# PITLOWIE

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## Highlights

The sub-surface deposits in a series of gullies at Pitlowie comprise a sequence of estuarine sediments and buried peat. These have been intensively studied and dated, allowing a detailed reconstruction of the progress of the Main Postglacial Transgression close to its maximum and the subsequent fall in relative sea level.

## Introduction

Near Pitlowie, 8 km east of Perth on the north side of the Tay Estuary, Late Devensian raised marine deposits are dissected by a small gully system (NO 205230), now largely dry. The system forms part of a larger system of gullies originally studied by Sissons *et al*. (1965) and Morrison *et al*. (1981). These studies show that the gullies were largely formed during the Late Devensian, and that their lower ends contain Holocene sediments which record the Main Postglacial Transgression in the area. The Pitlowie gullies have been examined in detail by Smith *et al*. (1985b), who demonstrate that the final stages of the Main Postglacial Transgression and the beginning of the subsequent regression in the area are recorded in detail in the sediments.

## Description

On the northern side of the Firth of Tay, Late Devensian raised marine deposits form two well-defined surfaces extending for several kilometres on either side of the village of Glencarse (NO 197217). Both surfaces slope eastwards: the upper one from 20.1 m O.D. to 19.4 m O.D., and the lower one sloping eastwards from 16.1 m O.D. to 14.6 m O.D. (Cullingford, 1972, 1977). These surfaces overlie fine to medium-grained sands, in which excellent fossil cryoturbation structures have been observed (Smith *et al*., 1985b). East of Glencarse, the features are very extensively dissected by a system of gullies. The system consists of a main gully, drained by the Pow of Glencarse, fed by a number of tributary gullies, most of which are dry (Figure 15.5). Many of the gullies contain small peat bogs. The Pow of Glencarse runs south-westward to join the Tay Estuary, which in this area is surrounded by raised estuarine sediments forming the remarkably flat surfaces of the Tay carselands. The estuarine clays and silts extend into the gully system along the Pow of Glencarse, and occur in the mouths of most of the smaller gullies. The Pitlowie gullies lie at the head of the system.

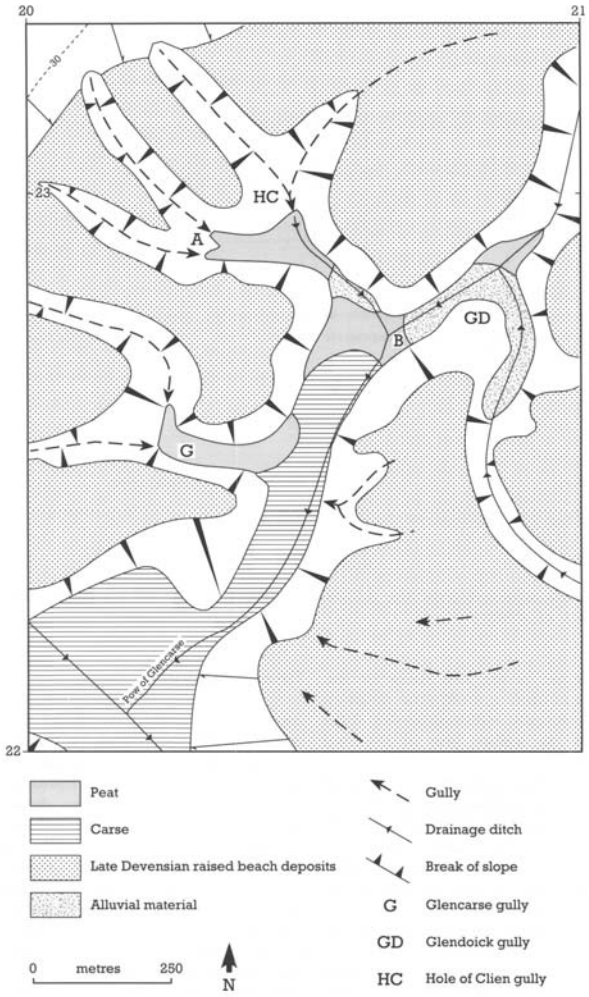


*Figure 15.5: Geomorphology of the Pitlowie gullies (from Morrison et al., 1981). The sediment sequence along the line AB is shown in Figure 15.6.*

Sissons *et al*. (1965) concluded that the larger gully system had been initiated during the Late Devensian following exposure of marine deposits when relative sea level fell. They showed that in addition to peat being present in the floors of the gullies, it also lay beneath the estuarine clays and silts there, and they therefore concluded that the gullies had largely ceased to form by the time peat accumulation started. Since it was likely that the peat had begun to accumulate early in the Holocene, they concluded that the gullies formed during the Late Devensian. They maintained that although the processes were not known for certain, it seemed possible that the gullies had been formed under periglacial conditions with a high surface runoff.

Morrison *et al*. (1981) examined the sediments within the larger gully system. They showed that the estuarine clays and silts were extensively underlain by peat, and that in the tributary gullies they formed a wedge within small peat bogs on the gully floors (Figure 15.6). Pollen analysis through the sequence of basal peat, grey silty clay (carse), and surface peat in the main Pitlowie gully near Hole of Clien farm (NO 204234), showed that the peat had begun to accumulate in the early Holocene, and that the episode of silty clay sedimentation occurred in the middle Holocene. The pollen record disclosed evidence that the silty clays were indeed marine, with Chenopodiaceae pollen associated with them as well as the high values of *Pinus* and *Quercus*, pollen characteristic of selective preservation in a marine environment (Traverse and Ginsberg, 1966). Morrison *et al*. (1981) obtained radiocarbon dates from samples of peat at the upper and lower contacts with the silty clays of the Hole of Clien gully and in nearby Glencarse gully. At Hole of Clien, 0.02 m thick samples gave, respectively, 6170 + 90 BP (SRR–1510) and 7500 + 90 BP (SRR–1511) for the upper and lower contacts. At Glencarse, 0.01 m thick samples gave, respectively, 6083 + 40 BP (SRR–1551) and 6679 + 40 BP (SRR–1150) for the upper and lower contacts. Morrison *et al*. concluded that the Main

Postglacial Trangression had culminated in the area between 6679 + 40 BP (the younger of the two dates for the lower contact) and 6100 + 35 BP (the weighted mean of the statistically indistinguishable dates on the base of the surface peat at the two locations).

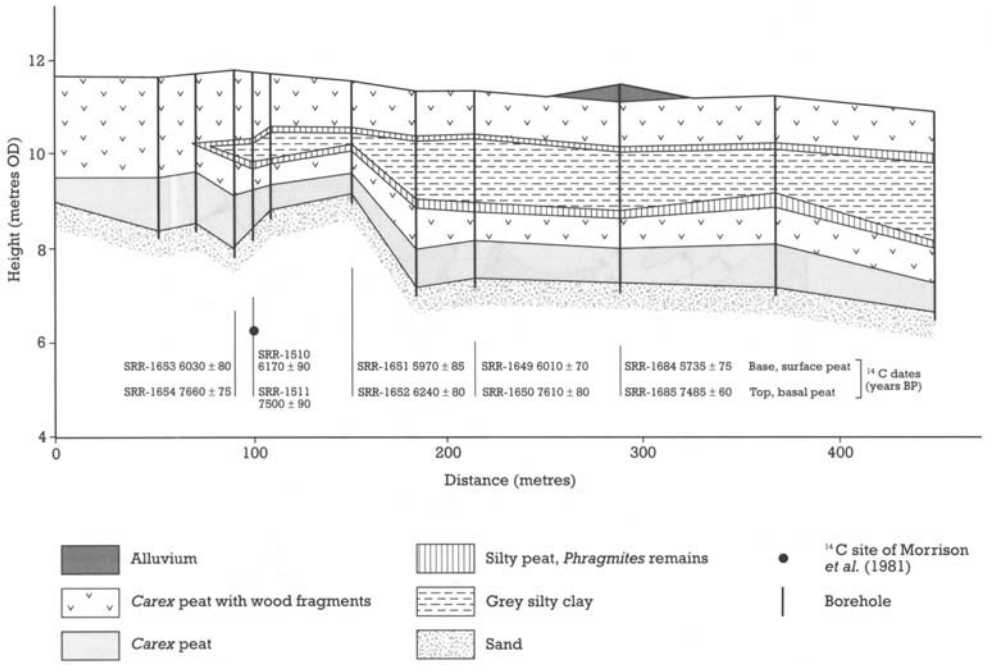


*Figure 15.6: Pitlowie: section along the Hole of Clien gully showing the sequence of sediments and radiocarbon dates (from Smith et al., 1985b).*

Smith *et al*. (1985b) confined their detailed study to the Holocene sediments in thePitlowie gullies. They determined the stratigraphy closely, and in the Hole of Clien gully studied the geochemistry of the sediments in an effort to determine whether or not deposition had been continuous. In addition they obtained eight further radiocarbon dates at the peat/silty clay interface along the wedge of the carse sediments. The dates and the detailed stratigraphy they obtained along the Hole of Clien gully are shown in Figure15.6. Their studies of the geochemistry of the silty clay showed no major changes in organic carbon, ë13CPDB, aluminium or magnesium, and they concluded that no hiatus in deposition within the silty clays was indicated.

## Interpretation

Smith *et al*. (1985b) concluded that since no hiatus was indicated within the silty clays (carse), and since the earlier pollen work ofMorrison *et al*. (1981) demonstrated no hiatus in the pollen record through the Holocene deposits, it was likely that a continuous depositional sequence obtained in the Hole of Clien gully. The radiocarbon dates indicated an initially rapid invasion of the gully by the Main Postglacial Transgression at around 7600 BP; culmination of the transgression possibly between 6240 + 80 BP (SRR–1652) and 6170 + 90 BP (SRR–1510), and regression from the mouth of the gully by 5735 + 75 BP (SRR–1684). The sea had thus occupied that part of the gully where the silty clays occur for nearly 2000 years, yet sedimentation, though apparently continuous, was relatively slight. Little sediment was evidently derived from the land, which emphasises the lack of gully development during that time.

The Pitlowie gully system was developed during the Late Devensian, possibly under periglacial conditions. Cut into sands and fine gravels which frequently display fossil periglacial structures in section, the gully system is one of the best examples of its type in eastern Scotland. The sediments which lie in the gullies record an apparently complete history of vegetational and environmental change in the area during the Holocene. The progress of the Main Postglacial Transgression and subsequent regression are recorded in detail over a period of around 2000 years in the Hole of Clien gully. Other aspects of the Main Postglacial Transgression are

recorded at Silver Moss, Maryton and Western Forth Valley on the east coast and Newbie, Redkirk Point and Dundonald Burn on the west coast.

It is probably the sheltered nature of this gully system which has enabled the Holocene marine sediments to be preserved in such detail and with such apparent continuity. It is the fine and detailed preservation of the Holocene sequence which marks out this site and will make it a focal point for detailed studies of relative sea level change in Scotland in the future.

## Conclusions

The sediments at Pitlowie are important for establishing the history of changing sea levels in eastern Scotland during the Holocene (the last 10,000 years). They have been studied in considerable detail and provide a detailed record of changes in the coastal environment during the middle Holocene. In particular, they allow a detailed reconstruction of the Main Postglacial Transgression (see Silver Moss above) and the subsequent fall in relative sea level.Pitlowie is therefore a valuable reference site for studies of this event.

## Reference list

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