Alluvial and aeolian deposits, Quaternary, Cainozoic of north-east Scotland

The alluvial deposits in the district are of five types: fluvial deposits underlying the floodplains and low-lying terraces of rivers, sediments within enclosed basins, lacustrine alluvium, alluvial fans, and river terrace deposits.

Alluvium of floodplains and low-lying river terraces
Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 86E Turriff. P915375.

Ribbons of alluvium flank the courses of the major rivers in the district, forming low-lying ground potentially liable to flooding. River bank sections commonly reveal clast-supported gravel (shingle) capped by ‘overbank deposits’ consisting of one or two metres of laminated, humic, micaceous, silty sand (loam), locally intercalated with peat. In general, the clasts forming the gravel are subangular to well rounded, reasonably well sorted and exhibit a pronounced imbrication dipping upstream. Only the faster flowing rivers in the district, such as the Spey, Dee, Don and Deveron, have extensive gravelly beds. The River Spey is particularly fast flowing and is braided downstream of Fochabers, where large linear bars of cobble shingle form where river channels bifurcate. Abandoned braid-bars forming the floodplain are generally afforested or covered by rough, boulder-strewn scrubland (Lewin and Weir, 1977). Most other rivers are single thread and have cultivated floodplains. Meander belts are common only along stretches of the Lossie, Ugie, Urie, Don and Feugh (Nether Daugh).
Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 76E Inverurie. P915378.

Thicknesses of alluvium are difficult to generalise as they are very variable, both within, and between catchments. Downstream of Fochabers, the coarse, gravelly alluvium of the Spey is on average about 6 m thick, locally ranging up to 12 m or more. Near Banff, the floodplain of the Deveron is underlain by 2 to 3 m of silt overlying 7 to 15 m of alluvial deposits including sand and gravel. The floodplain of the Ythan is underlain by 4 to 6 m of gravel downstream of Methlick, whereas thicknesses of between 7 and 10 m of alluvial gravel are common in the Dee valley. Alluvial gravels of the Don typically range between 3 and 5 m in thickness downstream of Inverurie, whereas those in the catchment of the Ugie typically range between 1 and 5 m. In the lower reaches of the Ugie, Ythan, Urie and Don, the alluvial gravels commonly overlie thick sequences of fine-grained glaciolacustrine deposits. They commonly infill buried valleys.

In most valleys, alluvial gravels would have accumulated either in cold climates following deglaciation and during the Loch Lomond Stadial, or, at the beginning of the Windermere Interstadial and Holocene, when little vegetation was present to stabilise soils in the river catchments. Apart from the Spey and Dee, there can be few stretches of river in the district where gravels are currently accreting as opposed to being reworked from older deposits a short distance upstream. The floodplains of larger rivers are generally bounded by bluffs, which in the lower Spey valley are typically steep banks up to 10 m high. In minor valleys, however, and in valleys occupied by 'misfit' streams like that of the Idoch Water, south-east of Turriff (P915375), and the Gadie Burn near Insch (P915378), the former floodplains are commonly poorly defined because the bluffs have been degraded by periglacial processes since their formation. In these circumstances, clayey solifluction deposits (head) commonly locally overlie alluvial sediments along the edge of the floodplains. In many small valleys, especially in central Buchan, there are no floodplains as such and little, if any, alluvium has been mapped. The floors of these valleys are underlain by up to 3 m or so of head deposits consisting of interbedded clayey sand and gravel and gravelly diamicton, locally overlying older river gravels.
Alluvium of basins

Alluvium has been mapped in numerous small, poorly drained, enclosed, or semi-enclosed basins across the district. Some of the basins are kettleholes, but the majority have been gouged out of rock or have been sub-glacially sculpted in till. Basins are particularly common on Sheets 76E Inverurie and Sheet 77 Aberdeen, where they are typically lined by up to 3 m or so of thinly bedded, silty, medium- to coarse-grained, micaceous, quartzofeldspathic sand. Most depressions, however, are underlain by a few metres of head deposits like those described in the minor valleys of the district above. Peat formerly occupied most of these depressions before being cut by man and drained artificially.

Lacustrine alluvium

Flat-lying spreads of interbedded humic sand, silt and clay lie within some poorly drained, enclosed basins that contained lochans before being drained artificially. In many instances it is difficult, however, to distinguish between lacustrine alluvium and the alluvium of enclosed basins described above, and the choice of category used varies somewhat from sheet to sheet. This is partly because many of the drainage schemes in the district were carried out following the Crimean War, in the 1860s, and it is no longer clear where the lochans once stood. Other spreads of lacustrine alluvium border existing bodies of fresh water, as, for example, around the Loch of Skene (P915378). In general mapped spreads of lacustrine alluvium are finer grained than the alluvial deposits filling small basins.

Much of the lacustrine alluvium began to accumulate during Late-glacial times, as for example, that in the Loch of Park, on Sheet 66E Banchory. Organic sediments at this site (Loch of Park) preserve records of vegetational change that has occurred in the district since deglaciation.

Alluvial fan deposits

Fans composed of sand, gravel and gravelly diamicton have accumulated since deglaciation, where tributary streams with relatively steep gradients debouch into more major river valleys. Small, but notable examples occur on Sheet 67 Stonehaven north of Mill of Barras (NO 850 794) and near Greenden (NO 811 776).

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

Dissected remnants of former floodplains flank the alluvium of many of the larger rivers in the district. These form terraces that slope gently down-valley and are typically composed of several metres of stratified clast-supported gravel or sandy gravel. Terrace aggradation probably occurred mainly during Late-glacial and early Flandrian times when the gravel would have been deposited mainly as bars and channel infills by braided streams. The gravel is commonly overlain by spreads of sand and silt up to about 2 m thick, laid down as overbank deposits during the waning stages of periodic flood events. These fine-grained deposits are widespread on the broad terraces of the major rivers where they produce well-drained, light sandy soils.

Most river terraces in the district are judged to have formed during ice-sheet deglaciation and consequently have been mapped as glaciofluvial sheet deposits. These terraces are kettled locally and commonly merge into spreads of moundy ice-contact glaciofluvial deposits. Others clearly formed as kame terraces banked up against ice stranded within valleys.

Particularly good examples of low-lying river terraces flank the floodplain of the Water of Feugh, upstream of Strachan (P915380). They generally rise no more than 3 m above the level of the floodplain and are composed entirely of interbedded sand and pebble gravel, capped by thin spreads of silt and clay. As many as three distinct terraces can be recognised, none standing greater than 1.5 m above the level of its neighbour and they preserve evidence of shallow palaeo-channels on their surfaces. These true river terraces lie adjacent to kettled glaciofluvial terraces, kames and esker ridges that may, in places, stand up to 25 m above the level of the floodplain.

**Blown sand**
Glacial and glaciofluvial features and the distribution of tills in the Elgin district.
P915371.

Deposits of wind-blown sand occur in many coastal localities. They are most commonly found next to sandy beaches, from where most of the sand has blown, but sandy glaciofluvial deposits have been a source locally. Blown sand is generally well sorted and fine to medium grained. Its composition depends somewhat on the provenance of the sediment source occurring locally, but is generally quartzose with varying proportions of finely divided shell. Areas mapped as blown sand generally include stabilised dunes, links and cultivated aprons as well as active dunes. Long stabilised deposits have been mapped locally as ‘older blown sand’. A detailed, systematic account of the coastal dune systems of north-east Scotland has been provided by Ritchie et al. (1978).

On Sheet 95 Elgin (P915371), the largest spreads of blown sand face Burghead Bay where dune ridges tend to be orientated south-west–north-east, parallel with the prevailing wind, and reach up to about 15 m high. Within historical times, the migration of sand along the north and west sides of the Loch of Spynie materially affected local drainage conditions and accounted for the disappearance of several lochs in the area (Peacock et al., 1968). Most of the blown sand on the sheet is probably redistributed beach sand, carried westwards by longshore drift and swept north-eastwards by the prevailing winds, but glacial sands must also have provided a significant source.
Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 96W Portsoy. P915372.

Few deposits of blown sand have been mapped on Sheet 96W Portsoy and Sheet 96E Banff, although some of the sandy glaciofluvial deposits occurring along the coast probably have been considerably redistributed by wind in the past when arctic, arid conditions prevailed. Blown sand caps the cliffs at Whyntie Head (NJ 628 661) (P915372), where the action of blowing sand has beautifully etched rocks in the vicinity (Read, 1923). Modern dunes fringe the bays of Cullen, Sandend and Boyndie, where they rest on deposits forming Flandrian raised beaches.

Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 97 Fraserburgh. P915374.
Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 87E Peterhead. P915377.

A continuous, generally 250 to 600 m-wide belt of blown sand backs the coastline for a distance of about 25 km between Fraserburgh and Peterhead on Sheet 97 Fraserburgh (P915374) and Sheet 87E Peterhead (P915377), where dunes reach 30 m in height locally (Peacock, 1983). The sand is generally quite shelly and was formerly used as a source of lime at St Fergus. The dunes are particularly active between Inzie Head and Rattray Head, where the combination of blowing sand and southward longshore drift finally blocked off a tidal inlet to create the Loch of Strathbeg in 1720 (Wilson, 1886). Less extensive deposits face the bays at Rosehearty and Phingask (east of Sandhaven) on the northern coast (Wilson, 1882), and the bays of Peterhead and Sandford on the east coast. The blown sand fringing the Bay of Cruden is relatively more siliceous and locally contains grains of magnetite.
An extensive area of sand dunes lies between Collieston and the Ythan estuary on the boundary of Sheet 87E Peter-head and Sheet 77 Aberdeen. It is mostly designated as the Sands of Forvie Nature Reserve and in contrast to the other deposits described above, the sands there have spread over 2 km inland and reach up to 57 m above OD. Dunes are commonly 12 m or more in height and are particularly active towards the coast and across the peninsula at the southern end of the reserve. The dunes continue to the south of the Ythan estuary, where they form a belt up to 500 m wide that extends 14 km to the estuary of the River Don (P915379). The dunes reach 15 m in height and back a sandy beach. They are relatively active with blowouts mostly trending from north-west to south-east. Northward expanding deflation plains are common, where a veneer of sand conceals raised Flandrian beach deposits. Sand is banked up against, and largely obscures, the Main Postglacial Cliffline backing those deposits. It also extends inland to about 1 km from the coast, where it mantles till and glaciofluvial deposits; ‘fossil’ sand dunes occur in the vicinity of the coastal look-out at Menie Links (NJ 986 210).

The rugged coastline to the south of Aberdeen is largely devoid of mappable deposits of blown sand. This is mainly due to the high cliff line, but also because the beaches are mainly formed of shingle.

References

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