

LOCH ASHIK (LATEGLACIAL PROFILE)

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Highlights

Pollen preserved in the sediments that infill the floor of Loch Ashik provide a detailed record, supported by radiocarbon dating, of the vegetational history and environmental changes on Skye during the Lateglacial.

Introduction

Loch Ashik (NG 691232) is located 4 km east of Broadford on the Isle of Skye. It lies at around 40 m OD and, at its maximum, is 175 m long and 125 m wide. In recent years the vegetational history of the island has undergone a major revision (Walker *et al.*, 1988; Walker and Lowe, 1990), and the pattern of Lateglacial and early Holocene environmental change that has emerged is more compatible with data from the Scottish mainland and other Hebridean islands than were the previously published interpretations from Skye (Erdtman, 1924, 1928; Blackburn, in Godwin, 1943; Vasari and Vasari, 1968; Birks, 1973; Vasari, 1977; Williams, 1977; Birks and Williams, 1983; Walther, 1984). A key element in this reinterpretation is the site of Loch Ashik, which contains an unequivocal Lateglacial pollen record and can now be regarded as the type Lateglacial profile for the Isle of Skye. Full details of the pollen record are contained in Walker and Lowe (1990), and a more concise description can be found in Walker and Lowe (1991).

Description

In an infilled embayment by an inflowing stream at the western end of the loch, a characteristic Lateglacial tripartite sediment sequence (*cf.* Sissons *et al.*, 1973) is preserved (Figure 11.16) (Walker and Lowe, 1990, 1991). This consists of basal minerogenic sediments (below 5.69 m) overlain by a unit of higher organic content (5.69–5.29 m) which, in turn, is succeeded by a further suite of minerogenic deposits (5.26–5.07 m). This Lateglacial sequence is overlain by over 5 m of Holocene lake muds and peats. Six radiocarbon dates (SRR-3116 to SRR-3121) have been obtained from the sediments (Figure 11.16).

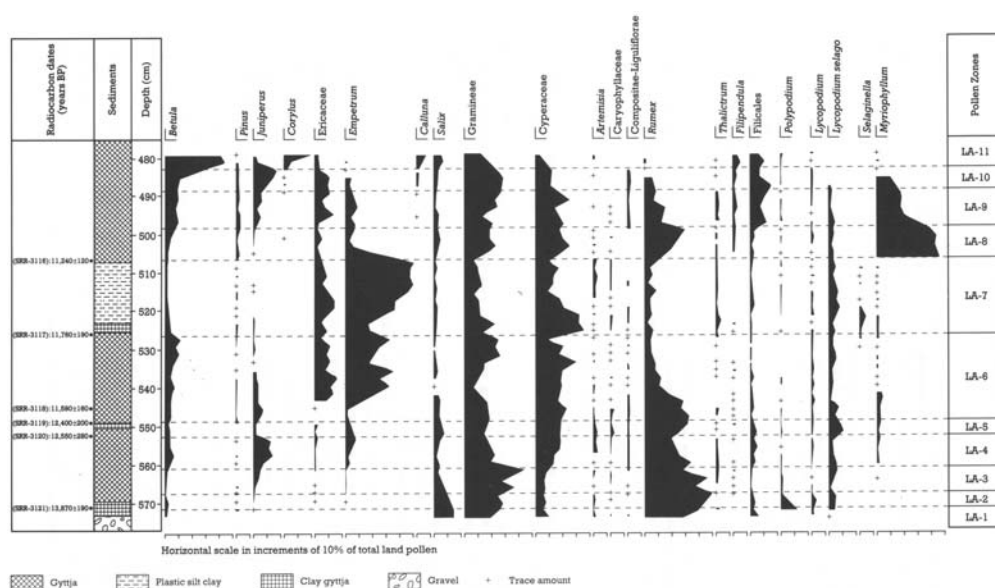


Figure 11.16: Loch Ashik: Lateglacial relative pollen diagram showing selected taxa as percentages of total land pollen (from Walker and Lowe, 1991).

The pollen diagram from the Lateglacial and early Holocene deposits (Figure 11.16) has been divided into eleven local pollen assemblage zones (LA-1 to LA-11) based on fluctuations in the curves for the principal taxa. These show an early Lateglacial pioneer vegetational stage dominated by open-habitat communities (LA-1 and LA-2), the expansion of woody plants, including birch and juniper (LA-3), and the subsequent establishment of *Empetrum* and *Erica* heaths (LA-5), the development of a grass-sedge tundra with some heathland stands during the Loch Lomond Stadial (LA-7), and finally the early Holocene vegetational succession from arctic–alpine communities to birch and hazel woodland (LA-8 to LA-11).

Interpretation

The sequence of vegetational changes represents a clear biotic response to climatic fluctuations at the last glacial–interglacial transition which began with rapid climatic amelioration around 13,000 BP, followed by gradual climatic deterioration during the Lateglacial Interstadial (from c. 12,000 BP onwards), the development of a climatic regime of arctic severity during the Loch Lomond Stadial (c. 11,000–10,200 BP), and a subsequent rapid rise in both winter and summer temperatures in the first five hundred years of the Holocene (Atkinson *et al.*, 1987).

Radiocarbon dating of the Loch Ashik sediments proved problematical, for although six age determinations were made on bulk samples of organic lake muds obtained from the site, the majority appear to be too old by comparison with radiocarbon dates on comparable biostratigraphic horizons from other sites in northern Britain. Indeed, only the date of 11,590 ± 160 BP (SRR-3118) on the late interstadial expansion of *Empetrum* appears to be consistent with the currently accepted radiocarbon chronology of Lateglacial biozones (Walker and Harkness, 1990). The measured ages most probably reflect the inwash of inert carbon residues into the lake basin, either in the form of mineral carbon from the local bedrock, or older organic carbon residues from soils around the lake catchment and/or from the inwashing of older carbon detritus (Olsson, 1979, 1986). Whatever the source of contamination, it is apparent that a reliable Lateglacial chronology cannot be established from the Loch Ashik sediments.

The Loch Ashik site is, nevertheless, significant in a number of respects. First, a high-resolution pollen record of the Lateglacial and early Holocene periods has been obtained from the basal sedimentary sequence, the percentage pollen counts being supported by pollen concentration, deteriorated pollen and sediment chemistry data (Walker and Lowe, 1990). Indeed the pollen concentration diagram is the first to be published from a Lateglacial site in the Hebrides. Moreover, the pollen record is directly comparable not only to those from sites on other Hebridean islands and adjacent areas of the Scottish mainland (Walker and Lowe, 1982, 1985, 1987; Tipping, 1984, 1986; Lowe and Walker, 1986a, 1986b; Robinson, 1987c), but also to those from other recently-investigated profiles on Skye (Walker and Lowe, 1990). It therefore demonstrates that the sequence of vegetational changes on Skye conforms with the pattern inferred from other sites in northern and western Scotland, a fact that was not apparent in previously published data from the island (Birks, 1973).

Second, the site is important for demonstrating the significance of deteriorated pollen analysis in palaeoecological reconstructions. The very high counts for *Empetrum* pollen in pollen assemblage zone LA-7 may be taken to indicate extensive heathland communities around the basin catchment during the Loch Lomond Stadial, and certainly the rising curve for this taxon is indicative of some local *Empetrum* presence. However, deteriorated pollen counts show that the majority of the *Empetrum* pollen exhibit signs of exine damage and hence are most likely to be of secondary derivation from eroding soils around the catchment (see also Loch an t-Suidhe).

Third, the profile shows unequivocal evidence of a mid-interstadial 'revertance' episode, reflected in both the sediment stratigraphy between 5.53 m and 5.49 m, and the pollen record changes from LA-3 to LA-5. The decline in *Juniperus* and *Empetrum* values in LA-4 is accompanied by increases in *Rumex*, Caryophyllaceae, *Salix* and *Lycopodium*, and also by a peak in the curve for deteriorated pollen. A similar lithological and biological oscillation in interstadial sediments has been noted at a number of sites in Scotland (Walker, 1984b; Tipping, 1991b) and has been widely interpreted as reflecting a break-up of the vegetation cover and increased soil erosion as a consequence of short-lived climatic deterioration. At other

sites in Scotland and Ireland, a date of around 12,000 BP has been inferred for this event (Pennington, 1975b; Watts, 1985; Lowe and Walker, 1986a). Coleopteran evidence suggests a fall of almost 10°C in temperatures of the coldest months of the year from 12,300 to 11,800 BP after which winter temperatures rose by 4–5°C (Atkinson *et al.*, 1987), and it may be this climatic oscillation that is being reflected in the Loch Ashik profile.

Finally, Loch Ashik is located in a critical position relative to the mapped glacier limits in south-eastern Skye. It lies approximately 7 km east of the Loch Lomond Stadial glacier that developed in Coir Gorm in the Eastern Red Hills and just over 4 km north-west of the Loch Lomond Readvance limit in the Kyleakin Hills of eastern Skye. The site is therefore a key element in the establishment of a glacial chronology for this part of the Isle of Skye (Walker *et al.*, 1988; Ballantyne, 1989a; Ballantyne and Benn, 1991).

Loch Ashik is thus of considerable importance, and may justifiably be regarded as the main reference site for the Lateglacial on the Isle of Skye. In regional terms, it is a key element in establishing the spatial and temporal pattern of environmental change in western Scotland during the Lateglacial and early Holocene periods. In a wider context, it provides one of the few detailed Lateglacial pollen sequences from the maritime fringes of western Britain (see also Loch an t-Suidhe) which offers a basis for correlation between the nearshore marine evidence (e.g. Peacock, 1989b; Peacock and Harkness, 1990) and offshore records (e.g. Duplessy *et al.*, 1981; Ruddiman and McIntyre, 1981b; Bard *et al.*, 1987) during the last glacial–interglacial transition. As such, the comprehensive stratigraphic record from the Loch Ashik profile may have a much wider significance.

Conclusions

Loch Ashik is a key reference site for reconstructing the vegetational and environmental history on Skye during the Lateglacial, between approximately 13,000 and 10,000 years ago. Its full and detailed pollen record provides valuable insights into the changes that occurred during this period, including rapid climatic amelioration at the start of the Lateglacial Interstadial around 13,000 years ago, the development of intensely cold conditions during the Loch Lomond Stadial (about 11,000–10,000 years ago) and the rapid warming at the start of the Holocene (10,000 years ago). The pollen and sediments also reveal a brief climatic deterioration during the Lateglacial Interstadial (between about 13,000 and 10,000 years ago). Loch Ashik forms an integral part of a network of sites that demonstrate the geographical and temporal pattern of environmental change during the Lateglacial.

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