TORVEAN

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OS Grid Reference: NH630420

Highlights

The landform assemblage at Torvean includes an excellent range of glaciofluvial features formed during the melting of the Late Devensian ice-sheet. It illustrates particularly well the evolution of a glacial drainage system and associated sedimentary environments during deglaciation.

Introduction

The Torvean site (centred on NH 630420) covers an area of *c.* 4.1 km^2 and forms part of an extensive zone of glaciofluvial deposits that extends more than 5 km south-west from the outskirts of Inverness on the west side of the River Ness. It contains an excellent assemblage of glaciofluvial landforms, including one of the best examples in Britain of a suite of kame terraces and one of the highest eskers. It is also important in demonstrating the development of an integrated marginal, submarginal and subglacial drainage system during the wastage of the Late Devensian ice-sheet. Several brief accounts of the Torvean landforms have appeared in the literature (Jamieson, 1865; Aitken, 1880; Horne and Hinxman, 1914; Ogilvie, 1923; Small and Smith, 1971), and they have been mapped in detail by Synge and Smith (1980) and Firth (1984).

Description

Torvean includes a suite of six major and five minor kame terraces, eskers, kames, river terraces and kettle holes (Figure 7.15) (Synge and Smith, 1980; Firth, 1984). The kame terraces form a striking "staircase' below 120 m OD on the valley side (Figure 7.10, T161–T171). The higher-level terraces merge eastwards with the massive Torvean and Tomnahurich eskers (over 68 m high); the lower terraces descend below the level of the Torvean esker. Below the lowest terrace (T171), at 60–70 m OD a series of eskers, kames and outwash terraces (T172–T174) are truncated abruptly to the south-east by an extensive bluff. Below is a suite of river terraces (T175–T181) with four separate levels (Firth, 1984), the highest three being Lateglacial in age and the lowest (T180 and T181) being Holocene in age; dating is based on the relationships observed between the terrace fragments and marine shoreline fragments (see Firth, 1984). In addition, there are terrace fragments (T178, T179 and T188) above the Holocene terrace which merge into kettled and channelled topography. At the eastern end of the site, terrace fragment T159 grades into a raised shoreline (S138) at 13.7 m OD. Kettle holes are frequent in the glaciofluvial deposits, including the impressive example at Poll Cruaidh. Well-bedded sands and gravels have been exposed in the quarry in the Torvean esker (NH 646432), but there have been no detailed sedimentological studies. Harris and Peacock (1969) recorded poorly-sorted gravel in a matrix of silty sand or silt, and also arched bedding in conformity with the topographic form of the ridge. The core of the esker, where it was formerly exposed, was formed of large boulders (J. D. Peacock, unpublished data). Near Dochgarroch (NH 620408) on the north-west bank of the Caledonian Canal, till has been recorded beneath the sands and gravels of the glaciofluvial deposits (Horne and Hinxman, 1914; Small and Smith, 1971).

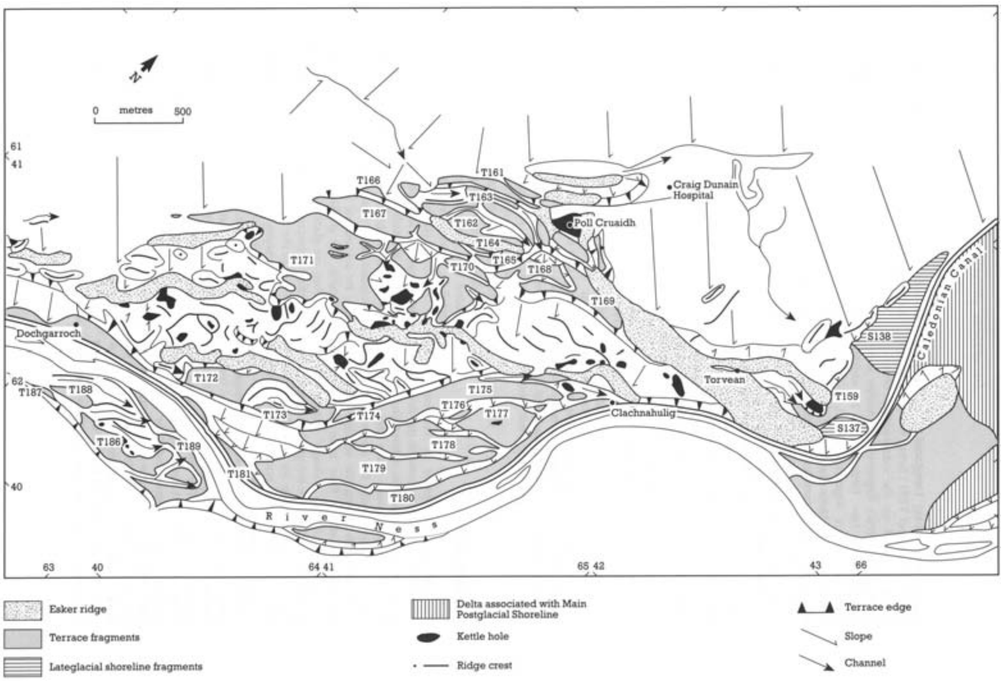

Figure 7.15: Geomorphology of the Torvean area (from Firth, 1984). The terrace fragments include kame terraces (T161–T171), Lateglacial outwash and river terraces (T172–179, T159), and Holocene river terraces (T180–181).

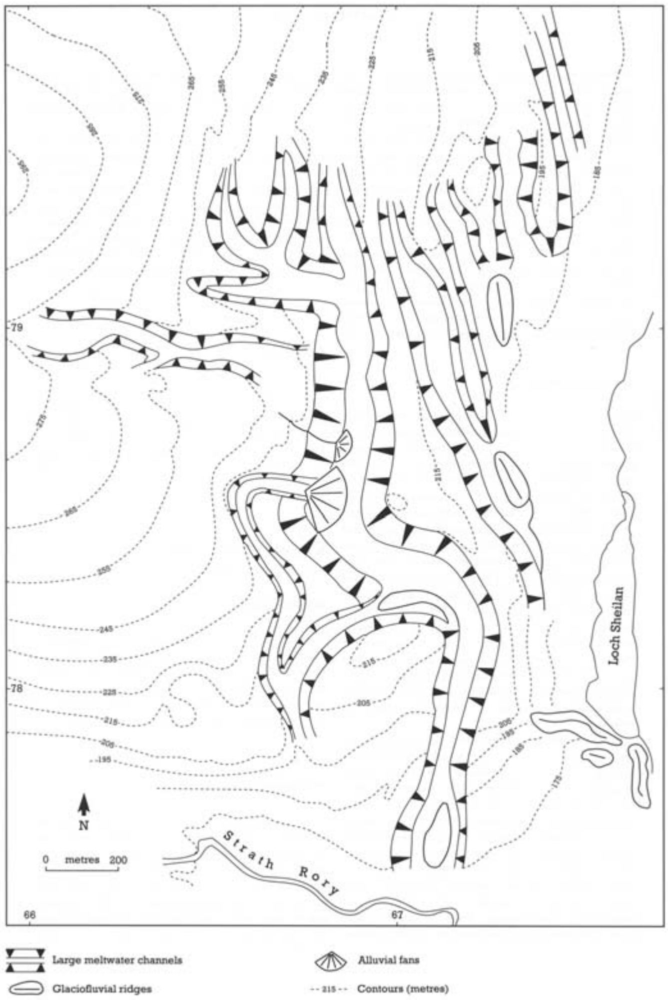

Figure 7.10: Geomorphology of the Struie meltwater channels, Strathrory (from J.S. Smith, 1968; Leftley, 1991).

Interpretation

The individual landforms at Torvean are all closely related and demonstrate the development of an integrated marginal, submarginal and subglacial drainage system when the Great Glen acted as a major route for meltwaters draining north-eastwards during the wastage of the Late Devensian ice-sheet. Two main stages in the development of the drainage system can be recognized. Initially, ice-marginal drainage associated with downwasting ice is indicated by the kame terraces. To the north-east, the drainage became subglacial, confined in an ice-walled tunnel in which the Torvean and Tomnahurich eskers were deposited. The lower kame terraces represent successive ice-marginal positions as ice wastage continued. The extensive kame and kettle topography and lower lying eskers then formed as the ice downwasted *in situ* on the valley floor, possibly in a manner similar to that described by Boulton (1972b) or Price (1973) in modern glacier environments. Meltwater continued to drain along the lowest kame terrace at the margin of the decaying ice mass and also through the ice via a system of eskers that lead north-eastwards to Clachnahulig (NH 644428).

In the lower part of the valley, between Loch Dochfour (NH 605387) and Clachnahulig, an extensive terrace system records the subsequent history of subaerial drainage development. The terraces form two groups according to their altitudes (Firth, 1984). The lower group occurs within a narrow, steep-sided valley, which includes the floodplain of the River Ness. Some of the lower terrace fragments have been interpreted as marine features, representing higher former sea levels in the Ness Valley and Loch Ness. Horne and Hinxman (1914) reported that the "25-foot' raised beach extended along the Ness Valley to a height of 50 ft (16 m) at Tomnahurich and Torvean.

According to one interpretation the sea also penetrated along the Ness Valley and into Loch Ness during the Lateglacial (Small and Smith, 1971; Synge, 1977b; Synge and Smith, 1980). Synge (1977b) and Synge and Smith (1980) inferred that two shorelines were present at 33 m and 25–28 m OD. The higher shoreline was represented at Clachnahulig in the form of a breached and infilled kettlehole. The lower shoreline was a major erosional feature, extending from Clachnahulig to Dunain, and it truncated both the glaciofluvial deposits and a river terrace graded to a lower sea level. It therefore represented a marine transgression. Synge (1977a, 1977b, 1980) placed these inferred shorelines in wider regional and national perspectives. However, from a detailed study of the Ness Valley and the shores of Loch Ness, Firth (1984, 1986) concluded there was no geomorphological evidence for any marine incursion into Loch Ness. In particular, the gradients of the terraces indicate that they are glaciofluvial or fluvial features. Firth therefore reinterpreted the shoreline fragments identified in the Ness Valley by earlier workers as outwash terraces, formed as the ice downwasted and retreated progressively into the Loch Ness Basin. As the ice margin retreated from Inverness to Loch Ness, relative sealevel fell from *c.* 35 m to 13.8 m OD. Firth suggested that this fall occurred after 13,000 BP.

The Ness Valley and Torvean deposits are also of interest in relation to the drainage of the ice-dammed lakes in Glen Roy and Glen Spean during the Loch Lomond Stadial. Jamieson (1865) first recognized a possible connection. He speculated whether the Torvean glaciofluvial deposits themselves might relate in some way to catastrophic drainage of the lakes. Although this specific link is now seen to be incorrect, Sissons (1979c, 1981c) developed the basic idea. Drainage of the Glen Roy and Glen Spean lakes via the Great Glen raised the level of Loch Ness. Overspill of water at the north-east end of the lake enlarged the valley of the River Ness and the floods of water deposited an extensive fan of bouldery gravel out into the Beauly Firth (see also Peacock, 1977a). Firth (1984) has elaborated on some of the details of this event, reconstructing the sequence of Lateglacial and Holocene changes in the level of the loch and demonstrating the links between the evidence around Loch Ness, in the Ness Valley and in the Beauly Firth (see Fort Augustus and Dores). Specifically, Firth concluded that the terrace fragments above the Holocene terrace at Torvean were formed during the flood associated with the drainage of the Glen Roy and Glen Spean ice-dammed lake.

Torvean is important in several respects. First, it contains what is believed to be the highest esker in Britain, with a height of over 68 m (Clapperton, 1977). Second, it contains what is one of the finest examples of a suite of kame terraces in Britain. Although individual examples of such landforms are not uncommon (see Moss of Achnacree and the Cairngorms), an assemblage such as that at Torvean is exceptional in terms of the size, extent and number of terraces present.

Third, the total landform assemblage at Torvean illustrates particularly well the relationships between different types of glaciofluvial deposits and landforms and the development of a marginal, submarginal and subglacial drainage system associated with the decay of the last ice-sheet. Torvean is exceptional among sites of this type in illustrating the relationships of kame terraces and eskers; at most other sites, drainage systems are represented by meltwater channels (see Struie Channels and Rammer Cleugh), kames or eskers (see Carstairs Kames), or by some combination of such landforms.

Fourth, the lower terraces at Torvean have a bearing on the interpretation of the Lateglacial history of Loch Ness, including the question of a marine incursion and the effects of the catastrophic drainage of the Glen Roy and Glen Spean ice-dammed lakes.

Fifth, Torvean is important in the wider regional context of glaciofluvial landform development in the Inverness area. Individually, Torvean, Kildrummie Kames and Littlemill provide classic examples of individual glaciofluvial depositional landforms; together they demonstrate within a relatively short distance what is arguably the finest group of such landforms in Britain.

Conclusions

Torvean is notable for glacial geomorphology, containing an outstanding range of landforms and deposits formed by the meltwaters of the last (Late Devensian) ice-sheet, between approximately 14,000 and 13,000 years ago. Not only are there particularly good examples of individual landforms (kame terraces, eskers, kames, kettle holes and river terraces), but the arrangement of the landforms and the relationships between different features (deposited beneath, in front of or along the side of the glacier) illustrate the development of the glacial drainage system as ice wastage progressed.

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