Nether Daugh, Kintore - 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.

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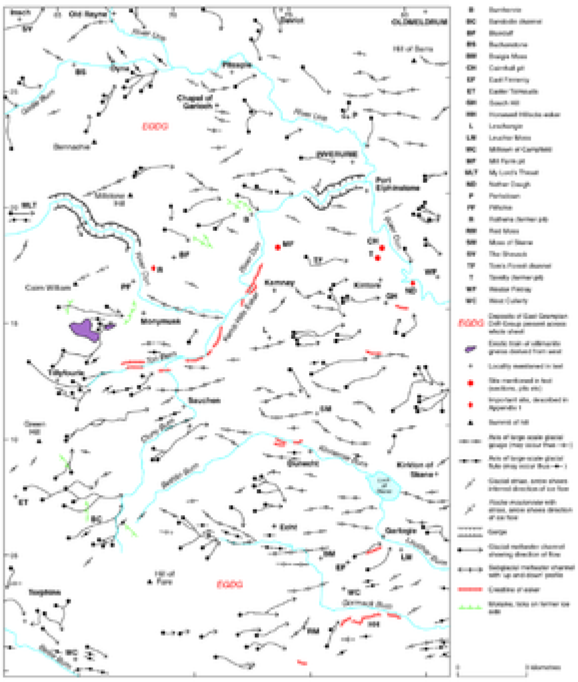
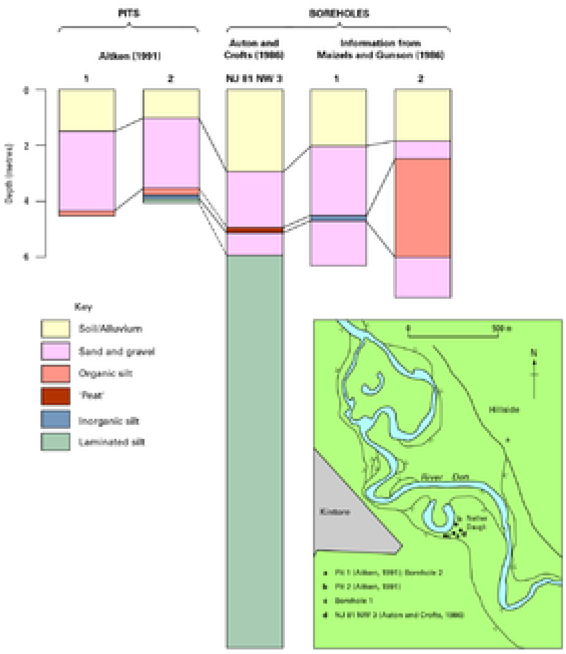
Contents

Nether Daugh, Kintore



Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 76E Inverurie. P915378.

Fine-grained sediments, containing the remains of plants and insects, recovered from pits excavated in the floodplain of the River Don, provide an insight into the type of environmental change that affected river catchments in north-east Scotland during the late Holocene. In particular, they suggest that aggradation of fine-grained alluvial sediments, which infill abandoned river channels, may have resulted, at least in part, from soil erosion initiated by deforestation and the development of early agriculture.



Lithostratigraphy at the Nether Daugh site.
P915324.

The Nether Daugh site (NJ 800 160) lies at the foot of a terrace, adjacent to an abandoned meander cut-off, in the Don valley east of Kintore, on Sheet 76E (P915324, P915378). This part of the Don valley is infilled by at least 16.2 m of sandy silt, with up to 5 m of laminated micaceous brown and grey sandy silt, passing up into olive-green and olive-brown unlaminated silt. These silts underlie up to 4 m of sand and gravel, which is capped by up to 2 m of fine-grained alluvium and soil (Auton and Crofts, 1986; Aitken, 1991). The silts are interpreted as sediments that were laid down in a lake, ponded at the Mill of Dyce (see Site 18 Mill of Dyce) and which drained away after 11 550 ^{14}C years BP (Auton and Crofts, 1986; Aitken, 1991, 1995). The uppermost parts of the silt sequence may contain organic matter, but its presence has not been confirmed.

BGS Borehole NJ 81 NW3 (Auton and Crofts, 1986) drilled at Nether Daugh proved 0.2 m of 'peat' approximately 2 m below the base of the fine-grained floodplain alluvium. Two further boreholes (P915324 boreholes 1 and 2) (NJ 8003 1600 and NJ 8002 1599, respectively), were drilled at the site in December 1986 (information from J Maizels and R Gunson, University of Aberdeen, 1986). Borehole 1 confirmed the presence of an organic interval, comprising 1.1 m of grey, organic mud, overlain by 0.5 m of grey sand with branches and twigs of *Betula*, and overlain in turn by 1.6 m of grey, organic sand. Subsequently, two pits were dug by mechanical excavator, in February 1988, in order to obtain samples of the organic material for palaeoecological analyses.

The stratigraphy of the two pits and the three boreholes from the site are similar (Aitken, 1991) and is summarised in P915324. Both pits contained an organic unit at least 10 to 20 cm thick, overlying fine-grained silty sand and overlain by 4.0 to 4.5 m of clay and grey pebbly sands. The organic remains in Pit 1 (NJ 8002 1597) comprised twigs, branches, bark, leaves and seeds in a matrix of grey, silty clay. The upper part of the organic unit in Pit 2 (NJ 8004 1603) contained a higher proportion of organic matter. It comprised woody peat, with thin sand laminations that contained plant macrofossils and insect fragments, again within a grey, silty clay matrix. These organic sediments are interpreted as part of a late Holocene channel fill succession (Aitken, 1991).

Pollen count from the Nether Daugh Pits

Percentage total dry land pollen

	Pit 1	**Pit 2**

Betula	15.4	13.2
Pinus	1.1	1.8
Quercus	0.6	0.9
Alnus	14.3	11.0
Corylus/Myrica	12.0	11.0
Salix	2.3	1.3
Gramineae	26.3	30.4
Cyperacea	15.6	26.0
Ericales	9.4	6.4
Caryophyllaceae	0.6	1.3
Epilobium	1.1	
Umbelliferae	0.6	
Polypodium	0.6	0.4
Sphagnum	5.2	0.8
Filicales	3.1	3.4

Although only bulk samples of the organic remains were obtained, pollen analysis, and ^{14}C dating of the organic unit was undertaken. Its pollen content was similar in both pits (see table right) and indicated sparse vegetation. Non-arboreal pollen is dominant, particularly Gramineae and Cyperaceae, and to a lesser extent Ericales. However, *Betula, Alnus* and *Corylus/Myrica* were present in significant proportions. The environment was, therefore, dominated by grass with some heathland, perhaps on the valley sides. Cyperaceae, and possibly *Myrica*, probably grew in the silted, abandoned channel, while some stands of birch, alder and possibly hazel woodland were present locally (Aitken, 1991).

A single sample from Pit 2 was separated into plant macrofossil and organic fractions for radiocarbon dating. The respective fractions yielded dates of 3855 ± 50 ^{14}C years BP (SRR–3718 i) and 4120 ± 50 ^{14}C years BP (SRR–3718 ii) (table below). The slight discrepancy between the two ages is attributed to the presence of reworked older organic residues in the silt.

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

Palaeoentomology was carried out on a single 3.5 kg sample from Pit 2. The full list of Coleoptera is given in the table below. The limited beetle fauna describes a landscape consistent with that suggested by the pollen evidence. Both suggest that the organic unit developed in an abandoned former channel of the river. The plant debris created a wet, boggy surface with open pools of stagnant or only slowly moving water bordered by reed swamp and a ground layer of hygrophilous herbs and scrubby brush or woodland. There is some indication that this was located within a moorland landscape (Dinnin in Aitken, 1991). Some of the beetle species shed light on the interpretation of the channel fill and subsequent floodplain sedimentation. The leaf beetle *Chrysolina fastuosa* feeds on hemp and deadnettle, which are arable and cultivated land species. Furthermore, *Selatosomus incanus* (click beetle) and *Trechus quadristriatus* (ground beetle) are species of open ground, and are commonly found on arable land (Harde, 1981; Lindroth, 1985). These three species indicate the possibility of arable agriculture (Dinnin in Aitken, 1991).

Coleoptera from Nether Daugh (Pit 2)

Species	Head	Thorax	Left elytron	Right elytron	No.
CARABIDAE					
Trethus quadristriatus (Sch.)		1	1		1
Bernbidion Maris (Pz.)	1			1	1
Pterostithus strenuus (Pz.)		1		1	1
Agonum fuliginosum (Pz.)	11	15	9	10	15
Dromius sp.			1		1
DYTISCIDAE					
Hygrotus sp.	1				1
Hydroporus palustris (L.)	4	3	3	3	4

Hydroporus sp.		1			1
Agabus/Ilybius sp.	F	F	F	F	F
Rhantus/Acilius sp.			F	F	F
Colymbetes fustus (L.)			1	1	1
HYDROPHILIDAE					
Helophorus sp.	1	2	1	1	2
Cercyon sp.	1	1			1
Hydrobius fustipes (L.)			1		1
Laccobius minutus (L.)	1	1	4	3	4
HYDRAENIDAE					
Octhebius sp.				1	1
Hydraena riparia (Kug.)	1	1	1	1	1
Limnebius sp.		1			1
STAPHYLINIDAE					
Lesteva sp.	1				1
Stems comma (LeC.)			1	1	1
Sterzus sp.	10	8	12	10	12
Lathrobium ?brunnipes (Fab.)	1	2	2	2	2
Lathrobium sp.	1		1	1	1
Gabrius sp.	1				1
Quedius spp.		2		1	2
Taehyporus ?solutus (Erich.)				1	1
Taehinus corticinus (Gray.)	1	2	1	4	4
T latitollis (Gray.)	3	3	4	7	7
Aleocharinae gen. et sp. indet.	49	70	59	52	70
SCARABAEIDAE					
Aphodius sphacelatus (Pz.)	1		1		1
SCIRTIDAE					
Cyphon spp.	12	12	24	20	24
ELMIDAE					
Esolus parallelepipedus (Muller)	1	2	2	2	2
ELATERIDAE					
Selatosomus intanus (Gyn.)		1		1	1
CANTHARIDAE					
Cantharis sp.	2			1	2
NITIDULIDAE					
Meligethes sp.			1		1
CRYPTOPHAGIDAE					
Atomaria Nesomela (Herbst.)			1	2	2
LATHRIDIIDAE					
Enicmus ?transversus (Oliv.)		1			1
CHRYSOMELIDAE					
Donacia sp.			1		1
Plateumaris sericea (L.)	4	1	2	2	4

Chrysolina ?fastuosa (Scop.)	1	1	1	1	1
Phyllotreta sp.			1		1
APIONIDAE					
Apion sp.	1	2	1		2
CURCULIONIDAE					
Phyllobius ?roboretanus (Gredler)		1	1	1	1
Barypeithes ?pyrenaeus (Seidlitz)	7	4	2	1	7
Notaris ?acridulus (L.)	1				1
Limnobaris pilistriatus (Stephens)	1	2	2	1	2

The presence of only a single Elmidae, *Esolus parallelopipedus*, one of the commonest of British Elmids, is also significant. Analysis of sub-fossil assemblages from Warwickshire (Osborne, 1988) demonstrates that the distribution of even the rarest species of this genus are relicts of once widespread ranges. These beetles live on clasts in well-oxygenated water with stony or gravel beds. Osborne (1988) suggested that the local extinction of such species was caused by the influx of particulate sediment burying the coarse-grained river bed. He proposed that such valley fill was the result of soil erosion initiated by either deforestation or changes in land use management. The absence of Elmidae from the Nether Daugh site may have resulted from similar processes within the Don catchment.

Channel abandonment and aggradation of the floodplain probably represents the only significant geomorphological change of the River Don and its valley since early Holocene valley floor stabilisation. This alluvial aggradation probably occurred during the mid- to late Holocene, in a largely cleared landscape. There is limited evidence of arable activity, mainly indicated by the occurrence of certain Coleoptera.

The age of the organic sediments, at about 4000 ^{14}C years BP, corresponds with that of the earliest cereal grain found in north-east Scotland, from Balbridie, near Banchory (information from Aberdeen Art Gallery and Museums Environmental Archaeology Unit, 1989). Furthermore, Edwards (1978) and Edwards and Rowntree (1980) have shown that the late Neolithic and early Bronze Age was a period of human impact on vegetation in north-east Scotland, with large-scale forest clearance resulting in increased sedimentation into lochs on Deeside. There is no evidence for significant climatic changes that may have initiated alluviation (Lamb, 1977). Indeed it appears that Holocene climatic changes were subtle and may have had little effect on erosion except where vegetation cover was removed (Brown, 1987). Hence, the infilling of the channel at Nether Daugh, and the subsequent floodplain aggradation, may be partially a consequence of anthropogenic activity in the Don catchment.

References

Full reference list