

# Early and Mid Quaternary, Northern England

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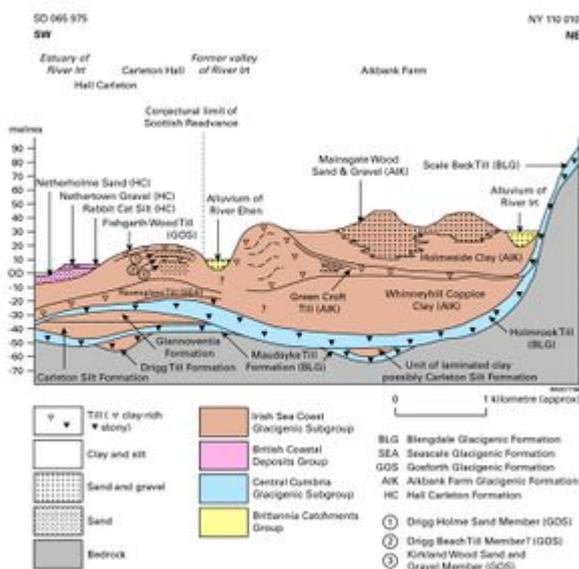
From: Stone, P, Millward, D, Young, B, Merritt, J W, Clarke, S M, McCormac, M and Lawrence, D J D. 2010. [British regional geology: Northern England](#). Fifth edition. Keyworth, Nottingham: British Geological Survey.

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## Introduction



Schematic transect across lower Wasdale, Lake District, showing relations of the lithostratigraphical units. P916097.

The glacigenic deposits occurring across the central part of northern England are assigned to the North Pennines Glacigenic Subgroup. These are dominated by clasts of Carboniferous lithologies (sandstone, limestone, mudstone, gannister, coal), but include some far-travelled clasts from Scotland and the Lake District (wacke-sandstone and siltstone, granite and granodiorite). Tills are generally dark grey.

Glacigenic deposits of this age are assigned to the Albion Glacigenic Group. The oldest Quaternary sediments known from northern England fill subvertical karstic fissures within the limestones and dolostones of the Zechstein Group that form cliffs along the coast of County Durham. The fissures are generally linear, vary from 1 to 7 m wide and extend 25 m vertically down the cliffs, locally along faults. They contain breccias formed of limestone and dolostone, together with a few clasts of red mudstone derived from higher parts of the Permo-Triassic succession now eroded away. Most of the fissure fillings are unfossiliferous and likely to be either Mesozoic or early Palaeogene in age as they are similar to evaporite dissolution breccias that occur elsewhere within the Permian limestones.

However, several fissures contain clay that has yielded assemblages of partially pyritised organic material including peat, seeds, tree trunks, ostracods, mammalian bones and freshwater molluscs. The remains of over a hundred species of plant have been identified in this so-called 'Castle Eden flora', the majority of which no longer grow in Britain, or are extinct. The likely Early to Mid Quaternary age is supported by the identification of *Mammuthus meridionalis*, an elephant that was common in Europe up to the Cromerian. Sparse glacial erratics of supposed Scandinavian origin have been found in fissure fill deposits locally, but how and when these erratics got into the fissures is not clear.

The Mid Quaternary spans five or more major glacial-interglacial cycles, but scant evidence of these events has survived in northern England. The oldest known glacial deposit is the Thornsgill Till Formation, a deeply weathered diamicton that is preserved in the valleys of Thornsgill and Mosedale, between Keswick and Penrith, in the Lake District. The till is greater than 14 m thick locally and contains clasts mainly of Borrowdale Volcanic Group and Skiddaw Group lithologies, and Threlkeld microgranite, which suggests that it formed beneath an ice cap centred on the Lake District. Analysis of the weathering profile (see 'Troutbeck Palaeosol' below) indicates that the Thornsgill Till predates the Ipswichian and may be as old as the Anglian (MIS 12).

The oldest known till in west Cumbria is the Drigg Till Formation, a reddish brown, stony diamicton containing an 'Irish Sea Coast' suite of clasts. It was encountered in boreholes in lower Wasdale and around Drigg, stratigraphically below varved glaciolacustrine deposits of probable Early Devensian age ([P916097](#)). Some clasts in the till are weathered, but far less so than in the Thornsgill Till. The presence of Criffel granodiorite and other Scottish clasts suggests that the till was laid down in a major glaciation by an ice sheet rather than by a local valley glacier, possibly during MIS 6. This has implications for landscape evolution, because it strongly suggests that lower Wasdale, one of the classic U-shaped, glacially over-deepened valleys in Britain, was largely created before any Devensian glaciations. A similar MIS 6 age is suggested tentatively for till underlying supposed Ipswichian deposits at Daltonin-Furness, and the Ayre Lighthouse Formation, which includes some 70 m of sand, gravel and diamicton of Irish Sea and Scottish provenance, resting on bedrock at -142 m OD in the north of the Isle of Man.

Probably the best known pre-Devensian till in northern England is the Warren House Gill Till Formation, or 'Scandinavian Drift' of earlier accounts. This dark grey, very compact, pebbly sandy clay diamicton crops out on the coast north of Horden, where it occupies the floor of a buried valley at the mouth of Warren House Gill. Recent removal of colliery waste has uncovered the deposit after many decades of burial. The till, which is up to 5 m thick, is distinctive because it contains Scandinavian erratics to the exclusion of rocks from the British mainland excepting local limestones and dolostones. More than 80 per cent of the erratics have been matched with igneous and metamorphic rocks occurring in the Oslo area of southern Norway, including larvikite and nordmarkite. Chalk, flint, red sandstone, red and green (Triassic) calcareous mudstone and belemnite fragments constitute about 6 per cent of the erratics, and numerous marine shell fragments occur within the lower part of the till. This lithological assemblage crops out in the North Sea Basin to the east and north-east, strongly suggesting that the till was laid down by ice that crossed the North Sea Basin from Scandinavia. The age of the glaciation is uncertain. It rests on fissure fillings similar to those yielding Cromerian fossils nearby and contains shells of extinct 'Arctic' species, which have probably been reworked. The till underlies the Warren House Gill Loess Bed, a periglacial deposit containing weathered clasts and concretions that probably formed prior to the Ipswichian Interglacial following retreat of the ice that laid down the till. Consequently, the Warren House Gill Till is now generally assigned to the glaciation of MIS 6.

In County Durham, the Easington Raised Beach Formation, which crops out at Shippersea Bay, north of the former Easington Colliery, probably formed during the Mid Pleistocene. The deposit

comprises about 4 m of partly cemented gravel and sand containing marine shells and, possibly, rare Scandinavian erratics. It rests on a bevelled platform cut into limestones and dolostones of the Zechstein Group at about 30 m above sea level. Twelve temperate genera of marine mollusc have been identified from the deposit, and borings by marine molluscs and annelid worms in the rock platform and cobbles confirm that the deposit is in situ.

Much debate has centred on the age of the Easington beach deposit, which is very important in establishing the regional lithostratigraphical succession. It has formerly been assigned to the Ipswichian (MIS 5e), because it yielded an 'infinite' radiocarbon age greater than 38 ka BP and contained Scandinavian clasts possibly derived from the Warren House Gill Till, thought to be of MIS 6 age. However, subsequent amino acid analyses on shells of *Patella vulgata* revealed two age populations attributable to the earlier MIS 9 and 7 interglacials respectively, the older population possibly having been reworked into the younger. Furthermore, a pre-Ipswichian, MIS 7 or older age would be more easily reconciled with the height of the deposit above sea level, as it is much higher than other, more reliably dated Ipswichian raised beaches in northern England, particularly at Sewerby, near Bridlington, which lie approximately at present sea level. The preservation of such an old beach fragment at Easington is explicable because the site lies to the south-east of a particularly hard Permian reef knoll that could have protected it from the passage of ice during one or more glaciations.

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