Extracted from the Geological Conservation Review
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ALMONDBANK

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OS Grid Reference: NO084262

Highlights

The sequence of deposits exposed in the river bank section atAlmondbank has provided important evidence for interpreting the pattern of deglaciation of the Late Devensian ice-sheet. Historically, this evidence was used to support a major readvance of the ice, but current understanding indicates progressive ice decay and deposition of the sediments in a prograding marine delta.

Introduction

This site (NO 084262) comprises a section on the north bank of the River Almond, located 1.75 km west of its junction with the River Tay and*c.* 1 km west of the outskirts of Perth. The sequence of deposits has provided important evidence for interpreting the pattern of decay of the Late Devensian ice sheet. In particular, it was first described and used bySimpson (1933) as evidence for a readvance, the Perth Readvance, which interrupted wastage of the ice sheet. The concept of this readvance was supported by Sissons (1963a, 1964, 1967a) as well as by Cullingford (1972), but the investigations of Paterson (1974), Browne (1980), Paterson *et al*. (1981) and Armstrong *et al*. (1985) have led to a rejection of the concept. The section at Almondbank, however, retains its importance in the interpretation of the deglaciation of this part of eastern Scotland.

Description

The sediments exposed in the Almondbank section comprise the following sequence, described by Simpson (1933) and Paterson (1974):

3.	Sands and gravels	4.6 m
2.	Laminated silts and clays	7.2 m
1.	Red-brown till	at least 3.7 m

Although Simpson (1933) described bed 3 as "morainic deposits', he recognized that the deposits were outwash, a view since confirmed bySissons (1963a) and Paterson (1974). The sands and gravels (bed 3) occur as terraces on both sides of the River Almond and contain large kettle holes immediately to the north of the section (Figure14.2).

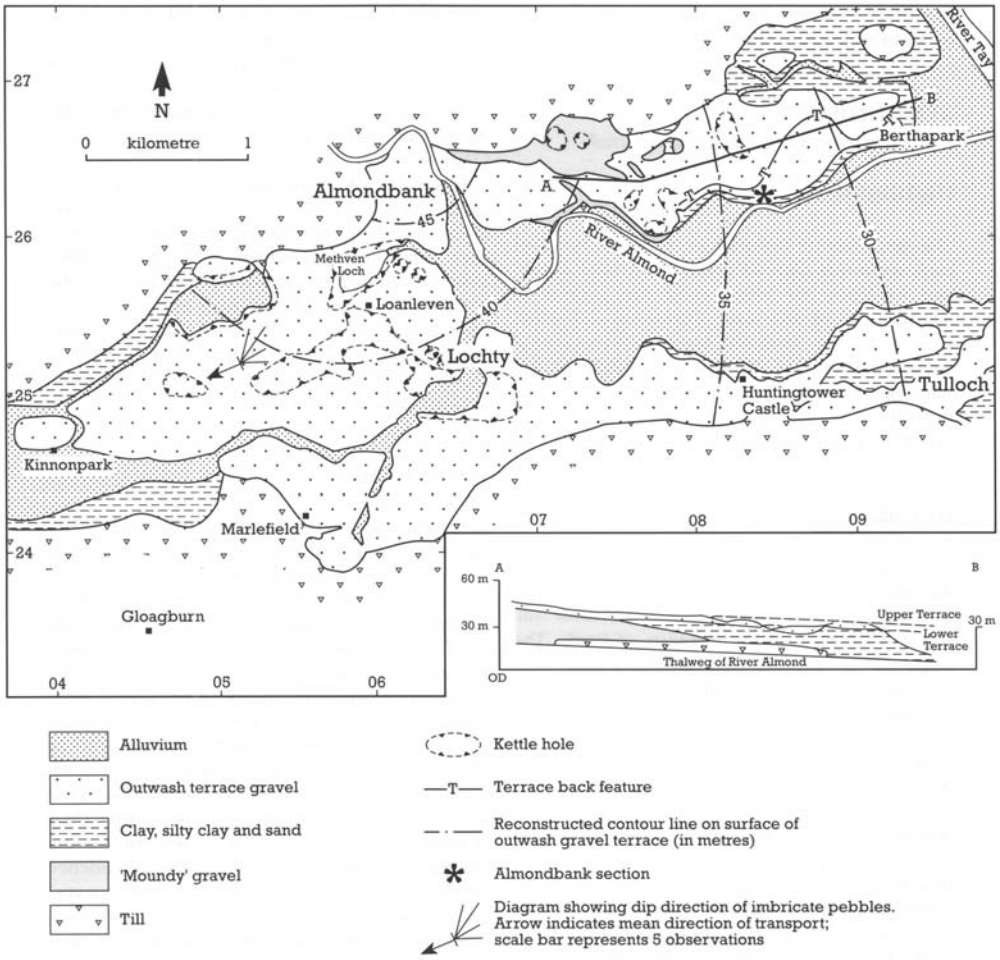

Figure 14.2: Map and section of Lateglacial deposits in the Almond Valley (from Paterson, 1974).

Paterson (1974) reported that the laminated sediments contained the mollusc*Portlandia arctica* (Gray), foraminifera and ostracods. Further details were provided byBrowne (1980) who reported a restricted microfauna with the foraminifera mainly being*Elphidium* clavatum (Cushman). Browne also established that the laminated silts and clays extended as far west as Crieff and that they had not been disturbed subsequent to deposition.

Interpretation

Simpson (1933) considered that the red-brown till (bed 1) was deposited by the last ice sheet to cover the area and that the laminated silts and clays (bed 2) were laid down immediately upon retreat of that ice sheet. Although he had found no fossils in the immediate vicinity, Simpson argued that the silts and clays correlated with the extensive fossiliferous marine clays (Errol beds, Peacock, 1975c) farther east in the Tay Estuary (Jamieson, 1865; Brown, 1867; Davidson, 1932). They could be traced as far west as Templemill (NN 875187), near Crieff, and Simpson inferred ice retreat to at least this locality during their deposition. In addition, Simpson interpreted the rhythmic bedding of these sediments as evidence of annual deposition (that is, they were varves) and estimated that the whole 12.2 m thickness atAlmondbank took 640 years to accumulate. It is of note that measurements on a similar sequence of laminated sediments at Dunning in the Earn Valley were matched byDe Geer (1935) with a Swedish varve sequence from which he inferred a date of deglaciation for that area of 13,013 to 13,071 BP.

The sands and gravels (bed 3) that overlie the laminated sediments are in a similar stratigraphic position to other, frequently poorly sorted, gravels which Simpson mapped in the Earn Valley as far west as Crieff. Simpson considered that these were the product of a readvance of the ice sheet. This conclusion was apparently confirmed by the occurrence of kettle holes in the sands and gravels, which implied the presence of ice at the time of their

deposition.

This interpretation of the Almondbank sequence was accepted by Sissons (1963a), although he suggested a modification to Simpson's readvance limit, placing it approximately 5 km north-west of Perth, where outwash graded into ice-contact glaciofluvial deposits. This latter limit was accepted by Cullingford (1972) who correlated the maximum of the readvance with a pronounced raised shoreline (the Main Perth Shoreline) which had been traced widely along the coasts of south-east Scotland; this shoreline also apparently correlated with a corresponding ice margin in the Forth Valley (Sissons and Smith, 1965a; Sissons *et al.*, 1966; Cullingford, 1977).

Subsequent work by the Geological Survey in the Earn-Tay area (summarised inPaterson *et al.*, 1981; Armstrong *et al.*, 1985) has confirmed Simpson's (1933) stratigraphic sequence, but effectively demonstrated that it is not necessary to invoke a readvance to explain it.Paterson (1974) found evidence that could be interpreted as indicating a readvance at only two localities; Almondbank, where the kettled outwash overlay laminated sediments, andShochie Burn (see below), where two tills were separated by a layer of sand and gravel. However, Paterson argued that the general absence in the area of an overlying second till together with the lack of disturbance of the laminated sediments precluded a readvance. The contained fossils confirmed the marine origin of the silts and clays, but Paterson argued that, if they were varves, then their period of formation would have been considerably greater than that estimated by Simpson since their thickness was proven to be much greater in boreholes downvalley from the Almondbank section. Alternatively, Paterson contended that these sediments were not varves, but that they accumulated by repeated discharge of material, possibly several times annually, in a marine delta advancing down the lower Almond Valley where there were still areas of stagnant ice (Figure 14.2). With the final decay of the "dead' ice, outwash containing kettle holes was left on top of the deltaic sediments.

According to Browne (1980), the altitudinal distribution of the laminated sediments implied that the sea at the time of the formation of the Main Perth Shoreline had penetrated much farther to the west than Cullingford (1972, 1977) had suggested and that hence the Main Perth Shoreline was not associated with an ice margin immediately north-west of Perth. The overall picture to emerge from the work of the Geological Survey was one of continuous ice retreat with deltaic sedimentation by the major rivers such as the Tay, Earn and Almond into a marine embayment stretching as far west as Crieff and occupying, at its maximum extent, the Methven depression between there and Almondbank.

The Almondbank section is one of considerable historical significance in the development of understanding of the glacial history of Scotland. The original interpretation of the sequence as resulting from a major readvance of the last ice sheet at approximately 13,000 BP has now been rejected in favour of an origin as the product of deltaic progradation following earlier uninterrupted deglaciation of the area. The sediments retain their interest, however, as one of the few accessible exposures of the marine, laminated deposits (equivalent to the Errol beds) in east-central Scotland.

Conclusions

The sequence of deposits at Almondbank is important for interpreting the mode of deglaciation of the Late Devensian ice sheet (approximately 14,000–13,000 years ago). Historically, it was the key reference site used to substantiate a major ice readvance, the Perth Readvance. Although the deposits have now been re-interpreted in terms of a delta that built seawards during uninterrupted decay of the ice sheet, the site retains both its historical significance and its high value for sedimentological studies.

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