Late glacial period, Quaternary, Northern England

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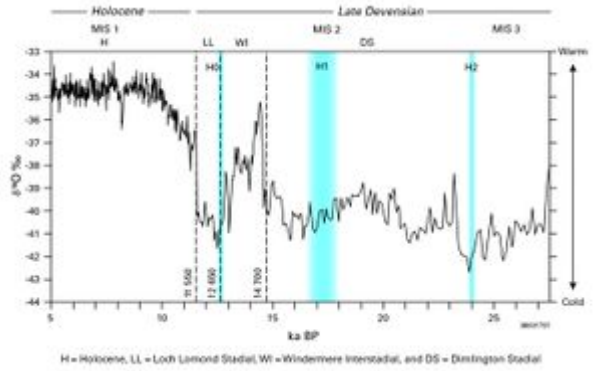
Introduction



Proxy climate record of the last glacial termination based on an ice core (GISP2) obtained from the Greenland ice sheet summit. Blue bands denote periods of time within which Heinrich Events (H0 to H2) occurred. Ice core data provided by the National Snow and Ice Data Center, University of Colorado at Boulder, and the WDC for Paleoclimatology, National Glaciophysical Data Center, Boulder, Colorado. P916095.

The period of time between the diachronous retreat of the MLD ice sheet from any given area, and the beginning of the Holocene at 11.55 ka BP, is referred to as ‘late glacial’. It includes the Windermere Interstadial and the Loch Lomond Stadial, both periods of climatic instability (P916095). Deglaciation commenced in a cold, arid environment and high parts of the district probably witnessed several thousand years of ice-free, periglacial conditions before the onset of rapid warming at about 14.7 ka BP, the beginning of the Windermere Interstadial. The abrupt amelioration in climate occurred when temperate waters of the Gulf Stream returned to the western coasts of the British Isles. River terraces and alluvial fans formed across the district by paraglacial processes, which swept away loose glacial debris before soils became stabilised by vegetation.

Masses of ice buried within glacigenic sediments during all phases of the MLD glaciation melted out relatively slowly to form kettleholes.

Organic sequences preserved within kettleholes may contain pollen, spores and the remains of beetles and midges, and hence provide a valuable record of environmental change: good examples have been described near St Bees and from the Isle of Man. Sediment cores from lake basins and bogs also provide extensive records into the Holocene, with notable results recorded from Windermere in Cumbria and Hawes Water in north Lancashire, from Blelham Bog south of Ambleside, and from Bolton Fell and Walton Moss north of Brampton. The lake basins in particular demonstrate the classic 'tripartite' late-glacial sequence: cold stage clastic deposits overlain by organic or carbonate-rich interstadial material, overlain by clastic sediment representing the Loch Lomond Stadial. At the start of the interstadial in northern England, summer temperatures rose by 7ºC within a decade or so, peaking at about 18ºC. Freshly deglaciated ground was first colonised by a pioneer vegetation of open-habitat, Alpine species, followed by the immigration of crowberry heath, juniper and dwarf varieties of birch and willow. Eventually, open birch woodland developed with juniper and isolated stands of Scots pine locally. An oscillatory climatic deterioration occurred throughout the Windermere Interstadial (P916095) and it is possible that glaciers had already started to build up in the Cumbrian mountains before more sustained cooling began at about 13 ka BP. Giant deer flourished during the interstadial, but then became extinct.

The Gulf Stream current retreated rapidly to the latitude of northern Portugal at 12.65 ka BP, heralding the start of the Loch Lomond Stadial. Summer temperature across northern England declined to an average of about 11.5ºC and a tundra environment became ubiquitous. Only plant communities tolerant of the Arctic conditions were able to colonise the unstable soils. The stadial witnessed the demise of large herbivores, including the woolly mammoth and woolly rhinoceros, but the role of hunting by Upper Palaeolithic man in the extinctions is still uncertain.

Periglacial processes destroyed the immature soils that had developed during the Windermere Interstadial, creating a range of rubbly deposits collectively known as 'head' that are especially well developed in the Howgill Fells and Cheviot Hills. There was extensive development of permafrost and ground ice, the latter melting to create fossil ice wedge casts and pingos (circular depressions) in lowland areas, particularly within spreads of glaciofluvial sand and gravel. Polygonal networks of ice wedge casts developed within the glaciolacustrine deposits of Millfield Plain. Both fluvial and debris-flow activity was enhanced, especially during springtime snowmelts, and slopes were particularly prone to failure. The sand and gravel that underlies the loamy floodplain alluvium in many of the larger valleys was probably deposited from braided rivers during the stadial.

Fossil periglacial features are widespread, particularly on slopes where intermittent viscous flow of seasonally thawed soils (gelifluction) has occurred. On steep, upland slopes, tear- shaped gelifluction lobes have been washed out to form arcuate lobes of boulders. The lower slopes of valleys and headwater basins commonly take the form of smooth, gently sloping gelifluction terraces that terminate in bluffs along the streams. The periglacial climate was particularly severe in upland areas, causing many rock falls and producing abundant frost-shattered rock. Many areas of talus formed during the stadial though most have since become inactive and vegetated: examples include the impressive Wasdale Screes in the Lake District and the block screes below crags of the Whin Sill and Carboniferous sandstone in Northumberland. Granite tors, and some of thermally metamorphosed andesite, formed on Cheviot hilltops. Blockfields and blanket head formed above about 600 m OD in the north Pennines, commonly displaying large-scale patterned ground composed of polygons and stripes.

At least 64 glaciers are thought to have existed in the Lake District during the Loch Lomond Stadial, mostly small ones on the north-eastern sides of summits and ridges, but probably including some

plateau icefields with outlet glaciers. The central Lake District boasts the most extensive suite of glacial landforms, typified by the magnificent cirques and arêtes of Helvellyn. Small glaciers are also thought to have occurred beneath the scarp of Cronkley Scar (NY 840 294) in Teesdale, and within the Cheviot Hills at The Bizzle (NT 920 220). The Isle of Man apparently remained unglaciated. Fresh hummocky deposits in some of the cirque-shaped valleys along the western fault scarp of the northern Pennines have been interpreted as moraines formed during the stadial, but are more likely to result from rotational landslides. Landslides were widely initiated during the late-glacial period, especially during ice sheet deglaciation, when glacially oversteepened slopes became unstable; they are considered further in Chapter 12.

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