Silver Moss

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Highlights

The sub-surface deposits at Silver Moss include a sequence of estuarine and buried peat sediments which provide a detailed and dated record of sea-level and coastal changes during the Holocene. They are particularly significant for studying the Main Postglacial Transgression and a major coastal flood which occurred in eastern Scotland during the middle Holocene.

Introduction

Silver Moss [NO 450 233] is a small peat bog in St Michael's Wood, 8 km north of St Andrews, in Fife. It occupies a gully which once formed a narrow embayment in the coastline when relative sea level stood at the Main Postglacial Shoreline in that area. Silver Moss contains a sequence of deposits which record the culmination of the Main Postglacial Transgression, together with a unique coastal flood, possibly a storm surge or tsunami. The site was first investigated by Chisholm (1971), and later studied by Morrison *et al.* (1981).

Description

In East Fife, the lower ends of the valleys of the Motray Water, Moonzie Burn and River Eden are occupied by extensive areas of raised estuarine sediments, which extend northwards towards the Tay estuary and southwards towards St Andrews, and which continue beneath coastal sand dunes to the east. These sediments, the local equivalent of the carse of central Scotland, consist of grey silty clay or clayey silt with lenses of sand. They underlie a remarkably flat surface which contrasts sharply with the rising ground inland. From the fossil content of these sediments (Chisholm, 1971) it is evident that they accumulated in a marine/estuarine environment. The break of slope at their inland limit is taken to mark a shoreline, which lies between 7 m and 9 m OD (Cul-lingford, 1972).

Towards the northern region of this carse area, near Craigie [NO 453 243], the rising ground inland consists of Late Devensian raised beaches which are dissected by a number of gullies leading eastwards. These gullies reach the edge of the carse, and in the lower ends of some of them small peat bogs occur. The largest of these is Silver Moss, which lies in a gully draining through St Michael's Wood. From boreholes made near the mouth of the gully, Chisholm (1971) showed that the raised estuarine (carse) sediments to the east of the gully mouth continued into it to form a layer within the peat (Figure 15.3). He noted that east of the gully mouth the carse sediments include a sand layer, which appears at the base of the carse within the gully. He also identified a sand bar at the mouth of the gully (Figure 15.3), which appears to have formed contemporaneously with the carse deposit when the gully was an arm of the sea. Chisholm obtained radiocarbon dates on two 6 in. (0.15 m) thick samples of peat: the upper sample (above the clays and silts) gave 5830 ± 110 BP (St–3062) and the lower sample (below the sand at the base of the clays and silts), 7605 ± 130 BP (St–3063). He concluded that the clastic sediments in Silver Moss had accumulated between those dates, but did not exclude the possibility that the clays and silts east of the gully mouth and sand bar may have continued to accumulate for some time after the younger date.

Morrison *et al.* (1981) later undertook further stratigraphical investigations of Silver Moss. They were able to trace the inland limit of the clays and silts, which form a tapering wedge within the peat (Figure 15.3). They also proved the extent of the sand, which they described as a grey, micaceous, silty fine sand. They found that it occurs within the clays and silts east of the gully but forms a separate, tapering wedge below the clays and silts within Silver Moss (Figure 15.3). Within the peat the sand extends over 250 m farther up the gully than does the wedge of clays and silts, eventually reaching a higher elevation than the latter (Figure 15.3).

Morrison *et al.* carried out pollen analysis through the sequence of deposits and also obtained further radiocarbon dates. From the pollen evidence, they found that peat had begun to accumulate in the early Holocene. The pollen sequences identified (Figure 15.4) were found to be similar to those of other Holocene coastal sites in eastern Scotland (Smith *et al.,* 1982, 1983). The gradual changes in the pollen record suggest that no breaks in sedimentation are present. High values of *Pinus* and *Quercus* pollen coincide with the wedge of clays and silts (Figure 15.4). Such increases, however, are common in marine sediments (Traverse and Ginsberg, 1966), and the presence of Chenopodiaceae in this layer is characteristic of a marine environment. However, Morrison *et al.* could find no changes in the pollen spectrum based on samples from the grey, micaceous, silty fine sand layer. The radiocarbon dates obtained by Morrison *et al.* (1981) are listed in (Table 15.2).

Interpretation

The gully in which Silver Moss lies had probably been formed before the early Holocene, when the peat began to accumulate. It seems possible that the gully may have been cut during the Late Devensian under periglacial conditions, in a similar manner to other gullies in raised marine deposits in central Scotland (Sissons *et al.,* 1965). As the peat of Silver Moss accumulated, the lower end of the gully became inundated by a marine transgression, and a sand bar began to form at its mouth. During this time, the prominent layer of grey, micaceous, silty fine sand was deposited.

(Table 15.2) Radiocarbon dates at Silver Moss (from Morrison et *al.,* 1981)

Sample	Altitude (m) OD (surface = 8.30 m)	Date (^{14}C years BP)	Laboratory number
Bottom 0.01 m of surface peat	7.23–7.24	5890 ± 5	SRR–1331
Top 0.01 m of peat beneath grey silty clay('carse')	6.75–6.76	7310 ± 100	SRR–1332
Bottom 0.01 m of peat above grey, micaceous, silty fine sand	6.38–6.39	7050 ± 100	SRR–1333
Top 0.01 m of peat below grey, micaceous, silty fine sand	6.19–6.20	7555 ± 110	SRR–1334

The radiocarbon dates obtained by Morrison *et. al.* place the age of the sand at between 7555 ± 110 BP and 7050 ± 110 BP. Chisholm (1971), who did not identify the sand as separate from the clays and silts, nevertheless obtained a radiocarbon date of 7605 ± 130 BP for the base of the layer (and his figure 6 actually identifies organic material between the sand and the clays and silts above). It is likely, however, that the layer was deposited in the gully over a much shorter period than the radiocarbon evidence implies. Chisholm remarked on evidence of erosion of the peat at the base of the sand (which would therefore make the basal date at best a maximum age estimate); the dates of Morrison *et al.* are reversed in the middle of the sequence (see (Table 15.2)), implying an older date for the base of the peat above the layer. Elsewhere, in eastern Scotland, a similar bed of sand in a similar stratigraphic position has been found at a number of sites (see Western Forth Valley, Maryton, Dryleys and Barnyards) (Smith *et al.,* 1985a). At each of these other sites the bed appears to have accumulated rapidly, probably over a period of much less than 100 years. The radiocarbon ages at these sites range between 6900 and 7200 BP. Given the radiocarbon dates at Silver Moss, it seems likely that the sand at this location correlates with these other sand beds. It was originally thought that they are the deposits of a major storm surge in the North Sea which was particularly effective for having occurred at a time of rapidly rising relative sea level (Smith *et al.,* 1985a; Haggart, 1988b), but a recent interpretation suggests that they relate to a tsunami associated with a major submarine slide on the Norwegian continental slope (Dawson *et al.,* 1988; Long *et al.,* 1989a). It is interesting to note that a similar sand layer has been found quite close to Silver Moss, near Craigie (Haggart, 1978), though this has not been dated.

The clays and silts (carse) continued to accumulate after the sand was deposited but, as relative sea level fell, peat began to form on the surface. The radiocarbon dates obtained by Morrison *et al.* below and above the wedge of clays and silts in the gully probably embrace the culmination of this marine transgression. The date for the base of the layer may well be younger than 7310 ± 100 BP (SRR–1332) in view of the age reversal referred to above; the age for the top of the layer, at 5890 ± 95 BP (SRR–1331), agrees well with Chisholm's date of 5830 ± 110 BP (St–3062) at the same horizon. These dates indicate that the event involved was the Main Postglacial Transgression. Morrison *et al.* maintain that the date for the end of the deposition of the clays and silts probably applies to the wider local area, despite Chisholm's reservations, since there is very little difference between the local altitude of the carse surface beyond the gully (up to 8.3 m OD) and the altitude reached by the wedge of the clays and silts within the gully (7.9 m OD).

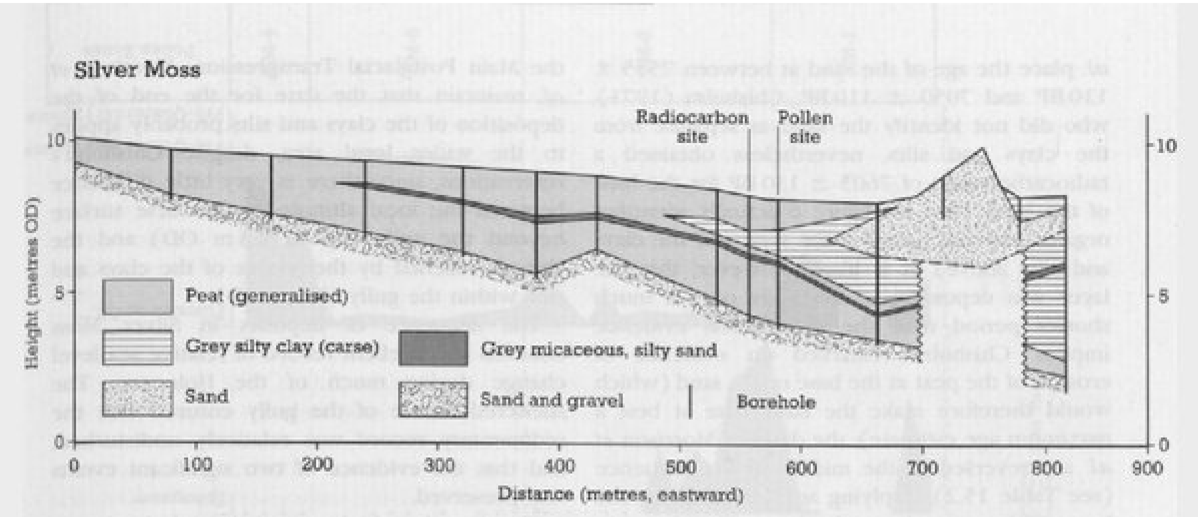
The sequence of deposits in Silver Moss contains an excellent record of relative sea level change during much of the Holocene. The sheltered nature of the gully ensured that the sedimentary record was relatively undisturbed, and that the evidence of two significant events was preserved.

The deposits which record the culmination of the Main Postglacial Transgression at this site will repay further study; notably, additional dating will contribute towards a better understanding of the wider pattern of diachroneity of the Main Postglacial Shoreline in Scotland. The grey, micaceous, silty fine sand layer is remarkably extensive in the moss, and provides an opportunity for reconstruction of the details of the event which led to its deposition. The layer can be identified so widely in the moss that its altitude and inland limit can be studied in great detail, and will provide evidence for the 'run-up' of the wave from which it was deposited. This should, in turn, provide evidence for the magnitude of the tsumani waves as anticipated in Bugge (1983) and discussed in Long *et al.* (1989a).

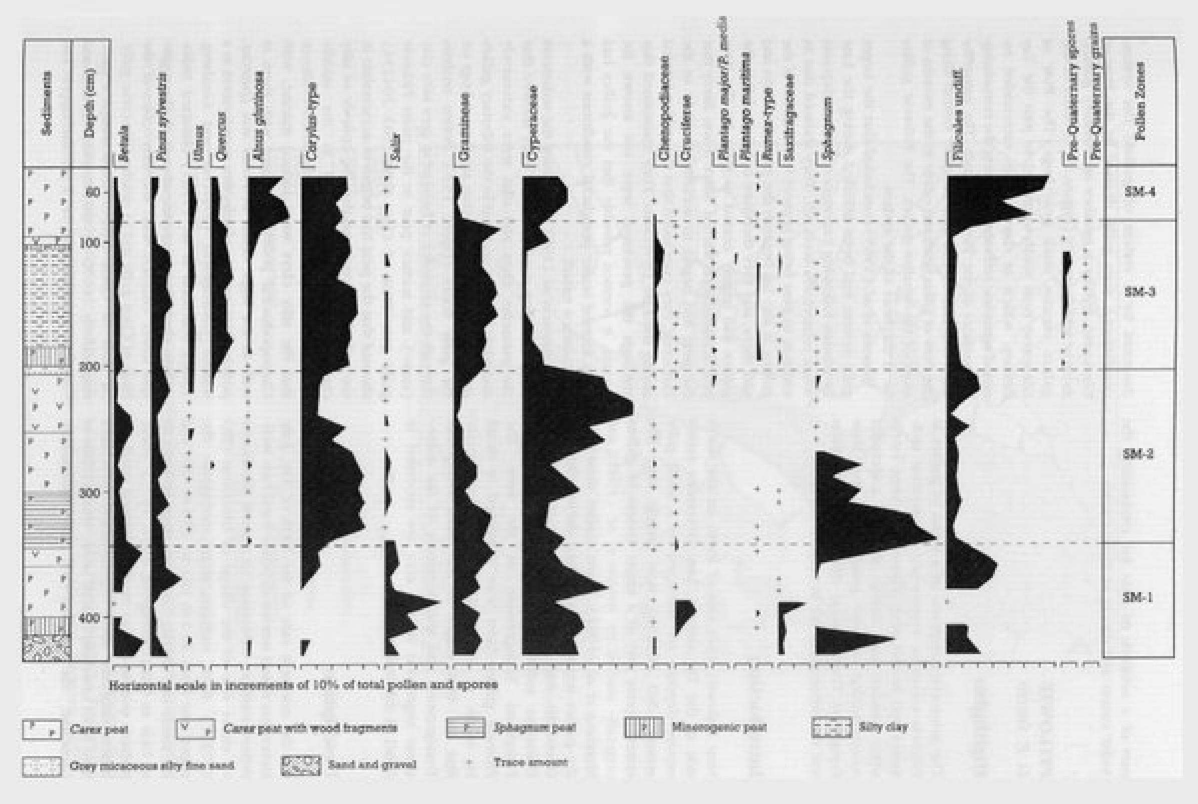
Conclusion

The deposits at Silver Moss provide a detailed record of sea-level changes during the Holocene (the last 10,000 years). In particular, they are significant for studies of the Main Postglacial Transgression (an encroachment of the sea on to the land that occurred around 6000 years ago as ice age glaciers in North America and Scandinavia melted away releasing large volumes of meltwater into the oceans) and a major coastal flood that occurred about 7000 years ago. Silver Moss forms part of a network of sites for establishing the wider extent and timing of these events.

References



(Figure 15.3) Silver Moss: section along the gully showing the sequence of sediments (from Morrison et al., 1981).



(Figure 15.4) Silver Moss: relative pollen diagram showing selected taxa as percentages of total pollen and spores (from Morrison et al., 1981).

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