Burn of Aith

J. Birnie

Highlights

The sediments which infill a deep basin at the Burn of Aith comprise lake clays and fen peats. The pollen and diatoms contained in these sediments provide a detailed record, supported by radiocarbon dating, of environmental changes in Shetland during the Lateglacial and early Holocene.

Introduction

The Burn of Aith site [HU 441 295] comprises a flattish area of lake and fen infill sediments approximately 1 km^2 in extent. It is located immediately inland from the east coast of Shetland Mainland near Cunningsburgh. The infill is exceptionally deep and contains a Lateglacial and Holocene sequence that is representative of lowland Shetland. Two cores have been analysed in detail, giving pollen, diatom and sedimentary characteristics (Birnie, 1981), and four radiocarbon dates have been obtained for the Lateglacial sequence in one core (J. Birnie, unpublished data). This is the earliest detailed information on the Lateglacial environment of Shetland.

Description

The infill sediments, lake clays and fen peats occupy a basin which exceeds 11 m in depth. It is formed in either till or bedrock and shallows gradually in the direction of the present outlet to the sea at Aith Voe. Despite the present surface being less than 5 m above sea level, all the infill sediments are of freshwater origin, so that the basin configuration must have prevented marine inundation, even with the rising Holocene sea level. The bedrock in the vicinity of the basin is Old Red Sandstone, although the adjacent upland catchment, drained by the Burn of Laxdale, is in phyllite and spilitic lavas (Mykura, 1976).

The stratigraphy at the coring site consists of the following sequence (Birnie, 1981, Aith II site):

6.Poorly humified organic material with clay matrix and wood fragments	1.41 m
5.Yellow clay with gritty layers and with fibrous vegetation	0.68 m
4. Fibrous organic deposit (fen peat) with clay content decreasing upwards	0.58 m
3.Light-grey inorganic clay	0.42 m
2.Organic clay with plant remains	0.3 m
1.Light-grey inorganic clay	0.11 m

Pollen frequencies from the different beds have been analysed (Figure 3.5). Radiocarbon dates from bed 2 were obtained from a separate core (Birnie, unpublished): lower part 13,680 ± 110 BP (SRR–2286), middle part 12,700 ± 80 BP (SRR–2285) and 12,670 ± 80 BP (SRR–2284) and upper part 12,190 ± 80 BP (SRR–2283).

Interpretation

The lowest clay (bed 1) is barren of both pollen and diatoms. Analysis of the overlying organic clay (bed 2) indicates a fairly alkaline lake, rich in diatoms and higher plant species, with pollen and macrofossils suggesting a land vegetation of open-ground herbs including *Rumex, Salix herbacea* and *Koenigia islandica* and thus substrate instability. However, pollen from the middle part of the bed indicates a phase when *Juniperus* and possibly some *Betula* shrubs were also present (Figure 3.5). In the overlying inorganic clay (bed 3) diatoms are relatively rare. Those present still suggest

alkaline conditions, but they are much reduced in variety. The pollen record consists of *Salix herbacea,* Umbelliferae and Compositae, with *Rumex* not returning until the top of the bed, where organic content begins to increase once again. The continuous organic sedimentation above this level (beds 4, 5 and 6) was assumed to be Holocene (Birnie, 1981), although the pollen record shows that an initial phase of tall herb growth was followed by a return of open-ground herbs including *Artemisia* and *Rumex, with Lycopodium selago.* Stable ground conditions were not finally achieved until a level dated, on the basis of the appearance of *Corylus* and *Ulmus* in the long-distance pollen, to post-9600 BP. Details of the Holocene environmental history are described by Birnie (1981).

The radiocarbon dates from the Lateglacial organic clay appear to be relatively older than might be expected (see Cam Loch). Either they reflect errors arising from the 'hard-water effect' or they indicate a record of early Lateglacial Interstadial warming in Shetland, in comparison to the mainland of Scotland. Further dates are needed on the lower part of bed 4, which, with its indications of unstable ground conditions in the pollen record, may be part of the Lateglacial sequence, rather than the Holocene as had been assumed.

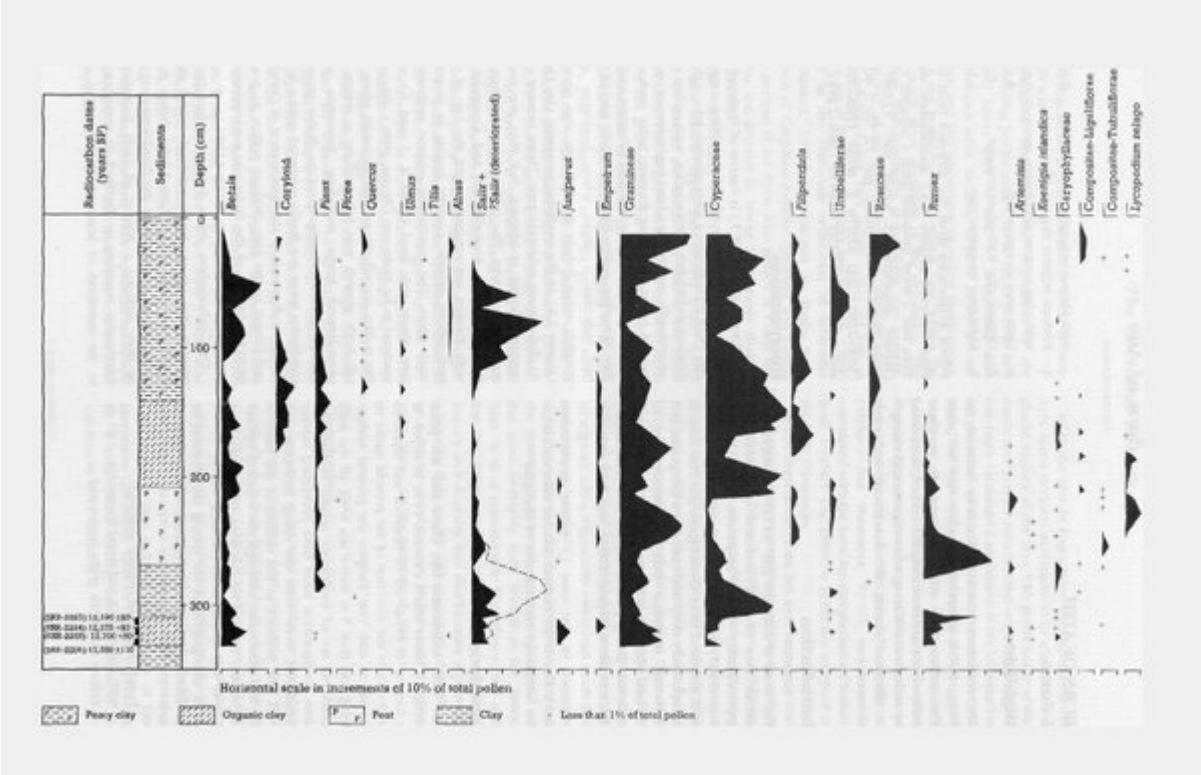
There is little published literature on the Holocene environment of Shetland, and nothing on the Lateglacial, apart from a moss identification (Hulme, 1979) and two radiocarbon dates on organic material within inorganic clays beneath Holocene peat. These were 12,090 ± 900 BP (St–1640) at Loch of Clickhimin, and 11,135 ± 135 BP (St–1714) on peat lenses within a minerogenic deposit at Tresta (Hoppe, 1974). The beginning of Holocene organic sedimentation has been dated to around 10,400 BP at two sites (Johansen, 1975; Hulme and Durno, 1980). Otherwise the stratigraphy from the Burn of Aith valley, described here, together with that of Spiggie Loch, which is undated, provides the only detailed information on the Lateglacial environment of Shetland (Birnie, 1981).

During the Lateglacial and early Holocene the oceanic circulation around the Shetland Islands was apparently rather different from that of today and this provides an instructive comparison with the evidence for environmental change at Burn of Aith. Following the last period of ice-sheet glaciation when arctic waters extended well to the south of the British Isles, an interstadial marine circulation with a weak North Atlantic Drift became established off western Scotland and in the Norwegian and North seas by 12,800 BP (Jansen and Bjorklund, 1985; Peacock and Harkness, 1990). The presence of the warmer waters off the British coast corresponds with the opening of the Lateglacial Interstadial in the terrestrial records from mainland Britain (Atkinson *et al.,* 1987), but contrasts with the very early date on the interstadial sediments from the Burn of Aith. Climatic deterioration during the Loch Lomond Stadial is clearly recorded both in the marine and the Burn of Aith records. Of particular interest at the Burn of Aith site, however, is the apparent delay in the onset of warm conditions at the Lateglacial–Holocene boundary, for the marine record along the Scandinavian coast suggests continuing colder conditions until approximately 9600 BP (Peacock and Harkness, 1990). At this time, therefore, the climate of Shetland may have been more closely akin to that of Scandinavia than the Scottish mainland.

Conclusion

Burn of Aith provides the only detailed record so far of the environmental history of Shetland during the Lateglacial (approximately 13,000–10,000 years ago). The pollen preserved in the sediments indicates a period of relatively mild climate with the development of herbs and shrubs during the Lateglacial Interstadial, about 13,000–11,000 years ago, followed by a return to more severe conditions with open-habitat vegetation during the Loch Lomond Stadial (about 11,000–10,000 years ago). At the start of the Holocene, the onset of stable ground conditions was delayed in comparison with sites elsewhere in Scotland, and shows more similarity in timing with events in Scandinavia. Burn of Aith is therefore an important reference site not only for studies of environmental history in Shetland, but also for establishing wider regional patterns of environmental change.

References



(Figure 3.5) Burn of Aith: relative pollen diagram showing selected taxa as percentages of total pollen (from Birnie, 1981).