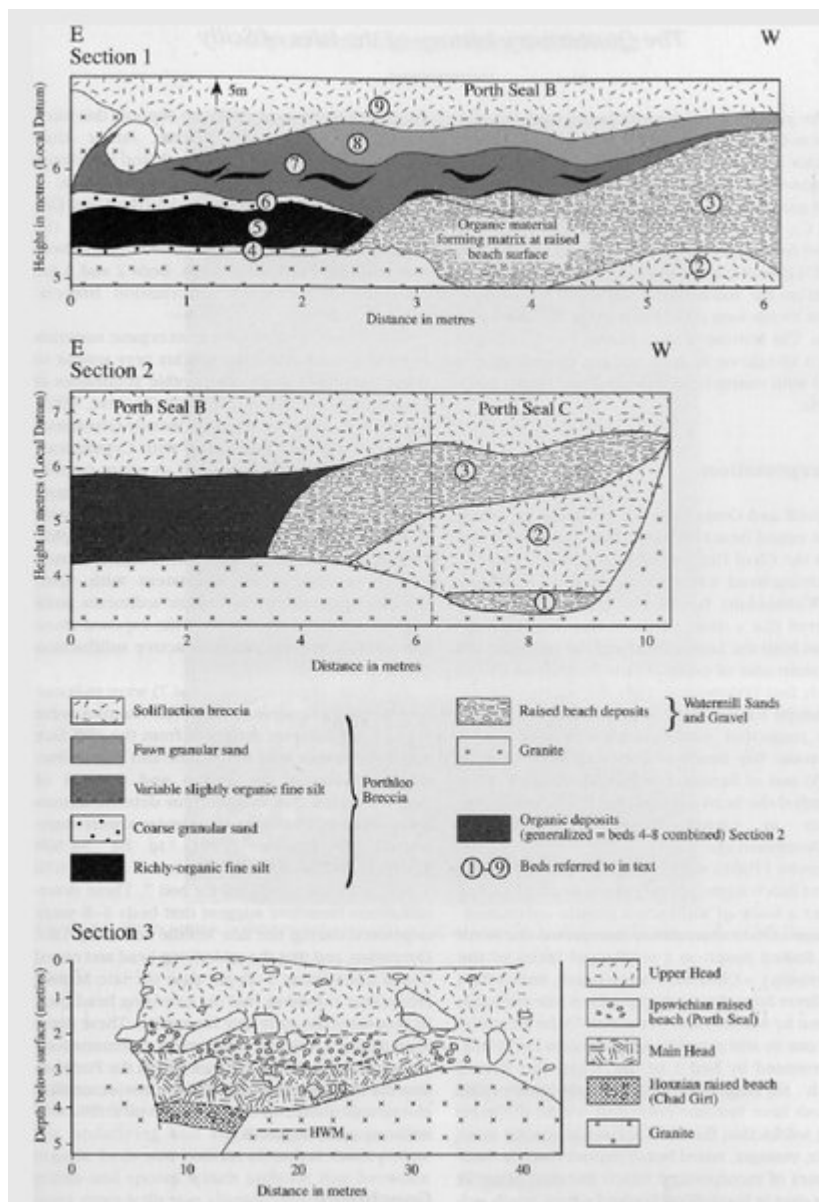
The richly organic beds (5 and 7) were radiocarbon dated by Scourse (1991). The samples were taken from different distances from the cliff face and each sample split into humic and humin fractions to identify the extent and sources of

contamination. Six radiocarbon determinations were obtained; the most reliable dates were interpreted by Scourse (1991) to be $34\,500 \pm 885/-800$ BP (Q-2410) for bed 5 and $25\,670 \pm 560/-530$ BP (Q-2409) for bed 7. These determinations therefore suggest that beds 4–8 were deposited during the late Middle and early Late Devensian, and that the underlying head and raised beach units (beds 1–3) pre-date the late Middle Devensian. It follows that the overlying head (bed 9) post-dates the early Late Devensian. These dates form part of a series of radiocarbon determinations from a network of organic sites within the Porthloo Breccia throughout Scilly which provide critical chronological data on the age of the identified sedimentary units (Figure 8.3).

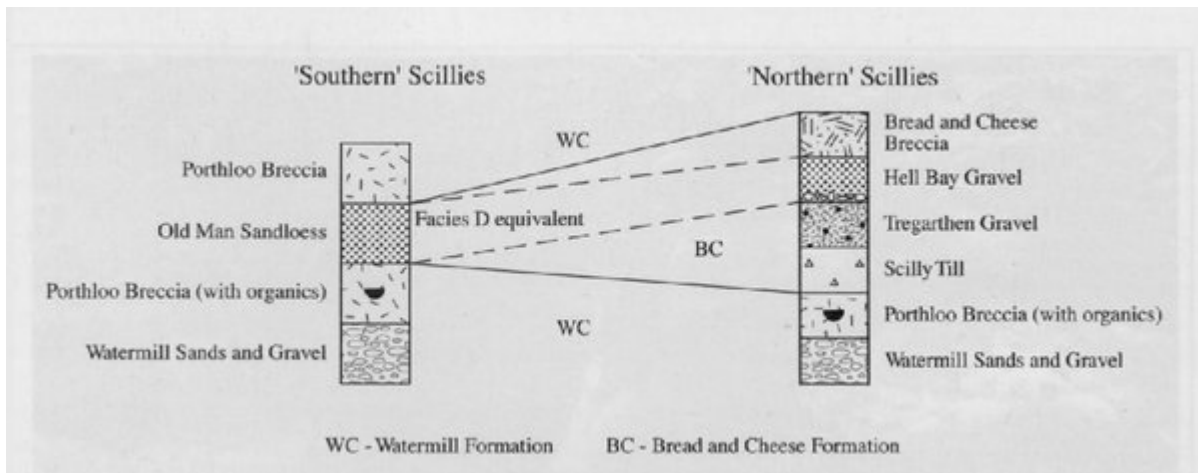
Conclusion

Porth Seal is a critical site because it contains rare organic beds which can be dated by the radiocarbon method. Such dating has shown that these sediments were deposited between 25 ka and 35 ka BP. These dates help to constrain the ages of the underlying and overlying sediments. The organic beds also contain abundant fossil pollen grains and spores which indicate that between these dates Scilly was characterized by open grassland vegetation in a cold Arctic climate. Porth Seal is also important because it shows controversial evidence of possibly two interglacial highstands of sea level.

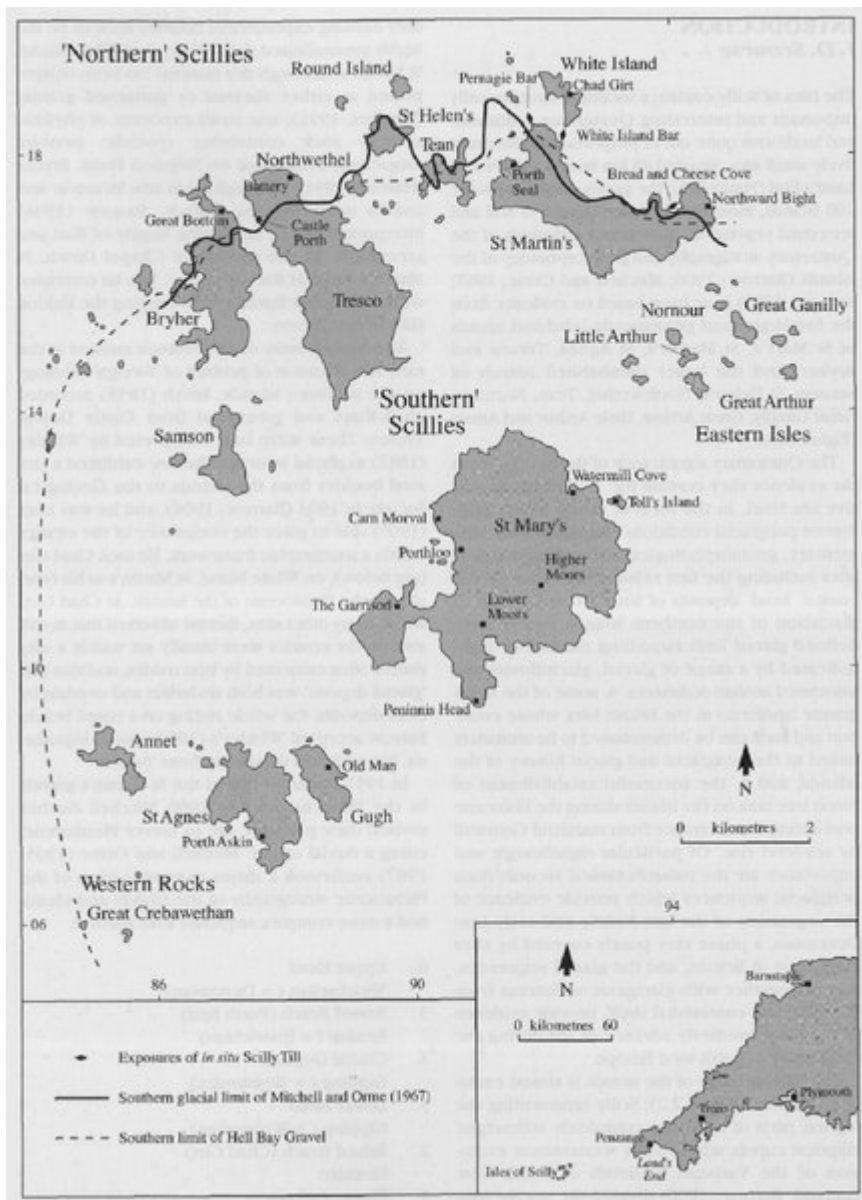
References



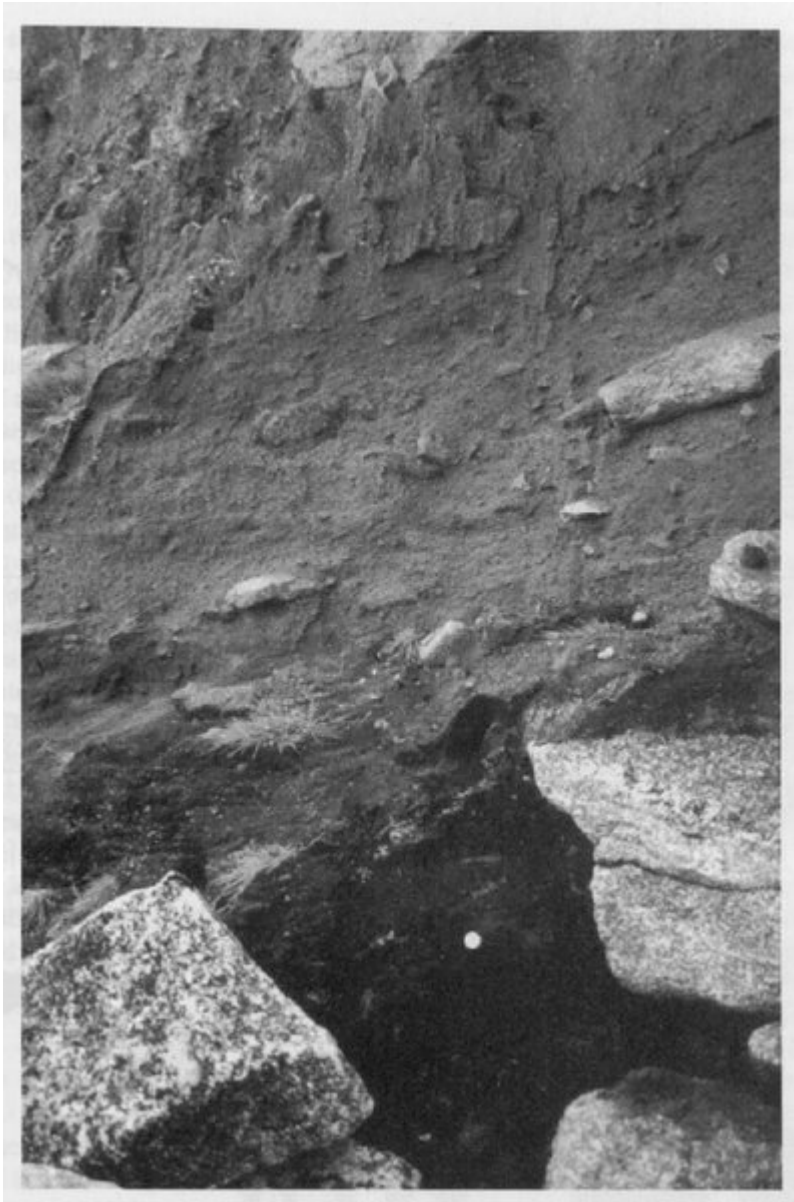
(Figure 8.8) The Pleistocene sequence at Porth Seal: Sections 1 and 2 adapted from Scourse (1991); Section 3 is based on a field sketch made in 1965 by F.M. Syngé and subsequently figured in Stephens (1970a) and Kidson (1977).



(Figure 8.3) A lithostratigraphic model for the Isles of Scilly. (Adapted from Scourse, 1991.)



(Figure 8.1) The Isles of Scilly: critical sites, exposures of the Scilly Till, the southern limit of the Hell Bay Gravel and Mitchell and Orme's (1967) glacial limit. (Adapted from Scourse, 1991.)



(Figure 8.9) Richly organic sediments lying beneath periglacial head at Porth Seal, St Martin's. (Photo: J.D. Scourse.)