# Knockhill Wood, Glenbervie - locality, Cainozoic of north-east Scotland

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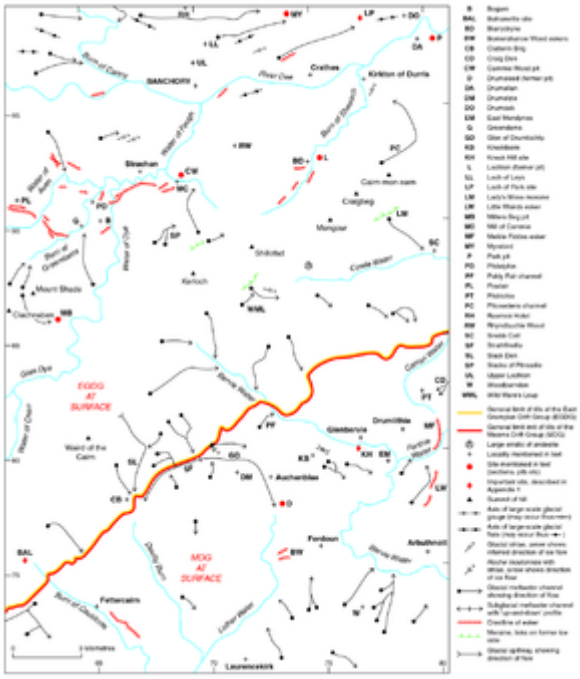
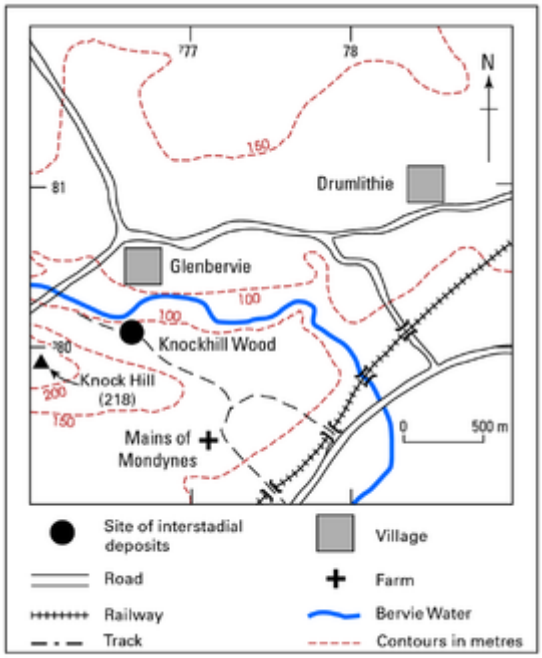
Merritt, J W, Auton, C A, Connell, E R, Hall, A M, and Peacock, J D. 2003. Cainozoic geology and landscape evolution of north-east Scotland. Memoir of the British Geological Survey, sheets 66E, 67, 76E, 77, 86E, 87W, 87E, 95, 96W, 96E and 97 (Scotland). Contributors: J F Aitken, D F Ball, D Gould, J D Hansom, R Holmes, R M W Musson and M A Paul.

# Knockhill Wood, Glenbervie




Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 66E Banchory. P915380.

A Late-glacial (Windermere) Interstadial peat, intercalated between red-brown diamictons at Knockhill Wood, Glenbervie (P915380), provides important evidence of the age of slope modification in Strathmore by landslipping. The $^{14}C$ age, pollen spectra and plant macrofossils obtained from the peat, and its stratigraphical contacts suggest that the last movement occurred either during the Loch Lomond Stadial or when the climate ameliorated, during the earliest Holocene.



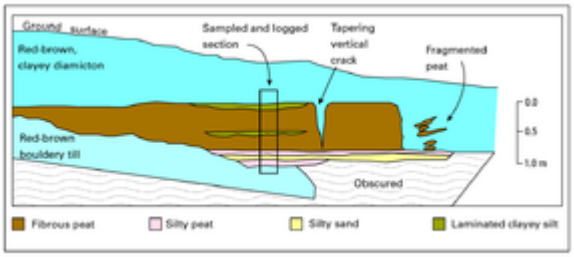

Location of Knockhill Wood site. P915329.

A composite organic deposit was discovered beneath reddish brown diamicton of the Mearns Drift Group during the resurvey of Sheet 66E Banchory in 1989. The deposits were located in a drainage ditch (NO 7667 8012) on the north-eastern side of a forestry track through Knockhill Wood, on the southern side of the valley of the Bervie Water, upstream of Glenbervie (P915329). The organic sediments consisted largely of peat, with subordinate layers of fine peaty sand and laminated clayey silt (see table below). They rested upon an unstratified bouldery till, also reddish brown in colour.

Stratigraphy of the Knockhill Wood site

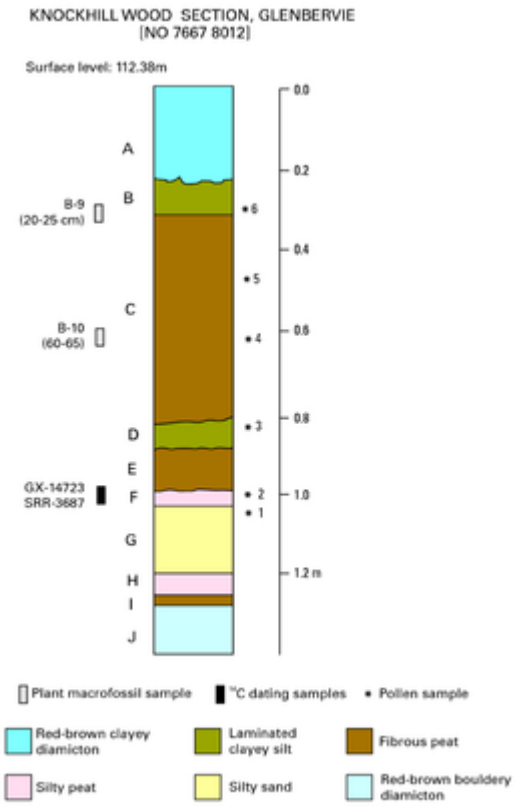
| Unit | Lithology | Description | Thickness (m) | Depth (m) |
|---|---|---|---|---|
| A | Landslipped till | **Diamicton**, stiff, clayey, slightly sandy; moderate reddish brown, 'flecked' with red. Clasts angular to subangular, gravel including decomposed andesite. Slightly irregular gradational base | 0.25 | 0.25 |
| B | Clayey silt | **Clayey silt**, with sand laminae and thin wisps of peat. Light olive-grey to pale reddish brown. Sharp planar base | 0.05 | 0.30 |
| C | Fibrous peat | **Peat**, fibrous, compact, with pronounced colour banding on freshly exposed face. Colour ranges from moderate yellowish brown, through dusky yellowish brown to black. Slightly irregular base | 0.51 | 0.81 |
| D | Clayey silt | **Clayey silt**, micaceous, with fine sand and some peat fragments. Dark yellowish brown to moderate greyish red. Uneven base | 0.07 | 0.88 |
| E | Fibrous peat | **Peat**, fibrous, dark yellowish brown to dusky yellowish brown | 0.10 | 0.98 |
| F | Silty peat | **Peat**, silty, laminated, moderate grey | 0.06 | 1.04 |
| G | Sand | **Sand**, silty and clayey, medium- to coarse- grained, greyish red. Some small peat lenses incorporated towards the base | 0.16 | 1.20 |
| H | Silty peat | **Peat**, silty and clayey, moderate olive-grey | 0.05 | 1.25 |

| | | | | |
|---|---|---|---|---|
| I | Fibrous peat | **Peat**, fibrous, dark yellowish brown to dusky yellowish brown | 0.02 | 1.27 |
| J | Till | **Diamicton**, firm, sandy and silty, moderate reddish brown. Clasts rounded to well rounded, large cobbles and boulders derived from Old Red sandstone conglomerates | 0.15+ | 1.42 |




Knockhill Wood exposure showing the relationship between the organic and glacigenic sediments. P915330.

The organic deposits are exposed along about 7 m of the ditch, and appear to form a wedge in the side of Knock Hill (P915330). They overlie bouldery till (unit J of table above) and are interstratified with clayey silts and sands. At the north-eastern end of the section, the upper part of the organic sequence (units B–F) is truncated by the overlying clayey diamicton of unit A. This diamicton is hard, but plastic, and apart from flecks of more vivid red clay, it shows little sign of internal stratification. Its base is slightly uneven and gradational over about 1 cm. Other sections lower down the hillside show that the basal till (unit J) reaches up to 8 m in thickness and varies laterally from being stiff and clayey, to friable and sandy. It rests on decomposed feldspathic andesite of the Montrose Volcanic Formation in a river cliff of the Bervie Water (NO 7642 8024).




Graphic log of the organic sequence at Knockhill Wood. P915331.

The base of unit A incorporates wisps and fragments of peat where it overlies the truncated stretch of the organic sequence. The organic sequence itself is penetrated to a depth of about 0.8 m by a vertical, downward-tapering crack filled with red-brown clayey diamicton (P915330). The crack is either an ice-wedge pseudomorph, or a vertical fracture that has opened up owing to down-slope gravitational movement. The latter explanation is perhaps more likely as there is no evidence of any reorientation of clasts within the fissure infill, as would be expected if it were of periglacial origin.

Six samples taken from a monolith (P915331) for pollen analysis by M J C Walker (University of Wales, Lampeter, 1989), yielded relatively sparse assemblages. Only one hundred pollen grains were counted from each sample (see table below). The pollen assemblages suggest an open, essentially treeless landscape, dominated by grass and sedge, with a number of herbaceous taxa present (e.g. *Compositae, Cruciferae, Rumex* and *Caryophyllaceae*). Tree pollen was sparse, although willow pollen was notable towards the bottom of the profile. The treeless nature of the landscape suggested by these assemblages is clearly indicative of interstadial or tundra climate, rather than warmer interglacial conditions.

Outline pollen count from Knockhill Wood

| | **Sample** | **6** | **5** | **4** | **3** | **2** | **1** |
|---|---|---|---|---|---|---|---|
| | **Depth (cm)** | 25-30 | 45-50 | 57-67 | 81-84 | 97-104 | 104-107 |
| **Trees** | *Betula* (birch) | 1 | 1 | 1 | 1 | | |
| | *Pinus* (pine) | 1 | | | 1 | 2 | 2 |
| | *Corylus* (hazel) | | | | | 1 | |
| **Shrubs/ dwarf shrubs** | *Salix* (willow) | 1 | 1 | | 4 | 4 | 7 |
| | Ericaceae (heather) | 2 | 1 | | | | |
| | *Empetrum* (crowberry) | | 1 | 3 | | | |
| **Grass** | Gramineae | 28 | 14 | 14 | 26 | 32 | 28 |
| **Sedges** | Cyperaceae | 54 | 75 | 65 | 34 | 34 | 34 |
| **Herbaceous taxa** | Compositae: Liguilflorae (daisy) | | 1 | 1 | 4 | 1 | 1 |
| | Compositae: Tubliflorae (daisy) | | | 1 | 19 | | |
| | Caryophyllaceae (pinks) | | 1 | 3 | 1 | 1 | |
| | Cruciferae (brassica) | | 1 | 4 | 2 | 11 | 12 |
| | *Epilobium* (willowherb) | | | | | 1 | 1 |
| | *Ranunculus* (buttercup) | | | | 2 | 1 | 1 |
| | *Rumex* (docks) | 10 | | 3 | 2 | 3 | 8 |
| | *Thalictrum* (meadow-rues) | | 1 | 1 | | 4 | |
| | *Artemesia* (mugworts) | 1 | | | | 2 | |
| **Aquatics** | *Myriophyllum* (water-milfoils) | | 1 | | | | |
| | *Potamogeton* (pondweeds) | | | | 3 | 1 | |
| **Spores** | Filicales | | | 5 | 10 | 11 | 7 |
| | *Lycopodium* | | 4 | | | | |
| | *Lycopodium selago* | | 1 | | | | |
| | *Sphagnum* | 165 | | | | | |
| | **Indeterminate** | 2 | 2 | 3 | 4 | 3 | 6 |

The climatic inferences from the pollen analyses were supported by the results of plant macrofossil

analysis by M Field (Keele University, 1991) (see P915331 for sampling intervals). Sample B9 yielded 34 compressed *Carex* (sedge) fruits. Sample B10 yielded a well-preserved assemblage of macrofossils, but revealed the presence of only three taxa. A single seed of *Viola* sp. (violet), 81 compressed *Carex* fruits and hundreds of seeds of *Monitia fontana* subspecies *fontana*, a herbaceous annual to perennial of the 'Blinks' family (Stace, 1991) were recorded. The latter form is widely distributed at present in northern Britain and reaches north-westwards into northern Scandinavia. It occurs in damp habitats and its occurrence with *Carex* suggests a damp open landscape.

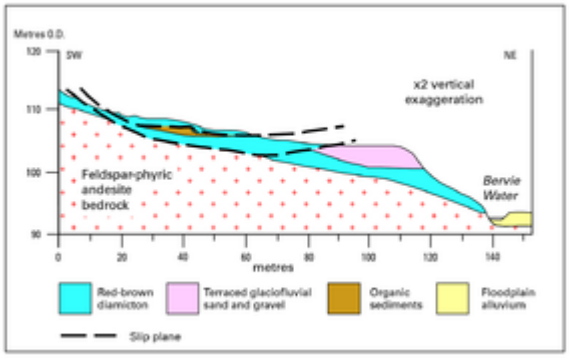
An initial radiocarbon age (GX–14723) of 12 460 ± 130 $^{14}$C years BP was obtained for an acid-washed bulk sample of the silty peat. A sample taken subsequently was pre-treated to separate the alkali soluble (humic) and alkali insoluble (humin) components for independent age measurement. This was undertaken in order to identify any younger contaminants not completely removed by the pre-treatment. An age of 12 305 ± 50 $^{14}$C years BP was obtained for the humic component (SRR–3687a) and 12 340 ± 50 $^{14}$C years BP for the humin component (SRR–3687b) (see table below). All of the radiocarbon dates indicate a Late-glacial Interstadial age for the lower part of the sequence. It is possible that the upper parts of the organic sequence may extend into the succeeding Loch Lomond Stadial, but at present, the evidence from the flora is inconclusive.

Radiocarbon dates from Late-glacial sites in the district

| Site | Grid reference | Laboratory number | Age (year BP) | Dated material and setting | Reference |
|---|---|---|---|---|---|
| Rothes cutting | NJ 277 498 | Beta 8653 | 11 110 ± 70 | peat under remobilised till | Appendix 1 |
| Garral Hill, Keith | NJ 444 551 | Q-104 | 10 808 ± 230 | peat under remobilised till | Godwin and Willis (1959) |
| Garral Hill, Keith | NJ 444 551 | Q-103 | 11 098 ± 235 | peat under remobilised till | Godwin and Willis (1959) |
| Garral Hill, Keith | NJ 444 551 | Q-102 | 11 308 ± 245 | peat under remobilised till | Godwin and Willis (1959) |
| Garral Hill, Keith | NJ 444 551 | Q-101 | 11 888 ± 225 | peat under remobilised till | Godwin and Willis (1959) |
| Garral 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 | 11320 | 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 | HEL-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 | GX-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-368Th (humin) | 12 340 ± 50 | peat under remobilised till | Appendix 1 |
| Brinzieshill Farm | NO 7936 7918 | SRR-387 | 12 390 ± 100 | peat under remobilised till | Auton et al. (2000) |
| Rothens | NJ 688 171 | SRR-3803 | 10 680 ± 100 | kettlehole infill | Appendix 1 |
| Rothens | NJ 688 171 | SRR-3804 | 11 640 ± 160 | kettlehole infill | Appendix 1 |
| Rothens | NJ 688 171 | SRR-3805 | 11 760 ± 140 | kettlehole infill | Appendix 1 |

The stratigraphical, sedimentological and palaeontological studies of the sequence at Knockhill Wood and the radiocarbon dates suggest that the organic sediments were laid down in a cool damp environment, during the Late-glacial (Windermere) Interstadial. The organic sequence overlies a basal bouldery lodgement till of probable main Late Devensian age, laid down on top of weathered andesite bedrock. The basal till is assigned to the Mill of Forest Till Formation. The origin of the overlying matrix-supported clayey diamicton is more problematic. Its compact structure and absence of well-developed internal stratification are typical attributes of lodgement or deforming-bed tills, rather than flow tills. No tills of Loch Lomond Stadial age are known from the district. Indeed, dating and palynological evidence from sites such as the Loch of Park indicate that the low ground was deglaciated throughout the Loch Lomond Stadial.




Postulated form of the landslip Knockhill Wood. P915332.

The upper diamicton has a gradational, but apparently conformable contact with the underlying organic sediments in the south-western part of the Knockhill Wood section, but it sharply truncates the upper part of the same sequence at the north-eastern (downslope) end of the exposure. This cross-cutting relationship, together with incorporation of fragments of peat in the till near the truncation surface, suggest that the diamicton has been emplaced as part of a landslip. The slip occurred by downslope movement along a gently curved, low-angle plane at the top of the laminated clayey silts (P915332). It is likely that slipping also occurred at the till/bedrock contact. If the tapering feature cutting the organic sequence is an ice-wedge cast, its presence would suggest that the movement probably occurred immediately following the Loch Lomond Stadial when rapid climatic amelioration took place.

# References

Full reference list

‘http://earthwise.bgs.ac.uk/index.php?title=Knockhill_Wood,_Glenbervie_-_locality,_Cainozoic_of_north-east_Scotland&oldid=34607’
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