
Site 21 Rothens, Monymusk

The site at Rothens [NJ 6878 1710] has yielded a pollen spectrum that represents a 'tripartite' Late-glacial sequence, encompassing much of the Late-glacial (Windermere) Interstadial, the Loch Lomond Stadial and the early Holocene. It is unusual in that it appears to contain evidence of a climatic fluctuation within the Late-glacial Interstadial that may correlate with the 'Older Dryas' episode of Scandinavia.

The site is situated in hummocky terrain adjacent to the now abandoned Rothens gravel pit, 2 km north-west of Monymusk, on Sheet 76E (Map 8). Exposures in the gravel pit revealed a complex succession interpreted as proximal and distal outwash deposits and associated overbank facies (Aitken, 1991, 1998). The site lies at the western end of a small valley that extends from the Don valley at Monymusk to Kemnay. It has been interpreted as a major route of meltwater drainage which occurred while the main valley still contained ice (Aitken, 1991). The site is a roughly circular kettlehole with a diameter of 300 m and lies at an altitude of about 88 m OD. It is flanked on its eastern and southern margins by an arcuate ridge.

The kettlehole contains at least 5 m of fill. The lower parts of the sequence have been sampled for pollen analysis and the stratigraphy of the sampled is as follows:

	Depth m
Dark brown peat	2.00–2.10
Dark brown fibrous peat	2.10–2.17
Brown woody peat containing twigs and wood fragments	2.17–2.57
Greenish-brown fibrous peat	2.57–3.88
Black nutrient-rich organic mud and silty peat (gyttja)	3.88–4.28
Grey, pebbly, sand	4.28–4.41
Black nutrient-rich organic mud and silty peat (gyttja)	4.41–4.62
Grey, silty clay	4.62–4.70
Black, fibrous peat	4.70–4.75
Green-grey silt becoming coarser grained and more micaceous with depth	4.75–4.93

Three distinct pollen assemblage zones occur and are numbered R-1 to R-3 (Figure A1.26). The sedimentary boundaries are slightly offset from the pollen zone boundaries, with changes in pollen stratigraphy preceding changes in sediment type. This may either represent a lag in the response of soil development and degradation, to changing environmental conditions, or indicate that the pollen zone boundaries are gradational. Details of individual zones are as follows:

R-1 Gramineae–Rumex–Cyperaceae Assemblage Zone (4.45–4.93 m)

This basal assemblage zone is dominated by non-arboreal pollen. It is characterised by high values of Gramineae (grasses), *Rumex* (docks) and Cyperaceae (sedges). Relative values of Ericales rise rapidly in the middle of the zone to attain a peak of 33 per cent TDLP (Aitken, 1991). However, absolute values for Ericales (heathers), remain relatively constant throughout the zone and the relative rise in Ericales may be, at least, in part, a statistical artefact (Figure A1.26). The zone is noteworthy for the high values of *Myriophyllum* cf. *alterniflorum* (water-milfoil). Pollen of woody plants is scarce, but *Juniperus* (juniper), *Betula* (birch), *Salix* (willow) and *Corylus/Myrica* (hazel/bog myrtle) taxa all occur. The upper boundary of the zone is placed at the rise in values for *Artemisia* (mugworts), the absolute rise in values for Ericales and the falls in *Juniperus* and *Betula* pollen. By comparison with other northern Scottish pollen spectra, zone R-1 is thought to be of Late-glacial Interstadial age (Aitken, 1991).

R-2 Ericales–Artemisia Assemblage Zone (4.25–4.45 m)

This zone is also dominated by herb pollen. It is characterised by constantly high values for Ericales (greater than 25 per cent) and increasingly significant values for *Artemisia*, which attains a maximum of 25 per cent near the top of the zone. *Salix* maintains its importance in the zone, but values for all other woody taxa are low. Aquatic plant pollen is absent. The upper boundary of the zone is placed at the marked decline in pollen of open habitat taxa, notably *Artemisia*, Compositae and Caryophyllaceae, and the beginning of the rise in values for woody plants, particularly *Betula* and *Juniperus*. By comparison with other northern Scottish pollen spectra, zone R-2 is thought to be of Loch Lomond Stadial age (Aitken, 1991).

R-3 *Betula*–*Juniperus* Assemblage Zone (3.69–4.25 m)

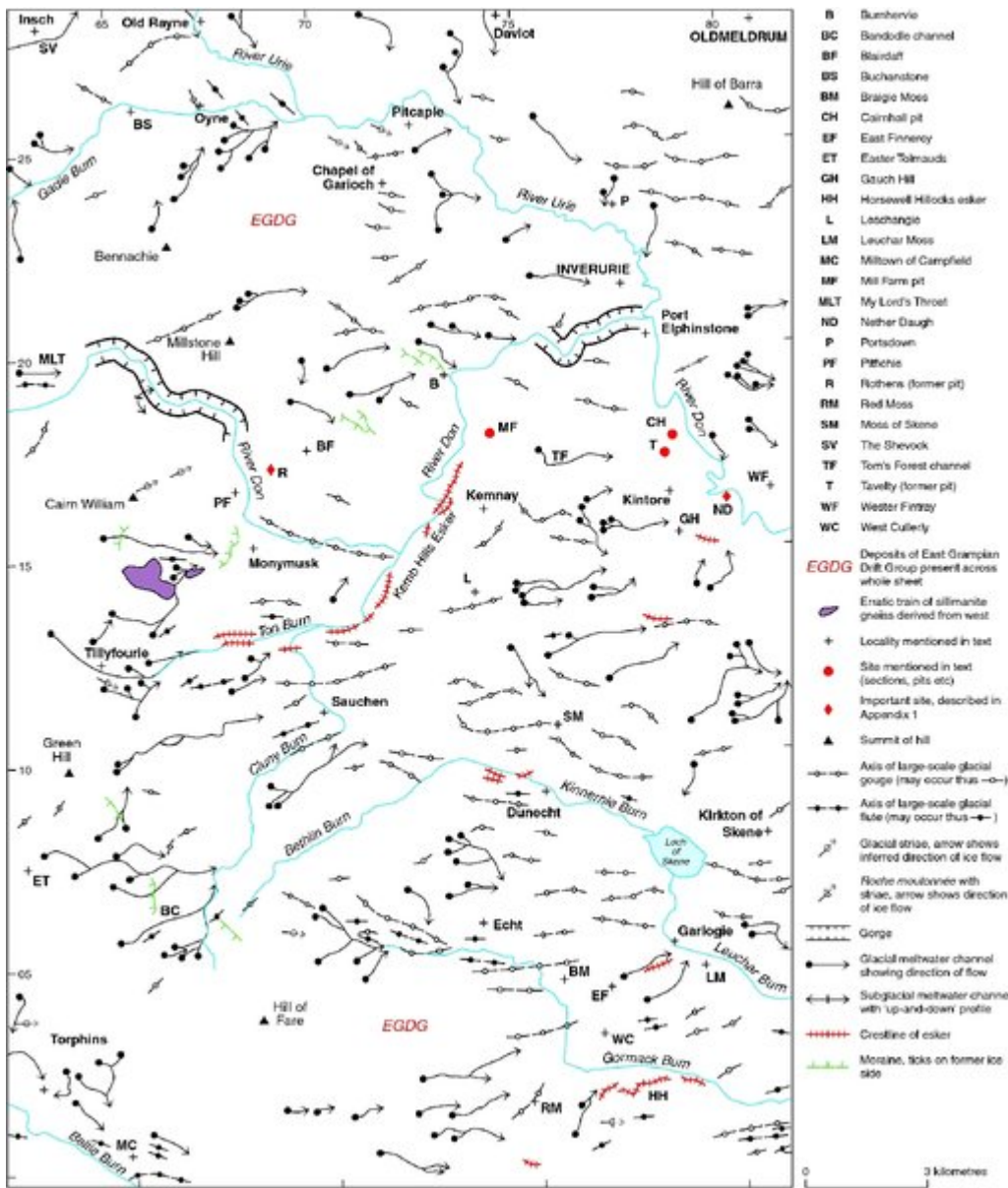
This zone is characterised by successive peaks in Gramineae, Ericales, *Juniperus* and *Betula*. Percentages of non-arboreal pollen decline throughout the zone, while the aquatic *Potamogeton* (pondweed) rises to a peak of 41.9 per cent at a depth of 3.70 m. Towards the top of the zone there is a rise in *Corylus/Myrica* pollen and a corresponding decline in *Betula* and *Juniperus*. By comparison with other northern Scottish pollen spectra, zone R-3 is thought to be of early Holocene age (Aitken, 1991).

Four radiocarbon ages have been obtained from the site (Aitken, 1991) (Table 8):

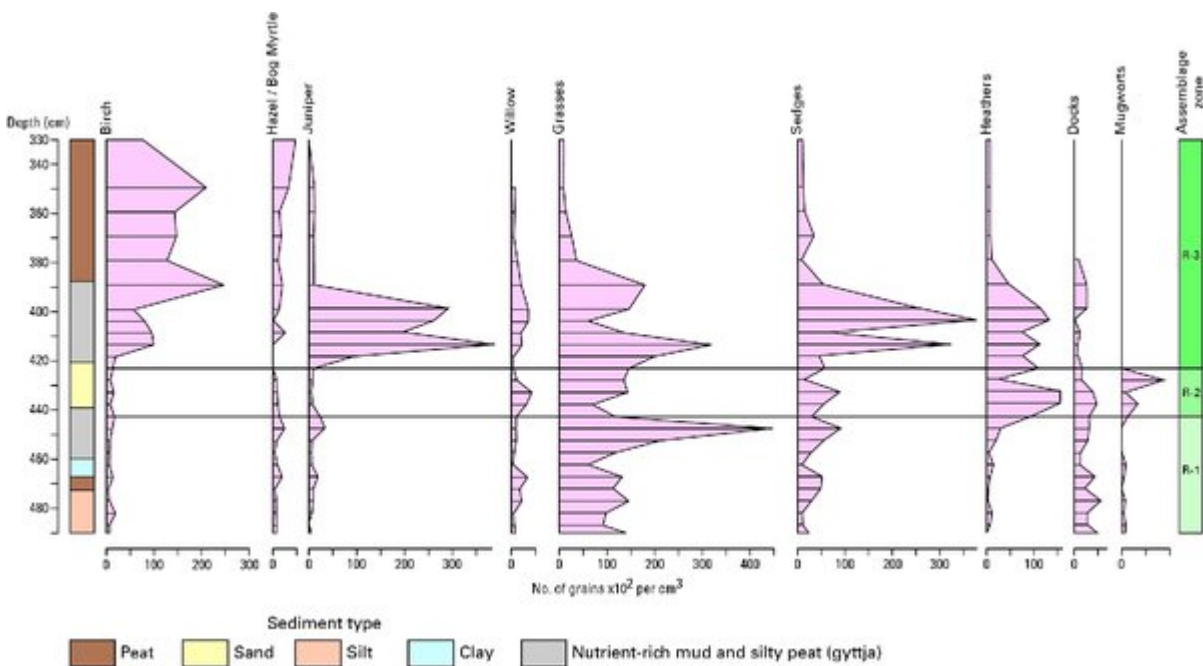
SRR–3802	4.28 m	8900 ± 110 ¹⁴ C years BP
SRR–3803	4.41 m	10 680 ± 100 ¹⁴ C years BP
SRR–3804	4.62 m	11 640 ± 160 ¹⁴ C years BP
SRR–3805	4.71 m	11 790 ± 140 ¹⁴ C years BP

When compared with radiocarbon dated pollen sequences from other Scottish sites, each of the ages from the Rothens deposits appears to be less than expected (Aitken, 1991). The ages of the bottom three samples are at least 200 ¹⁴C years less than expected, and the date of uppermost sample is perhaps up to 1000 ¹⁴C years younger than expected. The reasons for these discrepancies are unclear, but contamination by humus-rich ground water may have been an important factor. Furthermore, as a result of the paucity of organic material, the segments selected for radiocarbon assay were relatively thick (up to 5 cm) such that each date represents a mean value for the quoted level. The dates are therefore considered to be unsuitable for reliable detailed chronostratigraphical correlation with other sites. Nevertheless, the radiocarbon ages broadly confirm both the interpretations of the local stratigraphy and the palynology. The organic deposit between 475 and 441 cm formed during the Late-glacial Interstadial, while the overlying grey, pebbly sand was deposited during the succeeding Loch Lomond Stadial. The two lowermost dates, on either side of a less organic silty clay unit, approximately bracket the supposed 'Older Dryas Stadial' although this is by no means conclusive.

[References](#)



(Map 8) Glacial and glaciofluvial features and the distribution of glaciogenic deposits on Sheet 76E Inverurie.



(Figure A1.26) Absolute pollen diagram of selected taxa from Rothens (after Aitken, 1991).

Site	Grid reference	Laboratory number	Age (years BP)	Dated material and setting	Reference
Roths cutting	NJ 277 498	Beta-86532	11 110 ± 70	peat under remobilised till	Appendix 1
Carral Hill, Keith	NJ 444 551	Q-104	10 808 ± 230	peat under remobilised till	Godwin and Willis (1959)
Carral Hill, Keith	NJ 444 551	Q-103	11 098 ± 235	peat under remobilised till	Godwin and Willis (1959)
Carral Hill, Keith	NJ 444 551	Q-102	11 308 ± 245	peat under remobilised till	Godwin and Willis (1959)
Carral Hill, Keith	NJ 444 551	Q-101	11 888 ± 225	peat under remobilised till	Godwin and Willis (1959)
Carral Hill, Keith	NJ 444 551	Q-100	11 358 ± 300	peat under remobilised till	Godwin and Willis (1959)
Woodhead, Fyvie	NJ 788 384	SRR-1723	10 780 ± 50	peat under remobilised till	Connell and Hall (1987)
Howe of Byth	NJ 822 571	SRR-4830	11 320	peat beneath gravel	Hall et al. (1995)
Moss side, Tarves	NJ 833 318	I 6969	12 200 ± 170	peat under remobilised till	Clapperton and Sugden (1977)
Loch of Park	NO 772 988	IHEL-416	10 280 ± 220	kettlehole infill	Vasari and Vasari (1968)
Loch of Park		HEL-417	11 900 ± 260	kettlehole infill	Vasari and Vasari (1968)
Mill of Dyce	NJ 8713 1496	SRR-762	11 550 ± 80	kettlehole infill	Harkness and Wilson (1979)
Mill of Dyce	NJ 8713 1496	SRR-763	11 640 ± 70	kettlehole infill	Harkness and Wilson (1979)
Glenbervie	NO 767 801	CX-14723	12 460 ± 130	peat under remobilised till	Appendix 1
Glenbervie	NO 767 801	SRR-3687a (humic)	12 305 ± 50	peat under remobilised till	Appendix 1
Glenbervie	NO 767 801	SRR-3687b (humic)	12 340 ± 50	peat under remobilised till	Appendix 1
Britzieshill Farm	NO 7936 7918	SRR-387	12 390 ± 100	peat under remobilised till	Autou et al. (2000)
Rothens	NJ 638 171	SRR-3803	10 680 ± 100	kettlehole infill	Appendix 1
Rothens	NJ 638 171	SRR-3804	11 640 ± 160	kettlehole infill	Appendix 1
Rothens	NJ 638 171	SRR-3805	11 760 ± 140	kettlehole infill	Appendix 1

(Table 8) Radiocarbon dates from Late-glacial sites in the district.