
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 $26\,400 \pm 170$ and $22\,380 \pm 250$ 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 $10^{\circ}\text{C} \pm 1^{\circ}\text{C}$

Mean temperature of the coldest month $-9^{\circ}\text{C} \pm -3^{\circ}\text{C}$

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 anomalously young, probably owing to contamination by younger carbon in groundwater.

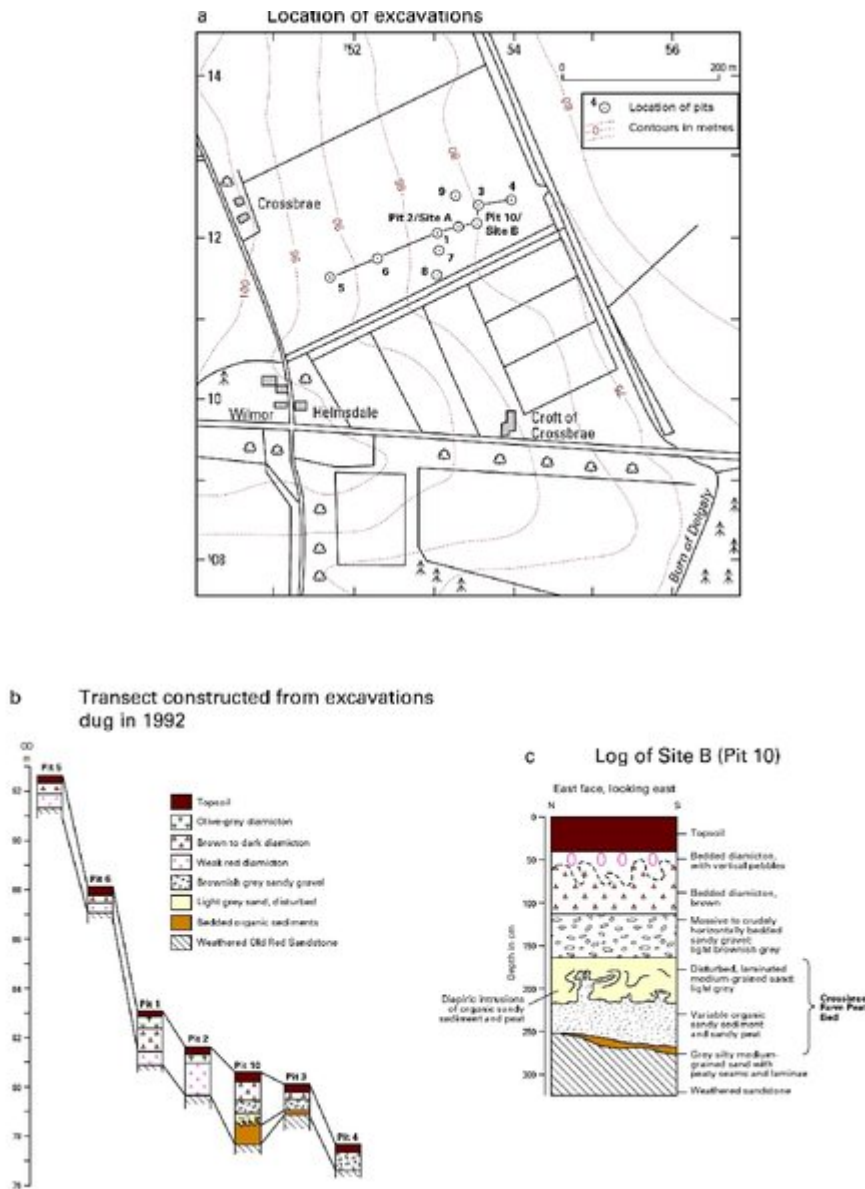
The Crossbrae Farm Peat Bed clearly predates the Late-glacial and the Sourlie Interstadial around 30 ka (possibly equivalent to the Ålesund Interstadial of western Norway, (Figure 43)). Crossbrae is one of only five sites in Scotland from which pollen of the Balkan heath *Bruckenthalia* has been recovered, 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 diamictos up to 2.5 m thick. The diamictos contain striated pelite clasts and show a strong down-slope clast fabric. They are interpreted as soliflucted

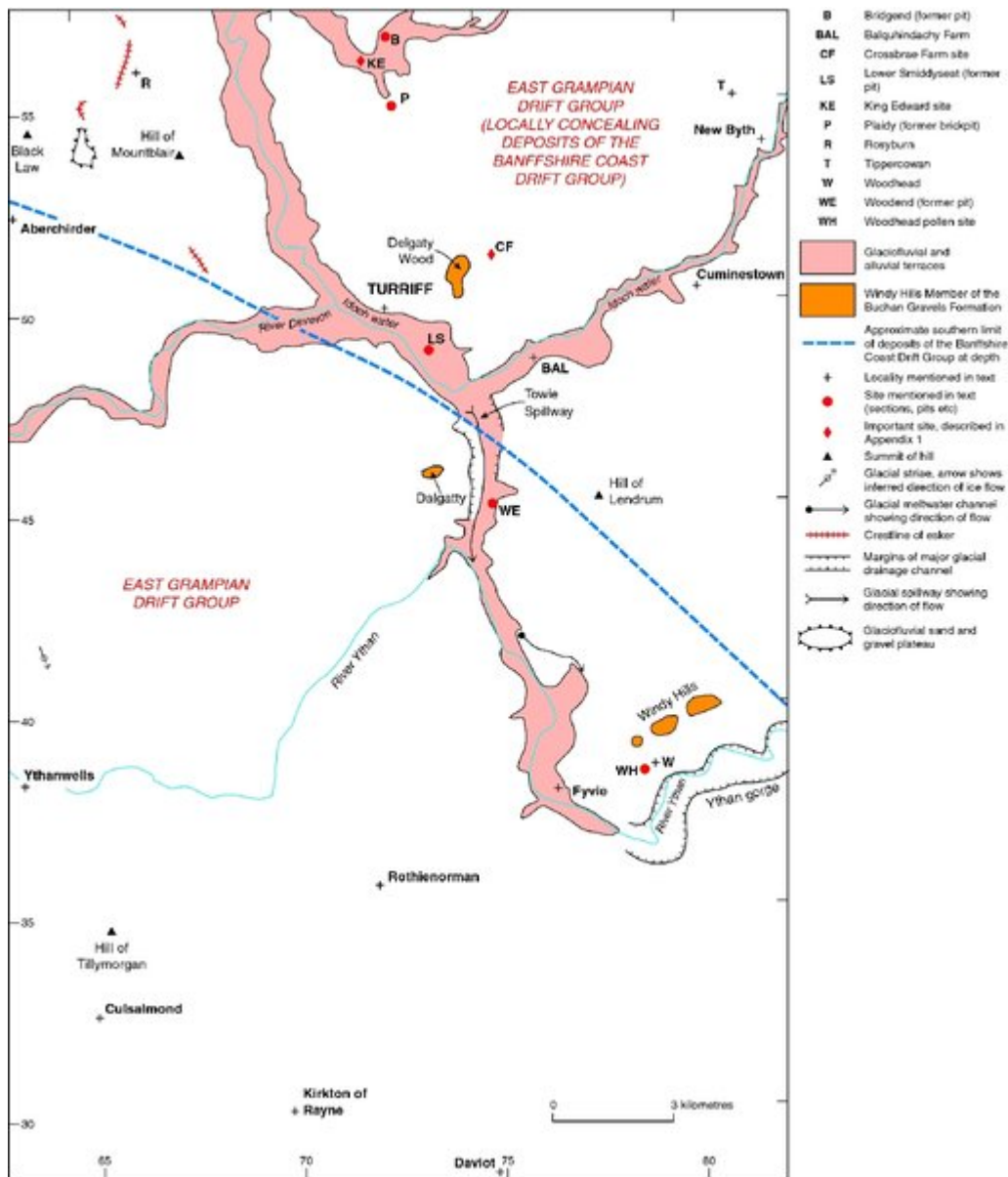
tills.

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).



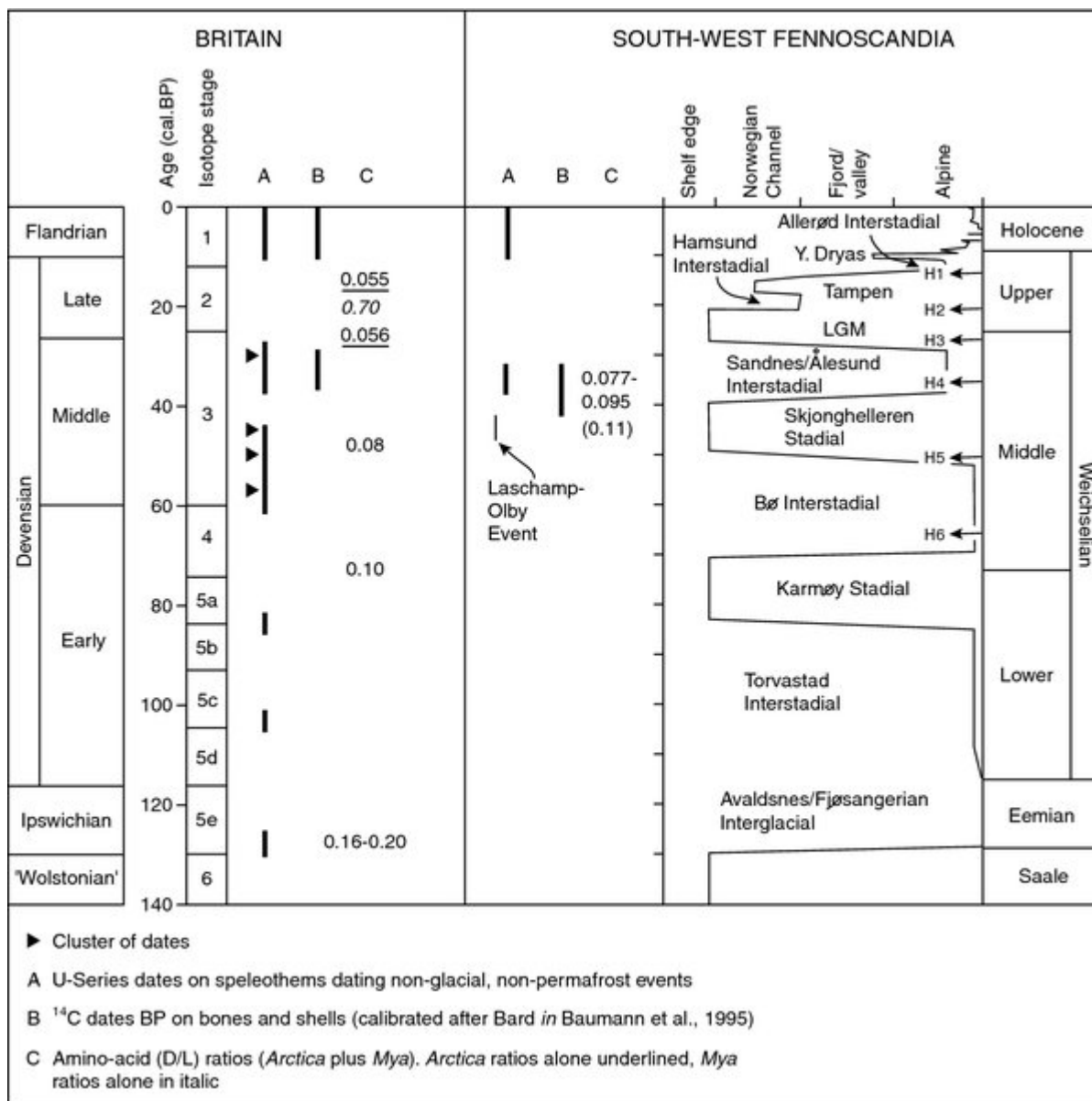
(Map 5) Glacial and glaciofluvial features and the distribution of glacial deposits on Sheet 86E Turriff.

Oxygen Isotope Stage	Teindland/Egin	Boyne Limestone Quarry/Keith	Gardens/Loch/Banff	Byth/Crossbar	Kirkhill/Lays	Peterhead/Gruden	Ellon/Fyvie	Aberdeen	Banchory	Stonehaven
Flandrian Holocene	1									
Lock Lomond Stadial	2a	Garra' Hill Gellifluctate Bed		Tadnash Gravel Bed			Woodhead Gellifluctate Bed			
Windermere Interstadial	2b	Garra' Hill Peat Bed		Thorncliffe Peat Bed			Woodhead	Mill of Dyce Peat Bed	Loch of Park dyke Peat Bed	Glenbevie Peat Bed
Urrington Stadial	2c	Boyne Clay Formation	Kirk Burn Silts Formation	Kirk Burn Silts Formation		St Fergus Silts Formation				
		Palaeosol Till Formation	Amhuach Till Member	Amhuach Till Member	Chowdrase Gellifluctate Bed	Marree Gellifluctate Bed	Ugie Clay Formation	Oranmore Sand & Gravel Formation	Lochline Sand & Gravel Formation	Craxie Sand & Gravel Formation
		Blackhills Sand & Gravel Formation	Blackhills Sand & Gravel Formation	Auchmedden Gravel Formation	Kirkhill Church Sand Formation	Essie Till Formation	Kippel Wills Sand & Gravel	Glen Dye Silts Formation	Glen Dye Silts Formation	Lay Silts Formation
		Tadnash Till Formation	Old Hybla Till Formation	Crook Till Formation	Byth Till Formation	East Lays Till Formation	Hutton Till Formation	Mill of Forest Till Formation	Banchory Till Formation	Mill of Forest Till Formation
					Hybla Till Formation	Sandford Bay Till Member	Beaulieu Till Member	High Kingowrie Till member		
							Auchnuchra Sand & Gravel Formation	Arree Sand & Gravel Member		
							Don Burn Till Member			
early Late Devensian glaciation		Aberdeen Till Formation	Whitcliffe Slaggyrills Formation	Whitcliffe Slaggyrills Formation		Corrie Darnick Formation	Refts at Oldmill	Pitburg Till Formation	Anderson Drive Darnick Formation	
	3			House of Wym Gravel Formation	Corriedale Gellifluctate Bed					
	4		Prothiers Burn Gravel Bed			Alde Till Formation	Handulacks Gellifluctate Bed			
	5a	Baldernish Sand Bed		Chowdrase Farm Peat Bed		Barmley Peat Bed				Burn of Benbow Peat Bed
peak/late Interstadial	5a	Teindland Palaeosol Bed	Truncated palaeosol		Fernieback Palaeosol Bed		Marwood Farm Sand Bed			
		Orbiston Sand Bed								
	6	DamenWood Gravel Formation		Chowdrase Till Formation	Richterhill Till Formation	Comp. Fault Till Formation		Pitburg Till in part?		Benbols Clay Formation
		Red Burn Till Formation	Crags of Boyne Till Formation		West Lays Sand & Gravel Formation		Tillymore Sand & Gravel Formation			Glen Green Formation
					Campbell Gellifluctate Bed		Beausayville Till Formation			
					Benbols Sand Bed					
	7				Kirkhill Palaeosol Bed					
	8				Phosene Sand & Gravel Formation					
					Kirkhill Gellifluctate Bed					
					Devenand Gravel Formation					
					Lays Till Formation					
References	Hall et al. (1995)	Sheet 609 Gordon and Wills (1955) Peacock and Merritt (2003)	Sheet 602 Peacock and Merritt (1997)	Hall et al. (1995) Whittington et al. (1995)	Cornell and Hall (1987)	Sheet 672 Cornell and Hall (1987) Whittington et al. (1995)	Sheet 679 Cornell and Hall (1987) Hall and Jarvis (1993)	Borman (1931, 1943) McLure (1977) Muir (1985) Munkh (1977)	Sheet 662 Vass (1977)	Sheet 67 Auld et al. (2003)

NOTE: In general, minimal ages are shown. For example, Chowdrase Gellifluctate Bed may be OIS 2c to 4, Anderson Drive Darnick may be OIS 6, Kirkhill Palaeosol Bed may be OIS 8 or 11. All Peat and Palaeosol beds are assigned to the group of the underlying or enclosing deposit. Bolded 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 Means Drift Group 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).