# Ludworth Intake

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## Introduction

Ludworth Intake is a prominent meltwater channel incised into the western flank of the Pennines. Various interpretations have been suggested for its origin including a spillway from a glacial lake, an ice-marginal channel and a sub-glacial channel. Jowett and Charlesworth (1929), Johnson (1963, 1968) and Stevenson and Gaunt (1971) have described the meltwater channel and its relationship to glacial events in the area.

## Description

Ludworth Intake lies to the south of the village of Chisworth on the outskirts of Greater Manchester. The channel is incised into a low col on the watershed between the main Etherow Valley and a small tributary of the River Goyt. Under present-day climatic conditions, the channel is dry and carries no surface drainage (Figure 5.49). The main channel of Ludworth Intake is over 400 m long and attains a depth of 10 m. The channel is sinuous in plan and its floor generally falls in height from north to south, although in its most northern section it has a slight reverse or northward slope.

Johnson (1968) described the nature of the sediments mantling the sides of Ludworth Intake. These sediments were revealed by temporary sections cut in the side of the channel for a coal mine adit. This exposed a sequence of soliflucted debris layers overlying weathered shale. Johnson (1968) identified five separate layers of solifluction debris in this section. Two layers were formed of heavily comminuted clay shale, whereas the remaining three were of a much coarser texture in which shale and mudstone fragments were still identifiable. The extent of comminution in each of the debris layers was taken by Johnson (1968) to represent differing climatic regimes during deposition. Pollen grains from between the layers of finer-grained debris are consistent with a Windermere Interstadial age (Johnson, 1968).

## Interpretation

Ludworth intake was originally interpreted as a channel cut by a lake spillway for an ice-dammed lake confined to the Etherow Valley (Jowett and Charlesworth, 1929). This interpretation was inspired primarily by the pioneering work of Kendall (1902, 1903) on the lake spillways and ice-dammed lakes in the North York Moors area. Kendall identified numerous ice-dammed lakes in the North York Moors area, including a large lake (Lake Pickering) and several smaller ice-dammed lakes pinned against the northern flanks of the moors. Although other researchers accepted Kendall's ideas at the time, later challenges to his theory have meant that in many descriptions of Ludworth Intake the spillway interpretation has been largely disregarded. Johnson (1965a) divided the meltwater channels of the western Pennines into two categories; a first group of widely dispersed channels cut across watersheds and cols at high levels, and a second group of subglacial drainage channels developed on the lower slopes of the hills. Ludworth Intake clearly belongs in the former of these two categories. Both Johnson (1963, 1965a, 1968) and Stevenson and Gaunt (1971) suggested that the channel was cut by a meltwater stream flowing either laterally along the ice-sheet margin or directly under the ice-sheet edge. These meltwater streams were fed by seasonal flow directly from the ice front or from meltwater passing from one part of the ice margin to another. A subglacial or submarginal origin would best explain the reverse gradient of parts of the channel. Johnson (1985b) later developed this concept by applying a land-systems approach to the western Pennine margin in which meltwater channels at different altitudes were related to successive lowering of the margin of a lowland ice-sheet pinned against an upland area. A good analogue for this situation is provided by Derbyshire (1961) who described similar col channels in Labrador. Derbyshire argued that channel erosion takes place when the ice surface is between 120 and 150 m above a col divide. As most col channels in the Manchester area (including Ludworth Intake) occur at heights between 275 and 370 m OD, the ice surface was probably more than 460 m OD at the Pennine margin

when the channels were eroded. More recent work on the meltwater channels of the Mid-Cheshire Ridge, to the west of the Pennines, including palaeohydraulic calculations and detailed ice-sheet reconstruction, has confirmed that many of these channels are indeed subglacial in origin (Sambrook Smith and Glasser, 1998; Glasser and Sambrook Smith, 1999).

Finally, Johnson (1968) attempted to establish a relative chronology for events at this site from the solifluction debris and pollen remains exposed in the temporary section. He concluded that the Ludworth Intake meltwater channel was initially cut into weathered shale before it was partially infilled by solifluction debris. The coarse basal layers of solifluction debris were interpreted as having formed immediately after deglaciation, whereas the upper coarse layers were a product of the return to a colder climatic regime during the Loch Lomond Stadial. A Windermere Interstadial age is attributed to the layers of finer-grained debris that separate these layers of coarse debris (Johnson, 1968).

## Conclusions

Ludworth Intake is an exceptionally good example of an isolated col channel cut by glacial meltwater erosion, a landform type common along the western Pennine margin. Although initially it was suggested that the channel originated as a spillway from a glacial lake, it now appears more likely that these channels were eroded by meltwater flowing in an ice-marginal or subglacial position. The meltwater channel at Ludworth Intake therefore is important for interpreting the nature of events and ice-sheet thickness during the Late Devensian glaciation.

**References**

*(Figure 5.49) Photograph of part of the Ludworth Intake meltwater channel. (Photo: N.F. Glasser.)*