Periglacial deposits, Quaternary, 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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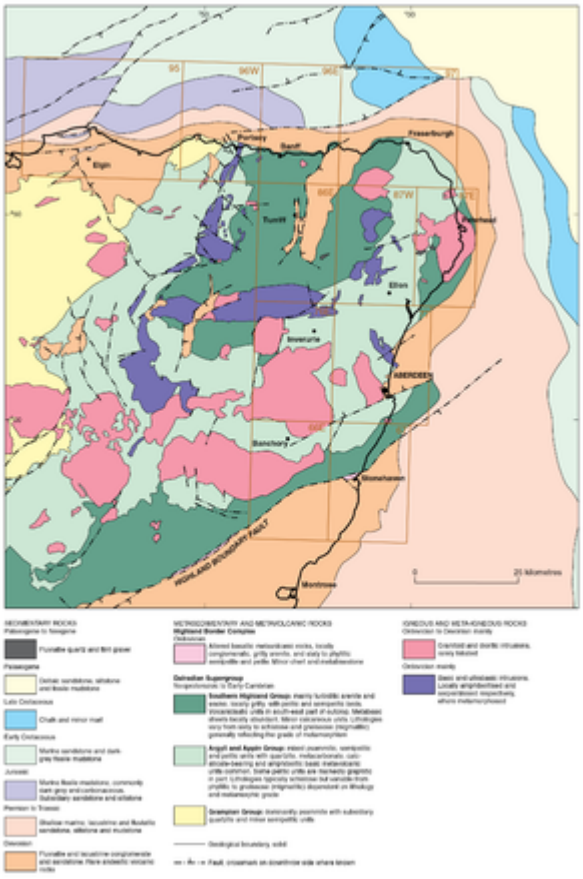
Rubbly clast-supported diamicton formed mainly of angular fragments of local frost-shattered metagreywacke. P104111.

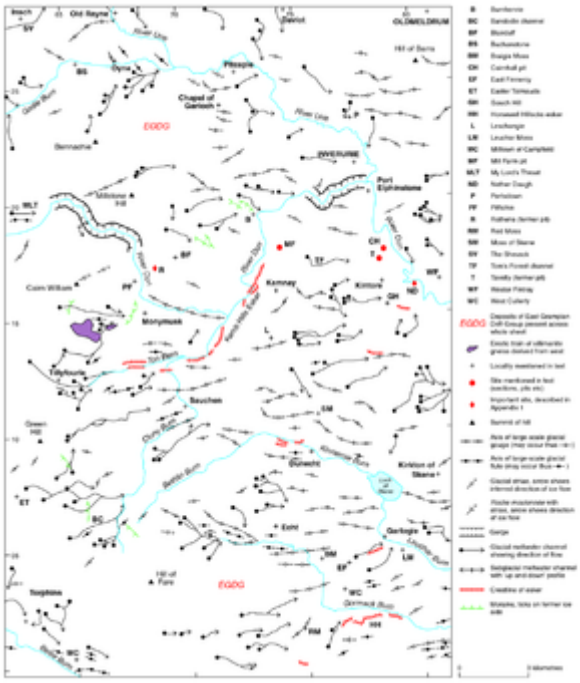
Gravelly head deposit with periglacial

festoon structures overlying, and locally penetrating into, cryoturbated grussified granite. P104112.

Head deposits are poorly sorted and poorly stratified sediments that have formed mainly as a result of the slow, viscous, downslope flow of waterlogged soils (solifluction and gelifluction), soil creep and hillwash. Solifluction was most active while periglacial conditions existed in the district during the latter part of the Main Late Devensian glaciation and the Loch Lomond Stadial (Galloway, 1958). It occurred during the summer months when the uppermost 0.5 to 1 m of the soil, the so-called 'active layer', thawed, while the ground below remained permanently frozen. The thickness and potential mobility of active layers depend very much upon the cohesiveness of the sediments affected, hence the thickest head deposits tend to occur where thoroughly decomposed rocks, clayey tills and fine-grained glaciolacustrine deposits have been remobilised.

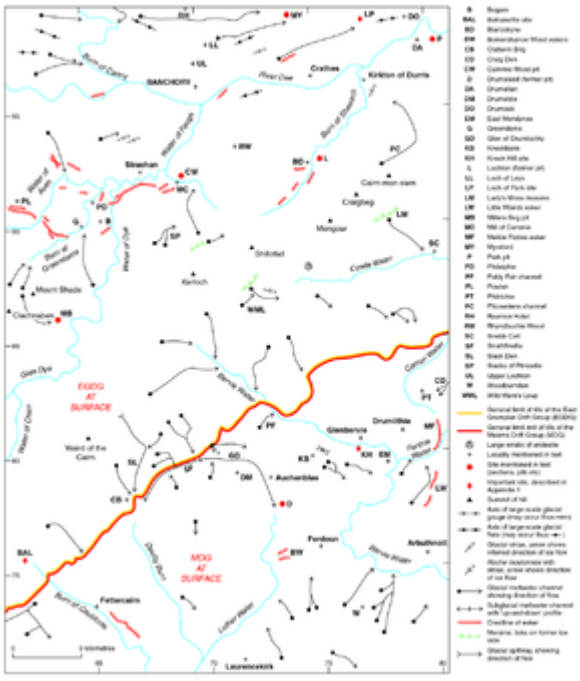


Solid geology of the district. P915249.



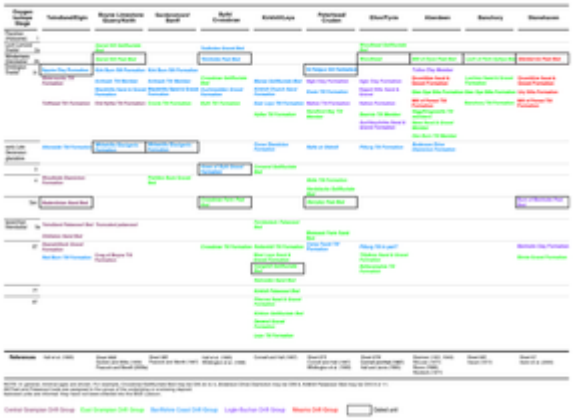
Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 76E Inverurie. P915378.

Head deposits are ubiquitous across the district (P104111; P104112), but generally it has not been practical to map them out. They are especially well developed across the Buchan plateau where decomposed rock materials have been affected by periglacial processes (Galloway, 1958; FitzPatrick, 1956, 1963, 1969, 1987). They commonly occur in the bottoms of glacial meltwater channels and valleys, locally concealing beds of gravel that were laid down during the formation of those features. Head deposits redeposited from weathered granite bedrock typically consist of clayey coarse-grained sand, as, for example, around the Hill of Fare (Sheet 76E). Quartzites tend to produce rubbly deposits, as for example on Mormond Hill (Sheet 97), where angular fragments of quartzite are locally associated with sparse boulders of granite carried from the Strichen pluton to the west.



Glacial and glaciofluvial features and the

distribution of glacigenic deposits on Sheet 66E Banchory. P915380.



Correlation of lithostratigraphical units in north-east Scotland. P915347.

The outcrop of basic igneous rocks of the Insch intrusion on sheets 76E and 86E (P915249) is largely blanketed by head deposits composed of angular gravel derived from the underlying bedrock. Head has been mapped around the village of Old Rayne where it reaches several metres in thickness. A good exposure occurs on the southern side of a glacial drainage channel drained by The Shevock (NJ 664 286) (P915378), where over 2 m of silty clast-supported angular gravel composed entirely of medium- and fine-grained basic rocks blankets fresh bedrock. Sandier gravel is seen to depths of over 1.5 m in several exposures in the village itself, and similar material mantles the norite bedrock near Oyne. Flatter spreads of clayey head, formed of remobilised till, have accumulated around the floodplains of The Shevock, near Insch, and the Gadie Burn around Buchanstone (NJ 656 261); comparable head deposits flank lacustrine alluvium west of Myrebird (NO 742 990) on Sheet 66E (P915380).

Head has been mapped relatively extensively on Sheet 96E Banff, where it applies to thick, weakly coherent masses of weathered bedrock or drift deposit prone to movement on waterlogged slopes, most commonly along steep cliff lines and along glacial melt-water channels.

Old, pre-Late Devensian head deposits have been located at several sites in the district where they provide an important part of the Pleistocene record (P915347). At least five periglacial episodes are represented at Kirkhill and Leys; other old gelifluctates and cryoturbates occur at Teindland, Crossbrae and the Moss of Cruden.

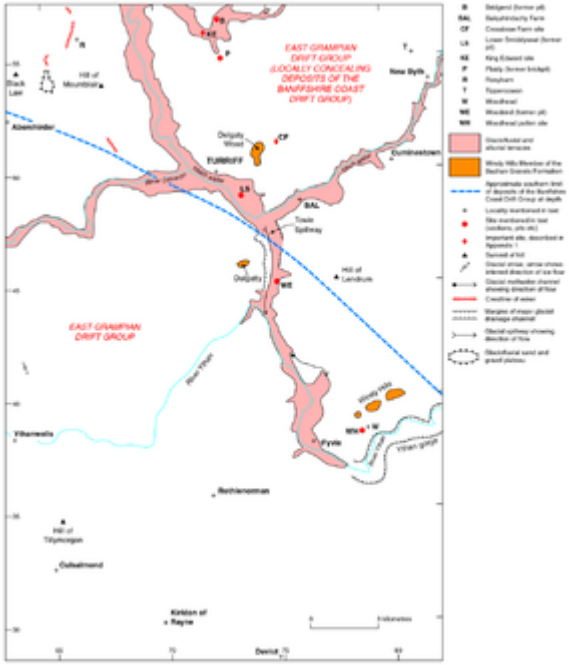
Remobilised deposits of till

The remobilisation and solifluction of glacial diamictons following their deposition has been widespread in the lowlands of north-east Scotland (Galloway, 1958). However, it is only apparent at a few sites where solifluction deposits rest on organic sediments dated to the Windermere Interstadial. These sites include the Rothes road cutting (Landslips) and Garral Hill, near Keith (Godwin and Willis, 1959), both to the south of the district. Others occur at Woodhead on Sheet 86E (Connell and Hall, 1987), Moss-side Farm, near Tarves on Sheet 87W (Clapperton and Sugden, 1977), sites near New Byth and at Glenbervie. These sites demonstrate the former instability of low-angle till slopes during the Loch Lomond Stadial and the widespread occurrence of slope-foot accumulations of periglacial diamicton. The frequency of former detachment slides involving former ‘active layers’ in the region is unclear, but their identification is important because slopes such as these are liable to be rendered unstable by engineering works.

Frost-shattered rock

Frost-shattered rock is widespread across the district and is particularly well developed on quartzitic rocks such as around Durn Hill (Sheet 96W) and Mormond Hill (Sheet 97). It reaches some 8 m in thickness on Sillyearn Hill (NJ 507 514), near Keith, to the south of the district (Galloway, 1958). Phyllites cropping out around the headwaters of the River Ythan (Sheet 86E) and the Glens of Foudland (NJ 605 348), farther west, also are shattered to depths of up to 5 m locally (Galloway, 1958). Some frost shattering occurred prior to the Main Late Devensian glaciation as shattered rock underlies till locally, such as at Newbigging (NJ 527 591), on Sheet 96W (Galloway, 1958).

Flint-quartzite head



Glacial and glaciofluvial features and the distribution of glacigenic deposits on Sheet 86E Turriff. P915375.

Cryoturbated till with vertically aligned pebbles capping the Windy Hills Gravel Member. P104102.

Flint-quartzite head deposits have been mapped out only on Sheet 87W Ellon, whereas they are portrayed as 'float' on Sheet 87E Peterhead. They are probably also developed on the other outcrops of the Buchan Gravels Formation on Sheet 86E Turriff.

Some outstanding examples of head deposits have formed on the flint and quartzite gravels of the Buchan Ridge and Windyhills (Sites 13 Windyhills and 14 Moss of Cruden). The gravels are invariably concealed beneath up to 1.5 m of 'cryoturbate', formed by stirring, churning and other processes of cryoturbation during repeated freezing and thawing cycles in former periglacial conditions. Vertically orientated elongate clasts are common at the top of these deposits, which are typically pale yellow/orangebrown to white in colour and consist of gravelly, sandy kaolinitic clays. The deposits are particularly susceptible to frost heaving and a road across the Moss of Cruden was rendered impassable as a result of this process one particularly cold winter in the late 1970s. Extensive iron pan is commonly developed at the base of the cryoturbated layer, causing poor drainage and the development of a peat cover at the surface.

A unit of moderate brown diamicton up to 1 m thick caps the cryoturbated Windy Hills Gravel Member at its type section near Fyvie (P915375). The diamicton includes sparse striated clasts of fresh Dalradian metamorphic rocks as well as quartz and quartzite pebbles from the gravel below. The unit is intensely cryoturbated with excellent examples of erect clasts (FitzPatrick, 1987, fig. 13.5; P104102). The unit is now interpreted to be a till that has subsequently experienced periglacial churning. Some of the flinty head deposits capping the Buchan Ridge probably have a similar origin.

References

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