Site 5 Crossbrae Farm, Turriff

The Late Pleistocene sequence uncovered in a drainage ditch at Crossbrae Farm [NJ 753 512], 3 km north-east of Turriff ((Figure A1.9)a; (Map 5)), in 1980 is important for three main reasons. Firstly, the interstadial organic deposits found there predate the last major cold stage and such sediments are rare in Scotland (Lowe, 1984). Secondly, the organic sediments yielded radiocarbon ages of 26 400 ± 170 and 22 380 ± 250 yr BP (SRR–2041) (Hall, 1984), which apparently indicate that they formed during an interstadial episode immediately before the build up of the last ice sheet in Buchan, thus constraining the timing of its expansion. Thirdly, the organic deposits were thought to be overlain only by solifluction deposits (Hall, 1984). The site was therefore cited as part of a body of evidence that this part of Buchan had escaped glaciation during the Late Devensian (Sutherland, 1984a). The results of further excavations at Crossbrae in 1992 ((Figure A1.9)b) and a multidisciplinary investigation of the sediments have been reported by Whittington et al. (1998).

The Crossbrae Farm Peat Bed locally rests on weathered Devonian pebbly sandstone ((Figure A1.9)c). The peat may also rest on till, as the drainage contractor for the 1980 excavation reported a 'hard, reddish-coloured boulder clay' (Crossbrae Till Formation of (Table 7)), at least 20 cm thick, beneath the peat, but only weathered bedrock was encountered in the 1992 excavations.

The Crossbrae Farm Peat Bed reaches a maximum known thickness of 55 cm and comprises sandy peat with interbedded silty sands and sand laminae. Pollen analysis has revealed a former dwarf shrub tundra vegetation, with *Betula nana* and *Salix herbacea*. *Bruckenthalia spiculifolia* was also present in the flora. Supporting evidence of an interstadial environment is provided by a range of plant macrofossil remains and by a total of 40 coleoptera taxa, including *Olophnum boreale* (Payk.), *Acidota quadrata* (Zett.) and *Boreaphilus henningianus* (Sahlb.). None of these beetles live today in the British Isles, but each is found in the present-day fauna of northern Fennoscandia. Based on the overlap of the climatic envelopes of 23 coleoptera species, the average temperature at the time of the formation of the Crossbrae Farm Peat Bed is estimated as:

Mean temperature of the warmest month 10°C ± 1°C

Mean temperature of the coldest month -9°C ± –3°C

Further radiocarbon age determinations for the Peat are as follows:

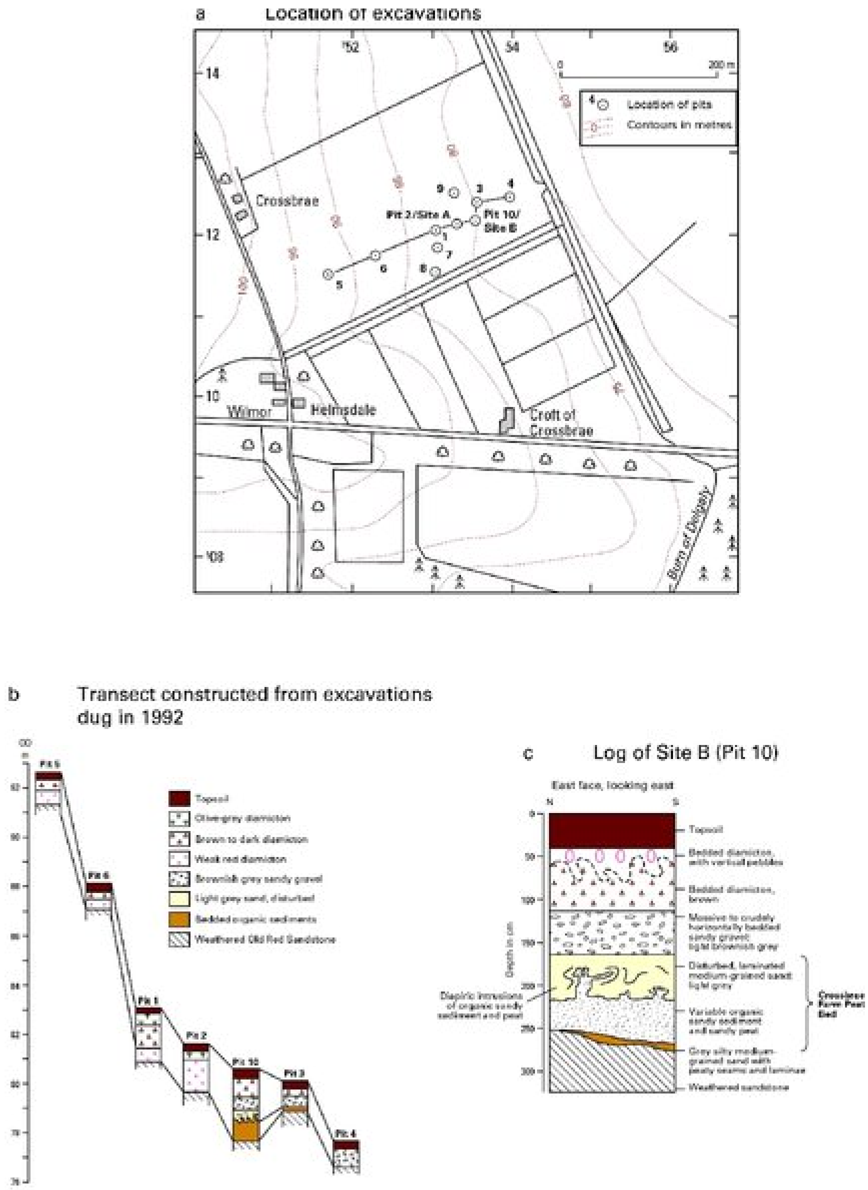
These dates must be seen as minima for the Crossbrae Farm Peat Bed. The dates obtained earlier therefore appear to be anomolously young, probably owing to contamination by younger carbon in groundwater.

The Crossbrae Farm Peat Bed clearly predates the Late-glacial and the Sourlie Interstadial around 30 ka (possibly equivalent to the Ålesund Interstadial of western Norway, (Figure 43)). Crossbrae is one of only five sites in Scotland from which pollen of the Balkan heath *Bruckenthalia* has been recovered, the others being Camp Fauld (Whittington et al., 1993) and Burn of Benholm (Auton et al., 2000) in north-east Scotland (see below), and Sel Ayre (Birks and Peglar, 1979) and Fugla Ness (Birks and Ransom, 1969) on Shetland (Whittington, 1994). The organic deposits at Allt Odhar (Walker et al., 1992), Sel Ayre and Camp Fauld (Hall, 1993c) all appear to relate to an Early Devensian interstadial in which an early warm phase is succeeded by significantly colder conditions. Available dating evidence suggests correlation of organic sediments at Allt Odhar, Sel Ayre and Burn of Benholm with the Brørup Interstadial, equivalent to OIS 5c (Table 7). The flora and coleoptera at Crossbrae preclude correlation with the warm stages of OIS 5a or 5c, but may represent the later colder phases. The remarkable similarity between the coleopteran assemblages at Crossbrae and Allt Odhar provides support for a common age. The Crossbrae Farm Peat Bed is tentatively regarded as being of OIS 5c age (Whittington et al., 1998).

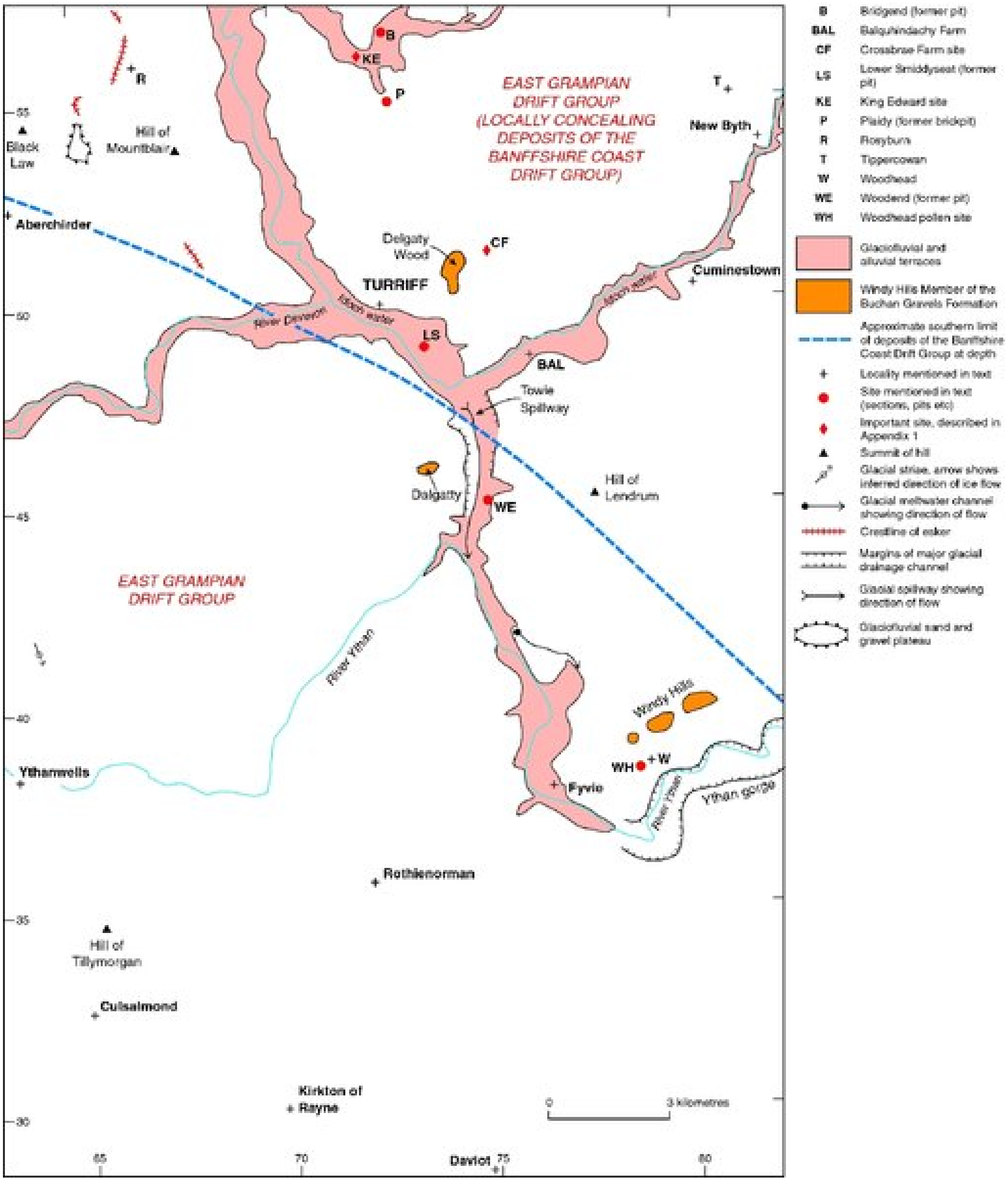
Excavations in 1992 showed that the Crossbrae Farm Peat Bed is directly overlain by coarse gravel up to 1.2 m in thickness. This clast-supported pebble and cobble gravel unit has a strongly erosive base and is dominated by quartzite and quartzose psammite clasts. It is succeeded by crudely stratified, clast-rich diamictons up to 2.5 m thick. The diamictons contain striated pelite clasts and show a strong down-slope clast fabric. They are interpreted as soliflucted tills.

The significance of the Crossbrae Farm site is the presence of a peat deposit that apparently represents an Early Devensian interstadial. The most recently obtained radiocarbon dates indicate that the peat is older than the Middle Devensian and therefore cannot constrain significantly the age of the last glaciation of this part of Buchan. The presence of coarse gravel of possible glaciofluvial origin is important. This gravel unit is most likely to be of Late Devensian age and as such provides no support for the view that part of Buchan escaped glaciation in the Late Devensian. However, it is possible that the gravel is older, as glacial deposits at the Howe of Byth site in Buchan (Hall et al., 1995b) and in the vicinity of Teindland in lower Strathspey (Hall et al., 1995a) have been ascribed to cold stages in Oxygen Isotope Stages 4 and 3.

[References]



(Figure A1.9) Crossbrae Farm site (after Whittington et al., 1998).



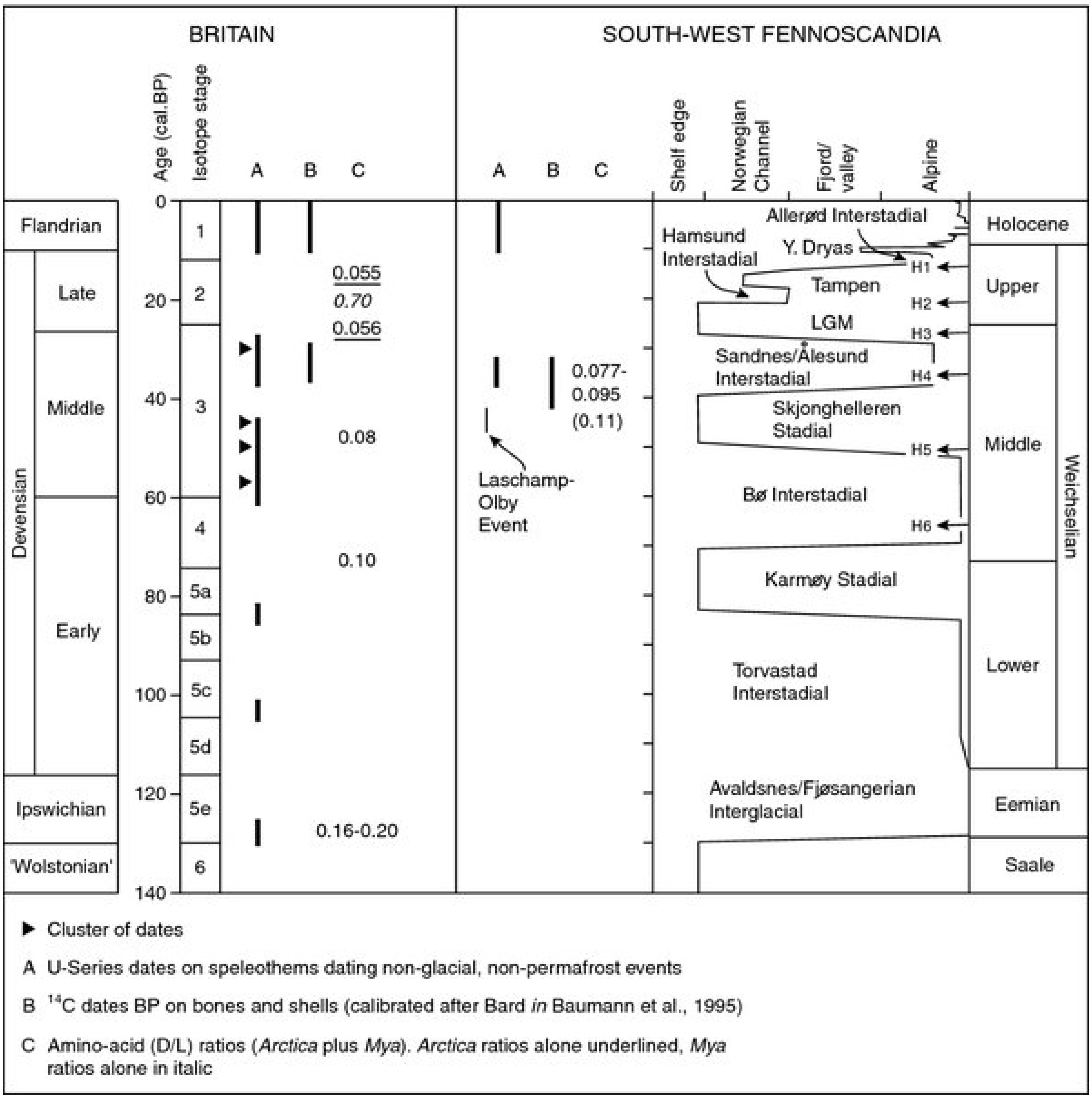
(Map 5) Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 86E Turriff.

Oxygen Isotope Stage	Teindland/Elgin	Boyne Limestone Quarry/Keith	Gardenstown/ Banff	Byth/ Crossbrae	Kirkhill/Leys	Peterhead/ Cruden	Ellon/Fyvie	Aberdeen	Banchory	Stonehaven
Flandrian (Holocene) 1										
Loch Lomond Stadial 2a		Garral Hill Gelifluctate Bed		Todholes Gravel Bed			Woodhead Gelifluctate Bed			
Windermere Interstadial 2b		Garral Hill Peat Bed		Thistlebide Peat Bed			Woodhead	Mill of Dyce Peat Bed	Loch of Park Gyttja Bed	Glenbervie Peat Bed
Dimlington Stadial 2c	Spynie Clay Formation Waterworks Till Formation Tofthead Till Formation	Kirk Burn Silt Formation Airnhosh Till Member Blackhills Sand & Gravel Formation Old Hythe Till Formation	Kirk Burn Silt Formation Airnhosh Till Member Blackhills Sand & Gravel Formation Crovie Till Formation	Crossbrae Gelifluctate Bed Auchmedden Gravel Formation Byth Till Formation	Manse Gelifluctate Bed Kirkhill Church Sand Formation East Leys Till Formation Hythe Till Formation	St Fergus Silt Formation Ugie Clay Formation Essie Till Formation Hatton Till Formation Sandford Bay Till Member	Ugie Clay Formation Kippet Hills Sand & Gravel Hatton Formation Bearnie Till Member Auchinrochnie Sand & Gravel Formation	Tullos Clay Member Drumlithie Sand & Gravel Formation Glen Dye Silts Formation Mill of Forest Till Formation Nigg/Kingswells Till members Ness Sand & Gravel Member Den Burn Till Member	Lochton Sand & Gravel Formation Glen Dye Silts Formation Banchory Till Formation	Drumlithie Sand & Gravel Formation Ury Silts Formation Mill of Forest Till Formation
early Late Devensian glaciation	Altonside Till Formation	Whitehills Glacigenic Formation	Whitehills Glacigenic Formation		Corse Diamicton Formation	Rafts at Oldmill	Pitfurg Till Formation	Anderson Drive Diamicton Formation		
3				Howe of Byth Gravel Formation	Corsend Gelifluctate Bed					
4	Woodside Diamicton Formation		Pitlow Burn Gravel Bed			Aldie Till Formation Hardslacks Gelifluctate Bed				
5a-d	Badentinan Sand Bed			Crossbrae Farm Peat Bed		Bonnyley Peat Bed				Burn of Benholm Peat Bed
Ipswichian Interstadial 5e	Teindland Palaeosol Bed Orbliston Sand Bed	Truncated palaeosol			Fernieslack Palaeosol Bed	Moreseat Farm Sand Bed				
6?	Deanshillock Gravel Formation Red Burn Till Formation	Craig of Boyne Till Formation		Crossbrae Till Formation	Rottenhill Till Formation West Leys Sand & Gravel Formation Camphill Gelifluctate Bed Swinedon Sand Bed	Camp Fauld Till Formation	Pitfurg Till in part? Tillybrex Sand & Gravel Formation Bellscamphie Till Formation			Benholm Clay Formation Birnie Gravel Formation
7?					Kirkhill Palaeosol Bed					
8?					Pitsow Sand & Gravel Formation Kirkton Gelifluctate Bed Denend Gravel Formation Leys Till Formation					
References	Hall et al. (1995)	Sheet 86W Godwin and Willis (1959) Peacock and Merritt (2000a)	Sheet 96E Peacock and Merritt (1997)	Hall et al. (1995) Whittington et al. (1998)	Connell and Hall (1987)	Sheet 87E Connell and Hall (1987) Whittington et al. (1993)	Sheet 87W Connell and Hall (1987) Hall and Jarvis (1993)	Bremner (1931, 1943) McLean (1977) Munro (1986) Murdoch (1977)	Sheet 66E Vasari (1977)	Sheet 67 Auton et al. (2000)

NOTE: In general, minimal ages are shown. For example, Crossbrae Gelifluctate Bed may be OIS 2c to 4, Anderson Drive Diamicton may be OIS 6, Kirkhill Palaeosol Bed may be OIS 9 or 11.
All Peat and Palaeosol beds are assigned to the group of the underlying or enclosing deposit.
Italicised units are informal: they have not been entered into the BGS Lexicon.

Central Grampian Drift Group East Grampian Drift Group Banffshire Coast Drift Group Logie-Buchan Drift Group Mearns Drift Group [box] Dated unit

(Table 7) Correlation of lithostratigraphical units in north-east Scotland.



(Figure 43) Devensian—Weichselian events in Britain and south-west Fennoscandia (after Peacock and Merritt, 1997; Sejrup et al., 2000). Norwegian data from Baumann et al. (1995) and Mangerud et al. (1981). D/L amino-acid ratios corrected according to Miller and Mangerud (1985). British data from Baker et al. (1995), Bowen (1989), Gordon et al. (1989), Lawson and Atkinson (1995) and Miller et al. (1987).