PULPIT HILL

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OS Grid Reference: NM852292

Highlights

The sedimentary infill in the topographic basin at Pulpit Hill contains an important and detailed pollen record of vegetational history and environmental change during the Lateglacial.

Introduction

The Pulpit Hill site (NM 852292) is a small (500 m²) infilled basin on lower Devonian (Old Red Sandstone) lavas and conglomeratic sandstones, located 0.75 km south of Oban, Argyllshire. The basin contains a sequence of polleniferous, lacustrine sediments of Lateglacial and early Holocene age, important for its position in the historical development of Quaternary pollen studies in Scotland (Donner, 1955, 1957). Recent investigations (Tipping, 1984, 1991b) have demonstrated a number of environmental changes within the Lateglacial Interstadial, in particular, a climatic deterioration early in the interstadial and a later, but pre-Loch Lomond Stadial, climatic decline, which appear to have wider significance for the Scottish Quaternary, and which have also been reported from pollen sites on Skye (Walker and Lowe, 1990).

Description

At its deepest point the floor of the basin is 7.2 m below the surface peat. Donner (1955, 1957) first sampled the site (then designated "Oban 2') in his study of pollen sites in central and western Scotland designed to delineate by biostratigraphic means the extent of Pollen Zone III ("Highland' or Loch Lomond Readvance) glaciation. His intention was to demonstrate a Lateglacial biostratigraphy at the site in order to show that the readvancing ice terminated at a limit (Donner, 1957) 2 km east of Oban. He failed, however, to obtain Lateglacial sediments, and there was no palynological evidence to support his contention that the basal sediments were deposited during the Lateglacial.

Tipping (1984, 1991b) reinvestigated the site, and was able to demonstrate a 0.8 m thick Lateglacial succession. Two cores within the basin showed closely similar sediment and pollen records. The findings confirm Donner's (1955, 1957) suggestion that the Loch Lomond Readvance limit lay to the east of Oban (see Gray, 1972, 1975b; Thorp, 1984, 1986).

The sediment infill in the basin comprises a succession of clay, clay/gyttja, detrital mud and peat deposits (Figure 10.15). Seven local pollen assemblage zones were identified, spanning the Lateglacial and the early Holocene (Figure 10.15).

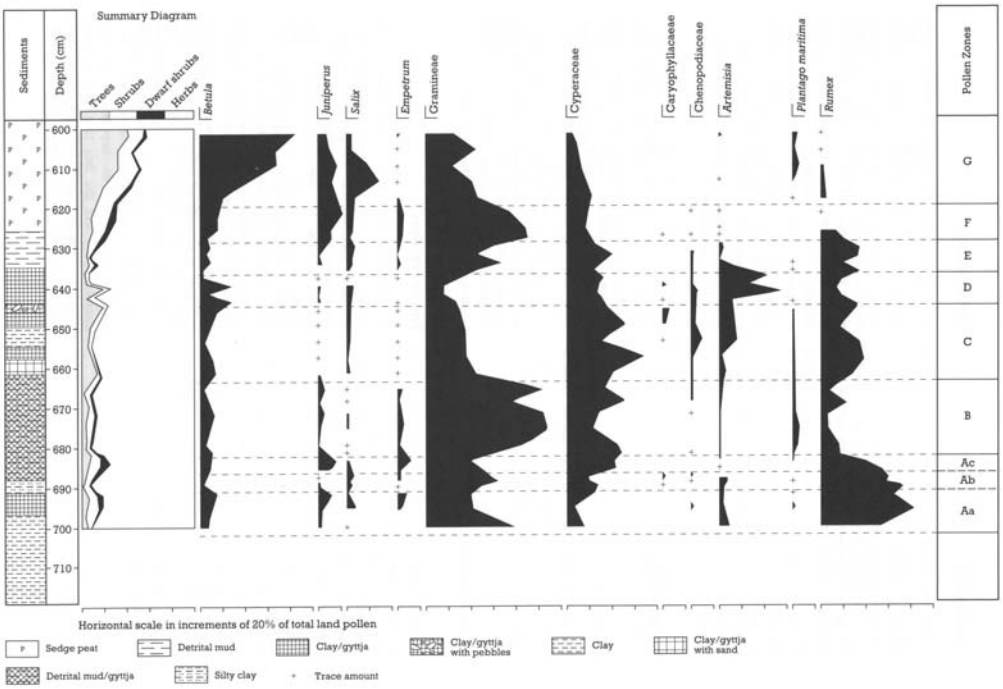

Figure 10.15: Pulpit Hill: relative pollen diagram showing selected taxa as percentages of total land pollen (from Tipping, 1991b).

Interpretation

The sediment and pollen records show several changes within the Lateglacial Interstadial. Following the establishment of organic-rich sedimentation in the basal pollen assemblage zone (A), a gradual change to pure clay (6.875–6.91 m depth) occurs with the reappearance of the earliest colonizing species (subzone Ab). The origin of the clay band is thought to lie in accelerated solifluction of material from the catchment at a time of short-lived climatic deterioration. Basin-edge collapse of pre-existing sediment is considered unlikely because of the diffuse boundary between the clay band and the underlying organic-rich clay (implying a gradual environmental change), the increasing pollen concentration values within the clay band (perhaps indicating that its deposition was not instantaneous) and the fact that the sedimentological, chemical (carbon/nitrogen) and palynological changes did not occur synchronously (Tipping, 1984, 1991b).

The Juniperus–Empetrum subzone (Ac) represents the mildest climatic phase of the Lateglacial Interstadial, which, characteristically for the west coast of Scotland, has no arboreal pollen taxa at percentages high enough to imply local growth. The suppression of tree growth by westerly winds stronger than those of the present day was suggested by Tipping (1984, 1991b) as the reason for this vegetational pattern, which contrasts sharply with the birch parkland found during this period in eastern Scotland (Lowe and Walker, 1977).

The Gramineae–Plantago maritima pollen zone (B) is thought to indicate a second, but more sustained, climatic decline and with no amelioration until after the Loch Lomond Stadial. This is recognized in the pollen record through the displacement by grassland of *Juniperus* and *Empetrum* associations, and in the chemistry of the sediments by declining carbon and nitrogen values. This climatic decline has become increasingly widely recognized in western Scotland (Tipping, 1984, 1991b), the Inner Hebrides (Lowe and Walker, 1986a; Walker and Lowe, 1990) and Ireland (Craig, 1978), and is radiocarbon dated to *c.* 12,000 BP.

Clay-dominated sedimentation did not recommence, however, until the Loch Lomond Stadial, when solifluction again introduced minerogenic sediment from catchment soils and produced several inwashed moss bands (*cf.* Birks, 1970). The pollen assemblages (zones C and D) from the stadial sediments are typical of tundra communities at the present day, with *Artemisia* a prominent taxon; in this respect the pollen record at Pulpit Hill conforms with the pattern at a great number of Lateglacial pollen sites in Scotland (Walker, 1984b; Tipping, 1985).

Pulpit Hill is of importance to the history of Lateglacial climatic and glacial geological studies, in that the site was examined by Donner (1957) in the first attempt to identify his "Highland Readvance' (synonymous with the Loch Lomond Readvance) with the climatic deterioration recorded in Godwin Pollen Zone III.

More recent palynological investigations (Tipping, 1984, 1991b) have succeeded in clarifying the Lateglacial stratigraphy and have shown that the site is of major significance for present understanding of the climatic changes during the Lateglacial, as well as in the clarity with which several climatic changes are shown. Recent syntheses (for example,Gray and Lowe, 1977b) have suggested that there were no climatic fluctuations during the interstadial comparable to those recognized in north-west Europe by Mangerud *et al*. (1974). This now seems to be incorrect and Pulpit Hill shows, in some detail, all the major climatic changes now recognized in the Lateglacial.

These changes principally are:

1. A short-lived climatic deterioration prior to*c.* 12,000 BP, probably of a similar character to the later Loch Lomond Stadial, though of apparent less severity or duration. This feature is now recognized at a number of sites in western Scotland (Walker *et al*., 1988; Walker and Lowe, 1990), but is perhaps best exhibited at Pulpit Hill, in the clarity of the stratigraphy, the high temporal resolution of the pollen counts and the geochemical assays. These show that the changes in certain indicators were not synchronous. The decline in organic content occurred before the appearance of pollen types of a more disturbed-ground community. The latter also occurred prior to indications in the sediments of soil instability. This pattern is most easily interpreted as climatic in origin.

This climatic deterioration appears to have correlatives at, for example,Loch Sionascaig, Loch Borralan and Lochan an Smuraich (Pennington *et al*., 1972), Corrydon (Walker, 1977), Stormont Loch (Caseldine, 1980a) and Loch Ashik, Slioch Dubh, Elgol and Druim Loch on Skye (Walker and Lowe, 1990). Correlations are not constrained by reliable radiocarbon dates at these sites, and accordingly, the synchroneity of this event cannot be demonstrated. The suggestion that this is correlated with the Older Dryas in north-west Europe (Pennington, 1975b) may not be justified on present evidence (Tipping, 1991b).

2. A brief period of climatic amelioration occurred following this phase before a further, and seemingly sustained, climatic deterioration set in at*c.* 11,800–12,000 BP (by correlation with dated pollen sites on Mull (Lowe and Walker, 1986a) and south-west Ireland (Craig, 1978)). The evidence from carbon/nitrogen contents and pollen stratigraphy atPulpit Hill is that this decline continued without a break to the markedly more intense deterioration of the Loch Lomond Stadial, and so accords closely with coleopteran evidence for this time period (Atkinson *et al*., 1987).

3. Within the Loch Lomond Stadial a trend to increasing aridity is clearly seen in the pollen record. This feature has been noted at only a few other sites in Scotland (MacPherson, 1980), due perhaps to inadequate resolution of pollen counts within the clay sediments of the stadial. Should it be confirmed at other sites it would have clear significance for the age of maximum glaciation of the Loch Lomond Readvance.

Finally, Pulpit Hill is important in that it remains one of only a few pollen sites to have been examined by the analysis of more than one pollen core. AtPulpit Hill, two cores were analysed, and the major vegetational and climatic changes discussed above replicated. This approach clearly indicates that the fluctuations recognized are not localized perturbations induced through sedimentological disturbance, nor are they statistical artefacts, but are real indications of the complexity of Lateglacial climatic evolution.

Conclusions

The deposits at Pulpit Hill provide a valuable record of environmental changes in the south-west Highland area during the Lateglacial (about 13,000–10,000 years ago). In particular, detailed study of the pollen and sediments has revealed two separate phases of climatic deterioration, the later one corresponding to the intensely cold Loch Lomond Stadial (about

11,000–10,000 years ago), together with the accompanying vegetation and soil changes. The detail of information available at Pulpit Hill makes it a valuable reference site and allows comparisons with the climatic records of sites in other areas.

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