Aqualate Mere

[SJ 780 205]

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Introduction

This site in Staffordshire, consists of an esker system formed during Late Devensian deglaciation. It is an important location because it demonstrates the close association between eskers and fan deposits and was used to develop an early model for esker sedimentation by the [British] Geological Survey (Dixon, 1922, 1926; Whitehead *et al.,* 1927, 1928). The esker, and related fan, kettleholes and ice-contact slopes, provides evidence for landform development associated with active ice-sheet marginal wastage and this region forms one of the most instructive locations in the country for demonstrating this type of esker model. There has been a recent revival of interest in the processes of esker sedimentation (e.g. Brennand, 1994; Huddart and Bennett, 1997; Thomas and Montague, 1997) and, in particular, the model whereby active ice retreat allows subglacial, ice-walled or supraglacial fluviatile sedimentation into pro-glacial lakes to produce beaded eskers or fans (e.g. Gorell and Shaw, 1991; Warren and Ashley, 1994; Thomas *et al.,* in press).

Description

The Aqualate Mere esker is located on the north side of Aqualate Mere and comprises a series of elongate hills, orientated east–west, in a linear strip some 1.6 km long and 300 m wide at its maximum (Figure 5.31). The esker is part of a regional series of deglaciation landforms that illustrate active ice recession to the north-west. The narrow, well-defined, ridge system starts midway between Forton and Aqualate Mere ((Figure 5.31)). At the eastern end of Round Hill it rises to a maximum of 15 m and then there is a low point in the ridge before a marked ice-contact face ('E' on (Figure 5.32)). Anc's Hill is slightly offset and is a much broader, bulkier deposit exposing sand and well-rounded Bunter quartzites and sandstone gravels on the surface. This is followed by an offset, low winding ridge about 10 m high that joins Oak Hill, where it steepens to about 35 m at position 'D' (Figure 5.32) and is a much broader feature. A similar morphology occurs on Rough Hill, and sands are exposed in an old pit on its northern side. Sheep Hill has a steep, ice-contact slope to the west and in the fields to the east flattens off in a series of gently dipping slopes that are fan-shaped. There are occasional, poorly drained depressions, as on the south side of Oak Hill, that represent kettleholes.

Interpretation

The interpretation of the Aqualate Mere deposits has to be viewed in the context of the regional deglaciation in this part of Staffordshire (Whitehead *et al.,* 1927, 1928; Worsley, 1967b, 1970, 1975). The area is located between the Ellesmere–Whitchurch–Bar Hill moraine (Boulton and Worsley, 1965; Yates and Moseley, 1967) and the Devensian drift limit to the south (Worsley, 1970). In this area the ice sheet created few distinct landforms, although these include the often cited Newport–Wolverhampton esker chain, of which Aqualate Mere forms a part. This esker was first identified by Dixon (1922) during the [British] Geological Survey's primary mapping, but no map was published showing the exact esker distribution. Occasional areas of sand and gravel, called 'kames' by Dixon, were described as being bounded by steep northern slopes and were interpreted as marginal ice-contact slopes. By projecting the trends of these marginal features Dixon was able to postulate ice-stand positions, which generally were concordant with an ENE–WSW alignment. Whitehead *et al.* (1927) suggested that many of the landforms must have been deposited extra-glacially at an ice-front, or in a glacial lake and that the most characteristic masses can be defined as eskers, deltas and fans, although there also are many undefined glaciofluvial deposits that might be categorized as kames and did not have a well-defined relationship with the ice sheet. The classification of these ice-margin al forms based on Whitehead *et al.* (1928) is given in (Figure 5.33).

Gregory (1921) suggested that eskers are 'the deltaic deposits of glacial rivers and their ridged form is due to their continuous deposition at successive positions by the slow recession of the river mouth during the retreat of the ice sheet.' Often it is suggested that these types of eskers, and those formed subglacially, indicate the waning phase of a glacial period by the very fact that they are preserved at all. The ice marginal area was most likely stationary and retreated by frontal melting. Esker deltas are formed in a pro-glacial lake fed from a feeding esker, whereas esker fans are fed from an esker and deposited subaerially as a frontal fan. Outwash deltas and outwash fans on the other hand do not have feeding eskers but show by their morphology that they have been deposited in association with a stationary ice front by an emerging sub-glacial river.

The pro-glacial lake in which some of these deposits were laid down was called 'Lake Newport' by Whitehead *et al.* (1927) and it was considered that it occupied the gap between the retreating ice front and the higher ground that separates the North Shropshire plain from the Trent basin to the east and the Lower Severn basin to the south-west (Figure 5.34). As the ice front continued its retreat, the lake spread northwards and also along the outcrop of the Coalbrookdale coalfield and the Wrekin. Lake Lapworth was created by a unification of Lake Buildwas to the west and Lake Newport (Wills, 1924;Whitehead *et al.,* 1927; Worsley, 1975) as the ice withdrew from the base of the Wrekin. In the Newport area there is evidence of a glacial lake with supposed shorelines, an overflow channel, lake deltas and lake-bottom deposits. The location of this shoreline is shown on (Figure 5.34). The overflow from this lake is thought to have occurred through a wide, flat-floored channel north-west of Gnosall (Figure 5.34) and into the Church Eaton Brook and the Trent drainage. Whitehead *et al.* (1927) considered that the Islington and Aqualate Park esker-deltas corresponded in height to the Gnosall overflow and that the Bunter Sandstone ridge at Chetwynd Park was an island in Lake Newport. The Islington esker-delta illustrates the morphological evidence well. The feeding esker is the flat-topped ridge, which has a lobate frontal margin to the south-east of Chetwynd Park and there is a marked ice-contact slope. At Aqualate Park the esker delta covers most of the park and the main ice-contact slope is a straight bank rising 10–13 m above the pools known as 'the Spectacles' (Figure 5.31).

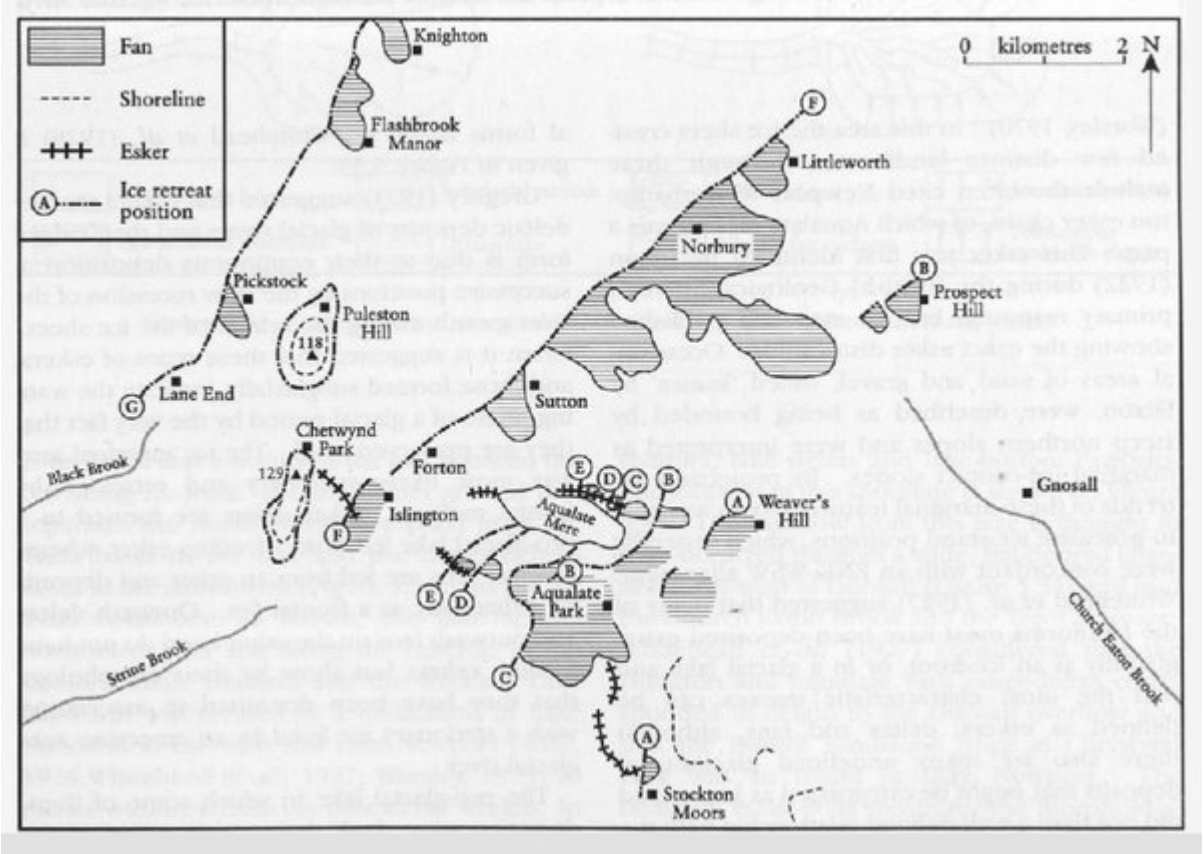
No sedimentological evidence is available in the area to prove the environment of deposition, although at Weaver's Hill (Figure 5.35) an old sand pit exposed 15 m of rippled and parallel laminated sands, dipping at about 8° to the south-east and overlain by about 50 cm of rounded pebble gravel. The ice-contact face is to the north-west and low fans built out to the south-east. These possibly were subaqueous as no flat-top is obvious and they are similar to the fans at the south-east end of Sheep Hill. A series of ice-frontal positions marked by fans and deltas (between 'A' and 'G', (Figure 5.32)) indicates that the ice front was retreating to the north-west. However, there is a marked lack of continuity at any one of these frontal positions because the sediments were deposited along the subglacial river positions. Some of the fans have been eroded into a number of small mounds and ridges, separated by dry channels, the result of subglacial streams. An example is the Norbury fan between Blackmere pool and Knightley Grange. There seem to be chains of such ice-frontal deposits running in a NW–SE trend. The most prominent is the one extending from Stockton Moors–Aqualate Park–Islington to Lane End (Figure 5.32). Another chain is the one associated with this GCR site from Weaver's Hill to Forton, where the subglacial stream seems to have shifted laterally to the north-east and then develops fans at Sutton and Pickstock. A third chain runs from Prospect Hill to Norbury and Flashbrook Manor and a fourth from Littleworth to Knighton. Some of these appear to have been deposited by a groups of streams giving scattered mounds and ridges. Laminated lake-bottom deposits cover a large area drained by the Black Brook and Strine Brook and most are wholly or comparatively stoneless. It appears that Lake Newport was separated from Lake Buildwas by ice at least up to the period associated with ice front 'G' on (Figure 5.32). With the creation of a Lake Lapworth (Wills, 1924; Worsley, 1975) the drainage flowed through the Ironbridge Gorge, and the Gnosall overflow was abandoned.

Conclusions

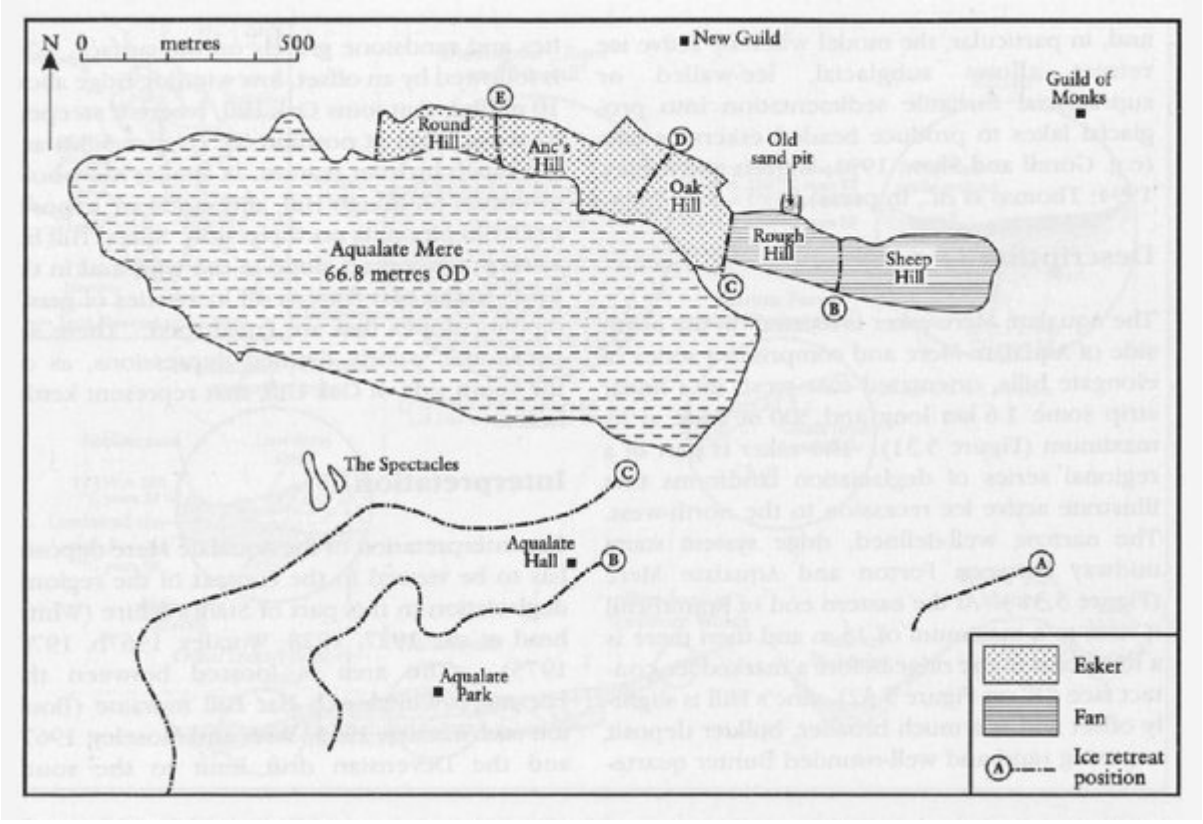
The Aqualate Mere landforms constitute an important part of the interpretation of ice-frontal deposition into pro-glacial lakes as the Irish Sea ice sheet actively retreated to the northwest. There is excellent morphological evidence for an esker chain, ice-contact slopes and probably subaqueous fans, rather than deltas, which built up pro-glacially from a subglacial river. Unfortunately sediment exposure is not available, but at nearby Weaver's Hill the sediments that are exposed are not inconsistent with this model of ice-frontal deposition into a pro-glacial lake. The regional picture is consistent with this local interpretation and it is considered that Dixon's original model for ice retreat and its association

with pro-glacial lakes is likely to be correct. However, without detailed sedimentological evidence to add to the landform interpretation the model must remain unproven.

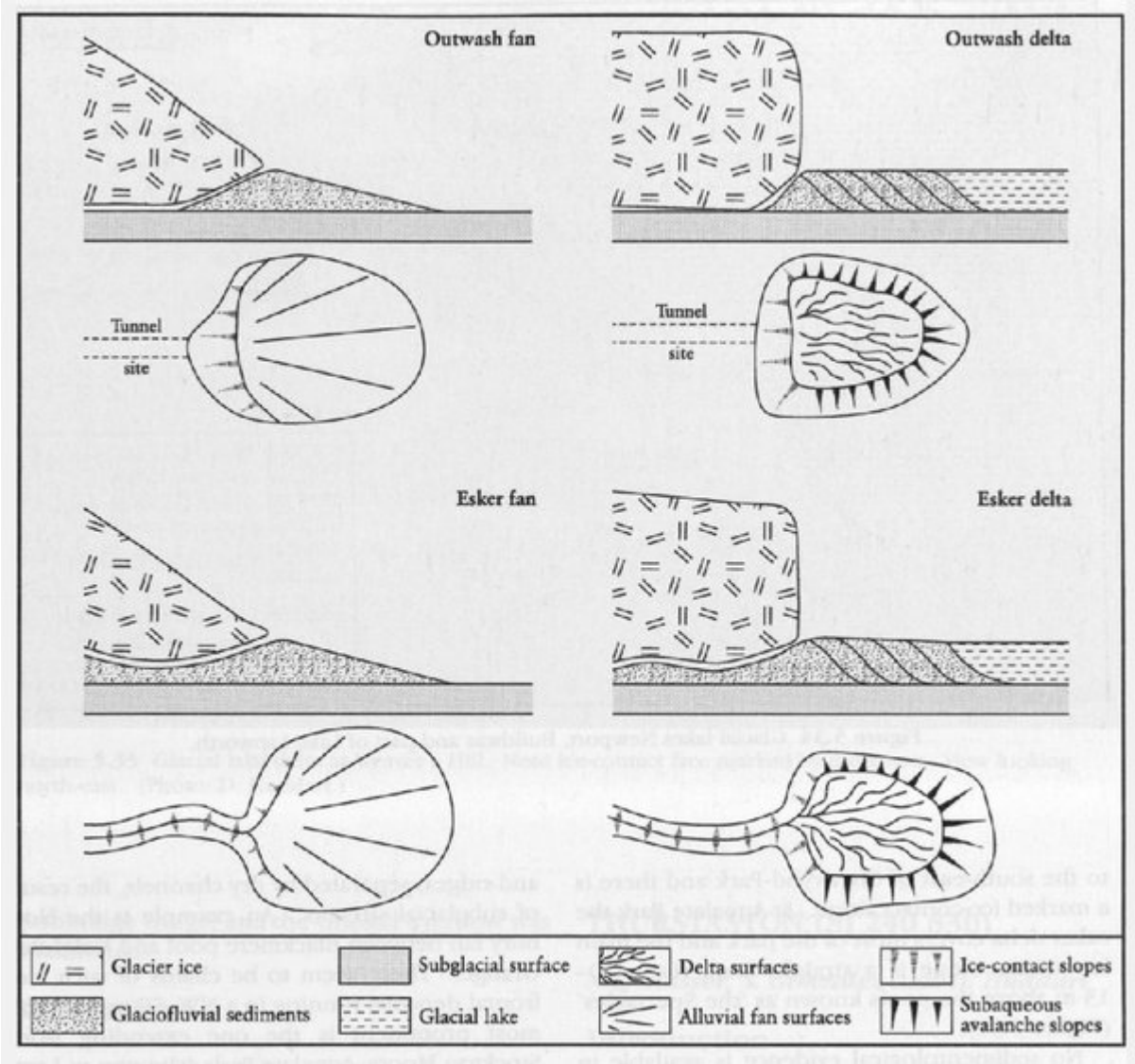
References



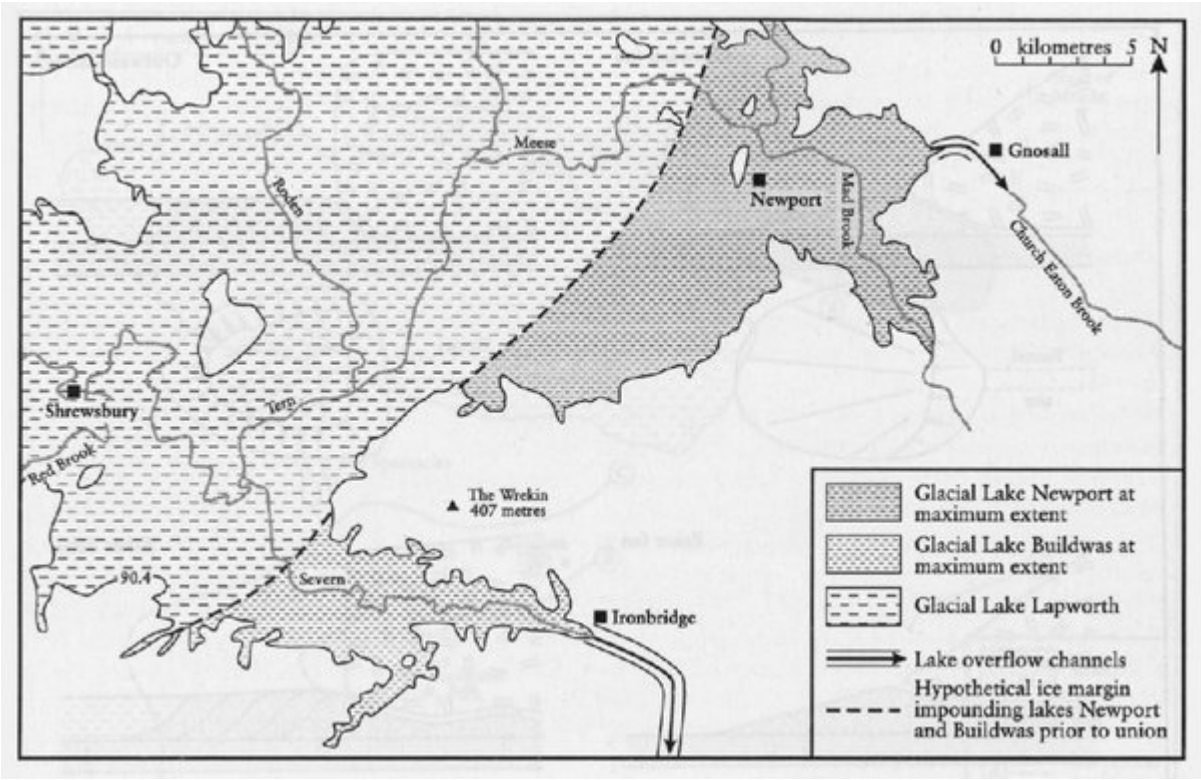
(Figure 5.31) Location of the GCR Aqualate Mere site and interpreted ice front positions. For more detail of the Aqualate Mere area, see (Figure 5.32).



(Figure 5.32) Regional distribution of glaciofluvial deposits and ice-front positions around the Aqualate Mere.



(Figure 5.34) Glacial lakes Newport, Buildwas and part of Lake Lapworth.



(Figure 5.33) Classification of marginal depositional fans (after Whitehead et al., 1928).

(Figure 5.35) Glacial lake delta at Weaver's Hill. Note ice-contact face marked by the arrow View looking north-east. (Photo: D. Huddart.)