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# Porth Clais

## Highlights

A key site showing evidence in the St David's Head area of a pre-Devensian glaciation, of high sea-levels with raised beach deposits during the Ipswichian, and glaciation and periglacial environments during the Devensian. Atypical till deposited during the Devensian by Irish Sea ice helps to define ice limits at that time.

## Introduction

Porth Clais [SM 741 237] provides one of the most complete exposures of Late Pleistocene sediments in Preseli and has long been regarded as a classic locality for interpreting Late Pleistocene events in south-west Wales. The sequence provides evidence for a succession of marine, periglacial and glacial depositional episodes. Considerable controversy, however, has arisen concerning the interpretation of the sequence. Some regard part of the sequence as till, a 'land-facies' of the Irish Sea ice-sheet, while others maintain that the sediments have undergone substantial periglacial disturbance and are not in place. The site attracted much interest with early studies by Prestwich (1892), Hicks (1894) and Leach (1911). It has been discussed more recently by Zeuner (1959), Mitchell (1962), Synge (1963), Bowen (1966, 1973a, 1974, 1977b, 1984) and John (1965a, 1965b, 1968a, 1969, 1970a, 1970b, 1971a, 1973). The most detailed accounts were provided by Leach (1911) and John (1970b).

## Description

The site is located close to a small cave, Ogof Golchfa [SM 742 237], about 90m west of Porth Clais harbour, and is sometimes referred to as Ogof Golchfa (John 1970b). The sections occur on a small headland which supports several raised shore platform remnants which vary in height from c. 3m to 9m OD (John 1970b). The exposures crop out around the margins of a small, 45m wide, vegetated terrace that slopes seawards at about 2°. John (1970b) noted the following sequence of deposits lying above the raised platform:

5 Sandy loam (0.75m)

4 Upper head (0.6m)

3 Non-calcareous local till (c. 2m)

2 Lower head and beach pebbles (c. 2m)

1 Raised beach shingle with erratics (c. 1m)

The marine platform is cut across a fine-grained dolerite sill, intruded in near vertical Lower Cambrian shales and sandstones (Cox *et al.* 1930). Parts of the sill form slight ridges across the platform, and, in places, striae-bearing ice-smoothed surfaces have been preserved. Most of the striae trend north-west to south-east (John 1970b).

Both Leach (1911) and John (1970b) noted the presence of large, well-worn boulders on the rock platform, sometimes embedded within the raised beach shingle. Most of the boulders are not far-travelled although one large erratic boulder of 'diabase' (microgabbro) projects from the drift cliff (Leach 1911). The platform bears few traces of the raised beach shingle, which is best developed above the entrance to Ogof Golchfa. The pebbles there are well rounded and comprise a mixture of local Cambrian rock types as well as Chalk flints, and igneous rocks from the St David's Head area. Leach noted that, in places, the shingle was cemented to the platform. The beach deposits grade up into a stratified head comprising a mixture of raised beach shingle set in a red-brown sandy matrix. Leach described the raised beach deposits as c. 3m thick, but John observed that this figure should include 2m of what he considered to be soliflucted beach material.

John (1970b) noted that the lower head was overlain by up to 2m of red-brown non-calcareous till, which, in places, lay directly on the striated shore platform. It contained a mixture of local rocks as well as farther-travelled igneous types.

Leach (1911) did not recognise an upper head overlying the till, unlike subsequent workers (for example, Mitchell 1962; Synge 1963; Bowen 1966; John 1970b). It is distinctly coloured as a result of a high concentration of purple Cambrian sandstone and shale fragments (John 1970b). To the west it is replaced by a 'rubble drift' of mixed local bedrock fragments and soliflucted till. It is succeeded by a thin veneer of sandy loam, often stoneless and silty, but also containing bands of flaky bedrock fragments and pebbles derived from the till.

## Interpretation

Prestwich (1892) noted that the raised beach contained both local Cambrian rocks and more far-travelled igneous rocks and Chalk flints, but offered no explanation for the mixture. Hicks (1894) described large boulders of picrite and granite found on the cliff tops near Porth Clais and concluded that the area had been glaciated by ice from a northern source. From local evidence, such as striae and crag and tail features, he suggested that the northern ice had crossed the Porth Clais area from north-west to south-east.

The interpretation of the sequence was further elaborated by Leach (1911) who was the first to describe till at the site. He noted that the till overlay both the head and raised beach, and, in places, lay on the striated rock platform directly. He concluded that "Since this deposit rests in part on a striated surface and contains striated stones and erratic boulders, its glacial origin is clear". The Porth Clais section was thus comparable with sections in Gower, and because the raised beach at these sites always occurred beneath the glacial sediments, a 'pre-glacial' age for the bed was favoured by Leach. The large erratics associated with the rock platform were considered by him to have been deposited by floating ice both before and during accumulation of the raised beach shingle, he concluded that the shingle must have been deposited during a period of cold climate.

From the evidence at Porth Clais, Mitchell (1962) and Synge (1963) developed a Late Pleistocene chronology of events for south-west Wales, based on stratigraphical analogies with sites on both sides of the Irish Sea Basin. Erratics found in the Porth Clais raised beach were considered to have been derived from deposits, now destroyed, of Lowestoft (Anglian) age, while the beach itself was considered to have accumulated during the Hoxnian Stage. The lower head and till were ascribed to the Saalian Stage. Both authors envisaged that the Porth Clais area had not been affected directly by Weichselian (Devensian) ice. Subsequently, however, it has been more simply suggested that the Porth Clais area was glaciated by Devensian ice, and that the raised beach deposits are of Ipswichian age (Bowen 1973a, 1974, 1977b, 1984; John 1965a, 1965b, 1968a, 1970a, 1970b). Despite such broad agreement, major differences have arisen in interpreting the evidence at Porth Clais.

According to John (1970b), the raised shore platform was fashioned during temperate interglacial conditions. Its age was uncertain, although it was probably Hoxnian or older, and possibly of composite age. Erratics found in the raised beach were considered to represent an early glaciation, of probable Saalian age. John disagreed with Leach's suggestion that large erratic boulders could have been ice-rafted during formation of the raised beach, particularly in view of the widely accepted correlation between Late Pleistocene glacial stages and low stands of the sea. He accepted that the boulders were both rounded and foreign but considered, in view of the slumped face of the exposure, that they could have fallen from the till. He placed the raised beach deposits in the Ipswichian Stage, and the overlying lower head (including soliflucted elements of the raised beach) at the beginning of the Devensian Stage, believing it to mark the onset of cold, periglacial conditions. The overlying non-calcareous till was considered to have been deposited as a 'land-facies' of the north-west to south-east moving Irish Sea ice-sheet. Fabric data from the till, although equivocal, suggested that the till had not been deposited beneath a powerful ice stream but in an ice wastage environment as flow or ablation till. The till has not been dated, but radiocarbon dates from fluvio-glacial sediments at Mullock Bridge, south of Porth Clais, indicated that the Porth Clais till was of probable Late Devensian age (John 1965b). It was therefore comparable to equivalent horizons at Druidston Haven, Abermawr and Poppit Sands. Further, the upper head was attributed to a short periglacial phase to yards the end of the Late Devensian, and the upper sandy loam was considered to represent a mixture of aeolian and colluvial (hillwash) sediments, formed possibly during an ensuing cold-temperate, arid phase.

Bowen (1977b) suggested that glacial sediments at the site were neither *in situ* nor representative of a 'land-facies' of the Irish Sea glacier (John 1970b), and he argued that the distance of glacial transport across the St David's Head area was too small for the Irish Sea till to have lost its usual characteristics.

He suggested that the considerable coastal slopes around Forth Clais had promoted redeposition of the glacial sediments, and he contrasted the site with Druidston Haven to the south, where the glacial sediments had been extensively preserved at the base of a steep-sided coastal valley. Porth Clais had therefore been glaciated by Late Devensian ice, but local site factors had led to substantial re-sorting of the sediments.

Forth Clais demonstrates that a period of high interglacial sea-levels, probably during the Ipswichian Stage, was followed by a phase of periglacial conditions. There is evidence to suggest that this periglacial phase was succeeded by a period of fully glacial conditions. The precise dating of events at Porth Clais has not been established, although most recent workers prefer an Ipswichian age for the raised beach sediments with the periglacial and glacial sediments belonging to the Devensian Stage. A Late Devensian age has been suggested for the till at Forth Clais, but the interpretation of these sediments is debatable. The glacial deposits lack the marine shell fragments commonly found at other sites in the region where Irish Sea ice moved onshore (for instance, Traeth-y-Mwnt, Abermawr, Poppit Sands and Druidston Haven). Its interpretation as a 'land-facies' of the Irish Sea ice-sheet (John 1970b) has been seen as unsatisfactory, and the till may have been redeposited under periglacial conditions (Bowen 1977b).

Porth Clais provides a sequence that can be used to reconstruct changing environmental conditions in south-west Wales during the Late Pleistocene. It provides one of the finest examples of raised beach sediments in the region and shows marine and terrestrial beds in a single section. Although the interpretation of till at the site is controversial, it is important for establishing regional patterns of ice movement: it demonstrates that St David's Head was glaciated by Irish Sea ice during the Late Devensian, and helps to constrain the maximum limit for this ice-sheet in south-west Wales.

## **Conclusions**

Porth Clais shows a succession of ice age deposits which represent the history of the last glacial cycle in south-west Wales. The till (boulder clay) shows that the St David's Head area was glaciated by an Irish Sea ice-sheet which moved from north-west to south-east.

## **[References](#)**