Site 4 King Edward

King Edward [NJ 722 561], midway between Turriff and Banff (Map 5), is a long recognised locality for the presence there of a Quaternary marine shell bed containing whole arctic marine shells beneath dark grey shelly till (Jamieson, 1866; Sutherland, 1984c). Opinion has been divided over the origin of the shell bed. The state of preservation of the shells and the extent of the shell bed led to the view that this was an in situ marine deposit (Jamieson, 1866; Sutherland, 1981). Alternatively, the intimate association of the shell bed with shelly till led others to consider it to be a glacial raft or rafts (Read, 1923; Peacock and Merritt, 1997).

Jamieson gave details of a section beside the Burn of King Edward about 100 m south-west of the old bridge over the Banff–Turriff road in a series of papers spanning almost 50 years (Jamieson, 1858, 1865, 1866, 1906). Today the section is obscured and forested. The upper part comprised up to 8 m of coarse glaciofluvial gravel penetrated by ice-wedge casts. It cropped out along the sides of the burn and its tributaries below high terraces (Read, 1923; Sutherland, 1984c). Below the gravel lay up to 9 m of dark grey pebbly mud, with striated shells towards its base. This diamicton, here named the Castleton Memberof the Whitehills Glacigenic Formation (Castleton Formation of Sutherland, 1999), is typical of the shelly till found widely in the King Edward area (Read, 1923). The base of the section revealed a thin (60 cm thick) layer of brown shelly sand interstratified with more than 3 m of stoneless dark grey silt. The silt contained arctic shells in a crushed and decayed state, but apparently in situ. Jamieson regarded the lowermost shelly silt as representing a marine submergence under arctic conditions that occurred prior to glaciation of the area.

Recent excavation of a river bank 200 m south-east of the original locality [NJ 7236 5604] has confirmed the general succession of terrace gravel resting on dark grey muddy diamicton. The latter rested on over 6 m of intercalated brown sand, grey silt and mud, and dark grey muddy diamicton. Shell fragments occur in varying concentrations and states of preservation throughout these layers. Whole shells, including specimens of *Lunatia pallida* and valves of *Arctica islandica* and *Macoma balthica* were recovered from a sand layer at a depth of 12 m (Table A1.4). The base of the mud sequence was not seen, but a pit beneath the adjacent floodplain of the Burn at [NJ 7234 5602] showed that it rests on coarse glaciofluvial gravel and on bedrock. Although not conclusive evidence, the presence of disturbed contorted and steeply dipping beds is strongly suggestive of glacial disturbance, possibly rafting.

Jamieson (1865) noted that the faunas from King Edward and Gardenstown (see below) are similar. He tabulated the then known modern distributions in terms of those living:

1. on the British coast
2. south of Britain
3. within the Arctic Circle
4. on the east coast of North America
5. in the north Pacific.

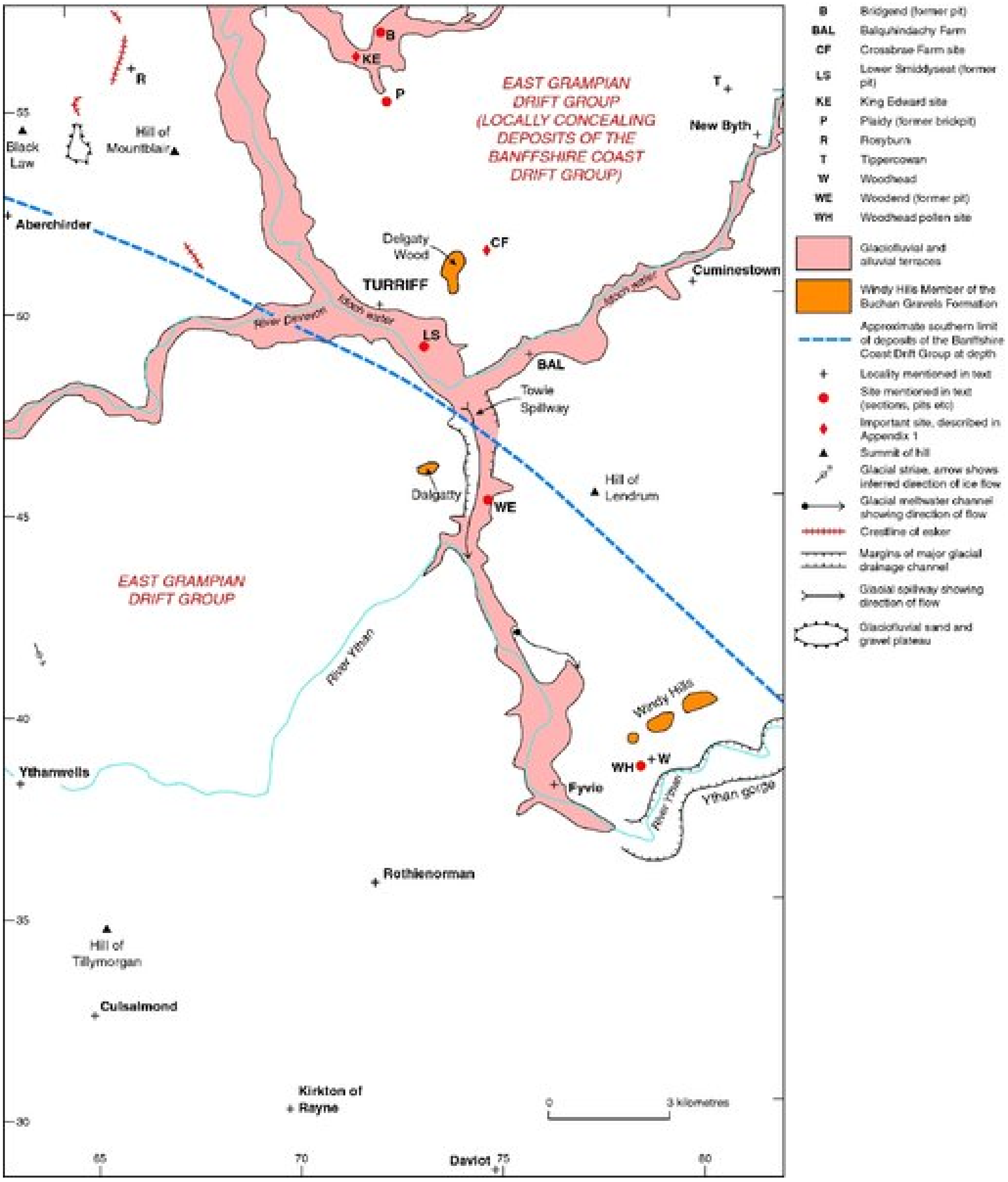
Item (3) unfortunately gives a misleading 'cold' impression because 'within the Arctic Circle' includes the coast of Norway with its boreal fauna (Zenkevitch, 1963). Of the shells in Jamieson's list, only two (*Tachyrhynchus reticulata* and *Serripes greenlandicus*) can be classed as truly arctic to subarctic. Another (*Yoldia limatula*) is an American species that may be confused with the arctic to subarctic *Y. hyperborea* (Ockelmann, 1954). Excepting these arctic species, a deep-water taxon (*Yoldiella lucida*) and two boreal taxa (*Polinices nanus* and *Turritella communis*), all the molluscs listed in (Table A1.4) have been recorded in the Late-glacial (Windermere) Interstadial (13 000–11 000 BP) Clyde Beds of western Scotland (Smith et al., 1904). The fauna may thus be taken as generally of non-arctic, interstadial, offshore aspect.

It seems likely that the shell-bearing sands and muds at King Edward are glacially transported rafts within a sequence of glacial deposits derived largely from the bed of the Moray Firth (see Chapter 8; Whitehills Glacigenic Formation). King Edward lies only 1 km north-west of Plaidy (Map 5) where a large erratic of Oxfordian mudstone was worked in the 19th century (Jamieson, 1859). Other shell-bearing marine deposits previously thought to be in situ (Sutherland, 1981) have since been shown to be erratic masses, for example at Clava (Merritt, 1992b), Gardenstown (Peacock and Merritt, 1997) and the Boyne Limestone Quarry (Peacock and Merritt, 2000a).

At King Edward, amino-acid ratios between 0.073 and 0.095 (mean value 0.078 + 0.010) have been obtained from five *Arctica* shells collected from till at a site 200 m north-east of Jamieson's section. Uncalibrated AMS radiocarbon ages of greater than 44 200 BP (AA–1323) and greater than 41 500 BP (AA–1324) are reported on two of the analysed shells (Miller et al., 1987). On this basis the shells in the Castleton Member of the Whitehills Glacigenic Formation have been assigned to the interval between 40 and 80 ka BP (Miller et al., 1987). This age is consistent with the faunal evidence at King Edward of interstadial conditions. It appears on current evidence that these marine muds and sands were originally deposited on the floor of the Inner Moray Firth during OIS 4 or 3.

The timing of the glacial phase or phases that emplaced the rafts of marine sediment is uncertain. While some tills and rafts derived from the Moray Firth are thought to have been deposited during the Late Devensian (Merritt, 1992b), the possibility remains that some were transported during a Middle Devensian glacial phase equivalent to the Norwegian Skjonghelleren glaciation (Figure 43). The dark grey shelly tills of the Whitehills Glacigenic Formation around King Edward are covered in places, or merge upwards into, red-brown sandy till (Read, 1923). The latter is probably laterally equivalent to the Crovie Till Formation at Gardenstown and the Old Hythe Till Formation at the Boyne Limestone Quarry, but the exact age of all these units is unclear (Table 7).

References



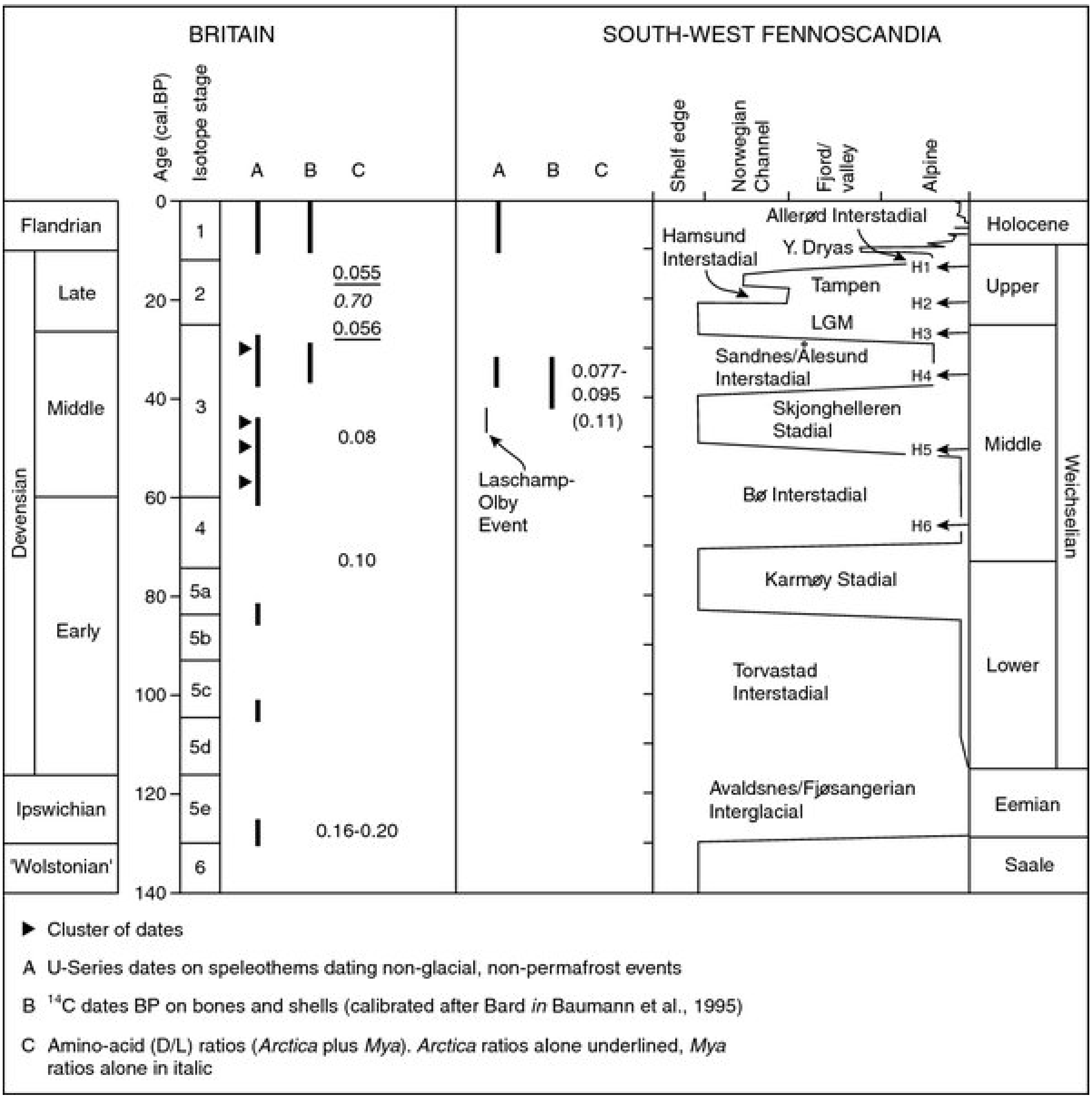
(Map 5) Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 86E Turriff.

Modern Name*	Jamieson (1865)	Gardenstown/Gamrie	King Edward
Antalis entalis	*Dentalium entalis*	x	x
Amauropsis islandica	*Natica islandica*	x	x
Aporrhais pes-pelicani	*Aporrhais pes-pelicani*		x
Boreotrophon clathratus	*Trophon clathratus*	x	x
B. clathratus var. gunneri	*T. clathratus var. gunneri*	x	x
B. truncatus	*Trophon truncatus*	x	x
Buccinum undatum	*Buccinum undatum*	x	
Colus gracilis }	*Fusus propinquus*	x	x
C. howsei }			
Epitonium greenlandicum	*Scalaria groenlandica*		x
Lacuna vincta	*Lacuna divaricata*	x	x
Oenopota pyramidalis	*Mangelia pyramidalis*	x	x
O. turricula	*Mangelia turricula*	x	x
Polinices nanus	*Natica marochiensis*		x
P. pallida	*Natica pallida*	x	x
Tectonatica clausa	*Natica affinis*	x	x
Tachyrhyncus reticulata	*Mesalia reticulata*		x
Turritella communis	*Turritella ungulina*		x
Tectura virginea	*Tectura virginea*	x	
Acanthocardia echinata	*Cardium echinata*	x	x
Anomia ephippium	*Anomia ephippium*	x	
Arctica islandica	*Cyprina islandica*	x	x
Macoma balthica	*Tellina balthica*	x	x
M. calcarea	*T. proxima*	x	x
Mya truncata	*Mya truncata*		x
Mytilus edulis	*Mytilus edulis*	x	
Serripes groenlandicus	*Cardium groenlandicum*	x	x
Spisula elliptica	*Mactra solida* var. *elliptica*	x	
Tridonta borealis	*Astarte borealis*	x	x
T. montagui	*Astarte compressa*	x	
Yoldia limatula	*Leda limatula*		x
Yoldiella lucida	*Leda lucida*		x
Zirphaea crispata	*Pholas crispata*	x	x

* For authors of species see Lubinsky (1980); Macpherson (1971) and Smith and Heppell (1991)

† The bivalve *Timoclea ovata* has been reported from Gardenstown/Gamrie (Peacock *in* Sutherland 1993b).

(Table A1.4) Mollusca from shelly deposits of the Whitehills Glacigenic Formation.



(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).

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*		*Thinholds 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 *Arnbath Till Member* Blackhills Sand & Gravel Formation Old Hythe Till Formation	Kirk Burn Silt Formation *Arnbath 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* *Auchleuchries 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*	*Pitlurg Till Formation*	Anderson Drive *Diamicton Formation*		
3				*Howe of Byth Gravel Formation*	*Corsend Gelifluctate Bed*					
4	*Woodside Diamicton Formation*		Pitchlies Burn Gravel Bed			*Aldie Till Formation* *Hardslacks Gelifluctate Bed*				
5a-c	*Badentinan Sand Bed*			*Crossbrae Farm Peat Bed*		*Bonnyley Peat Bed*				Burn of Benholm Peat Bed
Ipswichian Interglacial 5e	*Teindland Palaeosol Bed* *Orbliston Sand Bed*	*Truncated palaeosol*			*Fernieslack Palaeosol Bed*	Moreseat Farm Sand Bed				
6?	*Deanshillock Gravel Formation* *Red Burn Till Formation*	Crag of Boyne Till Formation		*Crossbrae Till Formation*	*Rottenhill Till Formation* *West Leys Sand & Gravel Formation* *Camphill Gelifluctate Bed* *Selmodon Sand Bed*	*Camp Fauld Till Formation*	*Pitlurg Till in part?* *Tillybrex Sand & Gravel Formation* *Bellscamphie Till Formation*			Benholm Clay Formation Birnie Gravel Formation
7?					*Kirkhill Palaeosol Bed*					
8?					*Pitscow Sand & Gravel Formation* *Kirkton Gelifluctate Bed* *Denend Gravel Formation* *Leys Till Formation*					
References	Hall et al. (1995)	Sheet 86W Godwin and Willis (1958) 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.