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Article

ICE-MARGINAL LANDFORMS IN THE UPPER CALDER VALLEY, WEST YORKSHIRE.

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Abstract

Cross-valley hummocky topography and other landforms typically associated with a glacial origin occur in the upper reaches of the Yorkshire Calder catchment. The landform features are well-defined and are associated with evidence of erratic lithologies nearby. These features are situated beyond the currently accepted Dimlington Stadial glacial margin and possibly represent the maximum extension of a past ice sheet across this part of West Yorkshire.

Introduction

Calderdale, West Yorkshire is the most southerly of the Yorkshire Dales. The River Calder (and its many tributaries) drains the steep slopes of the South Pennines, running from its source to the north of Todmorden, to its confluence with the River Aire at Castleford (Fig. 1.). Typically, the valleys in the west of the Calder catchment are steep sided and sinuous in form. The underlying geology of the area consists of mainly Millstone Grits, sandstones, shales, mudstone and siltstone from the Upper Carboniferous period in the west, giving way to younger rocks forming the Coal Measures to the east (Scrutton, 1994). Superficial deposits on the hills typically consist of peat or thin soils covering weathered rock and clays on the hills, with alluvium with scattered deposits of glaciofluvial gravels and sands found in the valley bottoms. Extensive patches of glacial deposits have been mapped to the north and west of Calderdale (BGS Geology Viewer, accessed 12.11.22).

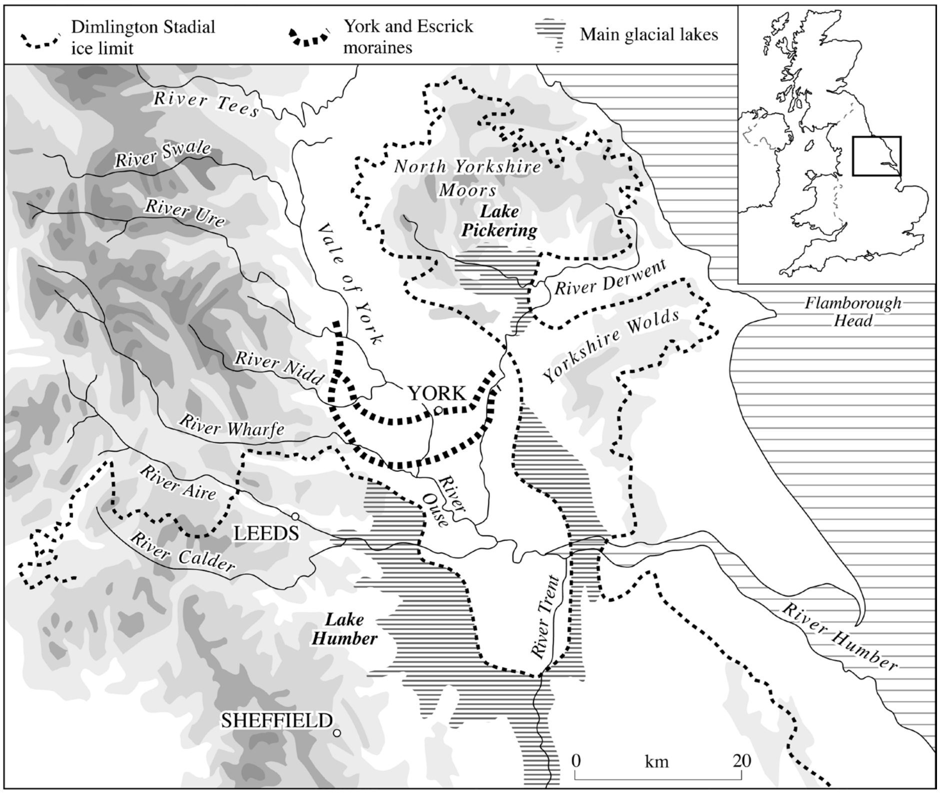

Figure 1. The location of the River Calder in relation to other Yorkshire Dales and the accepted Dimlington Stadial glacial margin (after Catt, 1991).

The Calderdale area has been considered as ice-free during the last glacial (Raistrick, 1934, Catt, 1991, Clark *et al.*, 2017) partly due to is sinuous valley pattern and ‘V’ shaped cross section which contrasts with the broader ‘U’ shape valleys of the more northerly dales (Aitkenhead 2002). Fragmented relict glaciofluvial deposits containing granite and black limestone have been reported at Elland and Cromwell Bottom (Green *et al.* 1871), but these are considered to be in a degraded state and much older than the last glacial event.

Field and map exploration

Field investigation reveals geomorphological features suggestive of glacial ice incursion in the upper reaches of the Calder catchment. Hanging valleys, boulder fields and abandoned lateral meltwater channels can be observed alongside hummocky topography. These features typically occur proximal to cross-valley mounds combined with locally sourced and erratic stones of all sizes. Study of old maps of the area reveal extensive areas of boulders and place names suggestive of lithological content or distinctive geomorphological features (Ordnance Survey, 1852, 1894).

Figure 2. Mounds crossing the valley south of Walsden, Todmorden.

Figure 3. Hummocky topography south of Walsden, Todmorden

At Walsden, Todmorden (SE 393 421), large hummocky deposits cross the broad, U-shaped and virtually dry valley (Fig 2., Fig 3.), running west to east from Summit (SE 394 418) to Todmorden (SE 393 423). Hanging valleys with corresponding waterfalls can be seen e.g. Owler Clough (SE 394 419). Boulder fields can be observed on the surrounding hillsides as well as atop the cross-valley mounds. Buildings displaying movement can be seen north and east of the cross-valley feature at Walsden and at Todmorden, suggesting unconsolidated deposits filling at least part of the valley bottoms (Fig 4.).

Figure 4. Listing buildings, Walsden, Todmorden.

At Crimsworth Dean[1] (SE 399 431), cross-valley mounds and hummocky topography with lateral relict dry channel features (Fig 5.), can be seen north of Lumb Falls (260m OD). Erratic limestone clasts and Carboniferous fossils have been collected from the stream by the landowner. Nearby place names such as Limers Gate (SE 400 430), Burnt Stones (SE 401 431) and Burnt Stones Hill (SE 401 431) suggest the occurrence of concentrations of clasts including erratic limestone which was collected and burned in historical times to provide lime for local farmers to ameliorate the acid soil of their fields.

At Castle Carr[2] (SE 402 429) mounds cross the valley of the Luddenden Brook at the Lowe (SE 402 429, 220m OD), with road diversion around a large gritstone boulder (Fig 6.). Discussion with the landowner reveals that three very large gritstone boulders lying on top of the mounds, were broken up and buried in the recent past. To the rear of the cross-valley mounds at the Lowe, the Luddenden Brook has cut through the deposit at Low Bridge (Fig 7.) Nearby

1 Access to the farmland above Lumb Falls (Crimsworth Dean Valley) is strictly private. The landform features can be seen from the public footpath at Baby House Hill (SE 399 432).

2 The Castle Carr Estate is strictly private. Public access is allowed on 4th July each year. Features at the Lowe can be viewed from the bridleway at Low Bridge (SE 402 329).

Figure 5. Sinuous dry channel to the eastern flank of Crimsworth Dean.

place names such as Stony Spot Plantation (SE 402 429), Burnt Stones (SE 401 431), Burnt Stones Hill (SE 401 431) and Limers Gate (SE 401 430) suggest localised concentrations of boulders and collection and burning of limestone clasts in historic times (Ordnance Survey, 1852, 1894).

Figure 6. Large, moss-covered gritstone boulder at The Lowe, Castle Carr.

At Hardcastle Craggs (SE 398 429), Millstone Grit bedrock structures cross the valley floor to the northwest of Gibson Mill (SE 397 430), with dry valley features to the immediate north of the Cragg. Gritstone boulders litter the immediate area and are found concentrated further upstream at Blake Dean (SE 396 431) and New Laithe Moor (SE 395 432).

At Cragg Vale (SE 340 423), a large, attached, gritstone bedrock outcrop is evident in the valley bottom immediately south of the Hinchliffe Arms public house. Corresponding hummocky landforms (Fig 8.), can be found on each of the valley sides, both

Figure 7. Mounds and channel incision to the rear of the Lowe, Castle Carr.

Figure 8. Hummocky topography and dry channels to the valley side south of Cragg Vale.

alongside this bedrock feature and further upstream, with associated abandoned channel features on the eastern bank.

The lack of cirque type features across and typical glacial geomorphology in this part of the southern Yorkshire Dales, suggests that during the last glacial snow and ice accumulated at higher elevations, to the north and west of the Calder catchment, eventually coalescing in ice sheet form and over considerable time transporting eroded material to the ice margins. Limestone erratics and place names suggesting the industrial scale collection and burning of limestone clasts from higher elevations on the moorlands to the north of Crimsworth Dean and Castle Carr, indicate ice flow from north to south, overtopping the higher elevations (Ordnance Survey, 1905-1907, 1919-1921). Stephens *et al.* (1951) recorded diamicton in the Thornton Valley (to the north and east of Castle Carr at an elevation of 426 m., indicating that ice would have overtopped the Bradford Basin, spilling into the upper reaches of the Calder, transporting limestone eroded from the more northerly Dales. The fact that these limestone clasts were available to be collected in historical times, suggests deposition by a relatively recent ice event and not from a much earlier and more widespread glacial event.

The bedrock features and hummocky deposits at Cragg Vale are possibly a result of localised glaciation, possibly fed from snow and ice fields occupying the surrounding high ground at Turley Holes and Higher House Moor. These snowfields may have been attached to those feeding the Lancashire ice sheet also feeding ice and material to the Walsden glacier. The dry channels perched above the current stream at Hardcastle Craggs and Cragg Vale suggest stream capture, possibly due to the blocking of the valley by ice, similar to that described by Rose (1980) at Kisdon Hill, Swaledale. The exact nature of landform genesis at Cragg Vale and Hardcastle Craggs requires further investigation.

Conclusions

The well-defined moraines, associated landform features and survival of limestone erratics, combined with proximity to the postulated Late Devensian ice margin, suggest that these features owe their evolution to incursion of ice into the area during the Last Glacial Maximum. The cross-valley features at Wallsden, Crimsworth Dean and Castle Carr, potentially represent the terminal moraines of the coalesced Lancashire and Yorkshire ice sheets, whilst the attached bedrock features and altered drainage at Hardcastle Craggs and Cragg Vale suggest a more complex evolution, possibly attributed to ice formation from either a local source or from regional variations, contemporaneous with the maximum ice expanse during the Late Devensian glacial.

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