Maryton

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Highlights

Deposits in the coastal section at Maryton include a sequence of estuarine sediments and buried peat. These deposits provide a record of the changes that occurred in sea level and coastal environmental conditions during the Holocene. The site is particularly notable for the evidence it displays for a major coastal flood in eastern Scotland during the middle Holocene.

Introduction

The site at Maryton [NO 683 565] is a cliff section in raised estuarine deposits on the west side of the Montrose Basin. It is important for demonstrating Holocene sea-level fluctuations in eastern Scotland and provides one of the best exposures showing the stratigraphic relationships of the estuarine (carse) deposits of the Main Postglacial Shoreline. It is also the only site known where a possible storm-surge or tsunami deposit dating to slightly prior to the maximum of the Main Postglacial Transgression is currently exposed. The site has been described by Smith *et al.* (1980) and discussed in a wider context by Smith *et al.* (1985*a); it has also been illustrated in Smith *et al.* (1985a), Long *et al.* (1989b) and Smith and Dawson (1990).

Description

The superficial deposits of the Montrose area were first described in detail by Howden (1868) and later summarized by him (Howden, 1886) in the following general succession:

6. Blown sand

5. Estuarine (carse) clay and sand

4. Peat

3. Glaciofluvial sands and gravels

2. Laminated marine clay

1. Till

The basal unit of till was overlain by laminated marine clay extending up the South Esk Valley to an altitude of 40 ft (12.2 m). Although the contact between the two was nowhere exposed, Howden was in no doubt of their stratigraphic sequence. The clay (bed 2) contained abundant fossil remains of arctic molluscs which Howden (1868) listed (see Dryleys). Jamieson (1865) gave additional details, and Brady *et al.* (1874) listed the ostracods.

Howden described sands and gravels (bed 3) overlying the marine clay and the till, which extended as far inland as the mouths of the Highland glens. These gravels were part of the sequence first described by Buckland (1841a), and in mineralogical composition were identical to the moraines of the Highland glens. Howden suggested that the sands and gravels were formed by meltwaters at the end of the great ice-sheet glaciation and subsequently while valley glaciers remained in the glens. Cullingford and Smith (1980) have mapped these deposits to the west of the Montrose Basin and noted that four separate outwash terraces can be related to distinct shorelines at altitudes of between 15 m and 25 m OD around the Montrose Basin.

In a number of stream courses tributary to the South Esk, Howden observed peat (bed 4) resting on the marine clays and extending on to the gravels. At one locality the peat was overlain by carse clays. Generally, however, the latter deposits rested on the lower marine clay and reached an altitude of 15 ft (4.6 m). Shells similar to those found in the present-day estuary were locally abundant in the carse clay. Details were given by Jamieson (1865) and Howden (1868). More recently, the pattern of Holocene sea-level changes in the Montrose area has been investigated in detail by Crofts (1971, 1972, 1974) and Smith and Cullingford (1985). In particular, Maryton has been described in detail by Smith *et al.* (1980). A sequence of marine and non-marine organic deposits infills a number of gullies dissecting Late Devensian marine and glaciofluvial terraces at the western end of the Montrose Basin (Cullingford and Smith, 1980; Smith *et al.,* 1980). A section in a terrace bluff at Maryton shows (Figure 14.5):

5. Grey silty clay (carse)	0.85 m
4. Peat	0.10 m
3. Grey, micaceous, silty fine sand	0.18 m
2. Peat	0.15 m
1. Laminated, pink silty clay	0.20 m

The sequence in the section is broadly similar to that revealed in boreholes in the Fullerton area 0.5 km to the west (Smith *et al.,* 1980). Samples for pollen analysis were taken from the Maryton section and two coring sites at Fullerton by Smith *et al.* (1980). They recognized three pollen assemblage zones at Maryton (Figure 14.6). Zone M–1 includes poorly preserved pollen from most of the laminated, pink silty clay (bed 1). Although the pollen frequencies are low and the range of taxa restricted, open habitat conditions are indicated. Zone M–2 includes pollen from the horizons between the upper layers of the pink silty clay (bed 1) and the lowest part of the carse clay (bed 5). Contrasts in pollen frequency and assemblage suggest a break in deposition between zones M–1 and M–2. The main characteristics of zone M–2 are the consistent representation of *Betula* and *Pinus sylvestris,* variable amounts of *Corylus*-type and *Salix*-type pollen and the presence of *Ulmus* and *Quercus.* Several taxa also suggest the proximity of damp conditions (Gramineae, Cyperaceae, Chenopodiaceae, Nymphaceae and *Filipendula*). Zone M–3 includes the greater part of the carse clay. The main representatives of M–3 are *Pinus sylvestris, Colylus* type, *Betula, Ulmus* and *Quercus.* Other taxa (Nymphaceae and Cyperaceae) again indicate local damp conditions.

Smith *et al.* (1980) correlated pollen zone M–1 with an equivalent zone from a similar, basal, laminated clay layer in one of the Fullerton boreholes. It was thought to reflect an open-habitat, Late Devensian environment. Zones M–2 and M–3 also have equivalents with similar tree and herbaceous pollen in both the Fullerton boreholes. These assemblages indicate a boreal environment, corresponding with Holocene 'chronozone' Fl I of West (1970). An additional zone, corresponding with 'chronozone' Fl II, is represented in one of the Fullerton profiles.

Smith *et al.* (1980) obtained radiocarbon dates for several horizons at Maryton and Fullerton (Table 14.4).

Interpretation

Sequences similar to those described by Howden (1868, 1886) from the Montrose area have long been recognized elsewhere in the Tay, Forth and Ythan estuaries. Together with the evidence from these other sites, the Montrose deposits have formed an important part of the wider interpretation of Lateglacial and Holocene sea-level changes in eastern Scotland (Jamieson, 1865; J. Geikie, 1874; Wright, 1937; Sissons, 1967a; Cullingford *et al.,* 1986, 1991). A full sequence of Lateglacial and Holocene deposits is nowhere exposed, but the section at Maryton demonstrates a key part of the succession spanning the period of the transgression associated with the Main Postglacial Shoreline; the Lateglacial part of the succession is represented at Dryleys (see above).

(Table 14.4) Radiocarbon dates on sand layer in peat at Maryton and Fullerton (Smith *et al.,* 1980)

Sample	Location	Date (14C years BP)	Laboratory number
0.02 m thick band of peat above basal laminated silty clay (bed 1)	Maryton	7340 ± 75 BP	SRR–869

0.02 m thick band of peat below sand layer	Fullerton	7140 ± 120 BP	Birm–823
0.02 m thick band of peat above sand layer	Fullerton	6880 ± 110 BP	Birm–867
0.02 m thick band from top of peat below the carse	Fullerton	7086 ± 50 BP	SRR–1149
0.02 m thick band from base of peat above the carse	Fullerton	6704 ± 55 BP	SRR–1148

Although the inversion of SRR–1149 and Birm–867 could reflect reworking or contamination, Smith *et al.* (1980) point out that the two dates are not statistically different at the 95% confidence level, and therefore suggest a mean age of 6983 ± 60 BP for peat above the sand layer.

In the Maryton sequence the basal, laminated, silty clay is interpreted as a Late Devensian estuarine deposit (see Dryleys above) (Smith *et at,* 1980). There is then a break in the sequence of deposits until peat began to form during the Holocene about 7340 BP. About 7140 BP, the peat accumulation was interrupted by deposition of the grey, micaceous, silty sand layer, before resuming until about 6980 BP, when it was terminated by deposition of the carse.

On geomorphological and stratigraphic grounds Smith *et at* (1980) correlated the carse surface in the Maryton area with the Main Postglacial Shoreline of eastern Scotland (see Sissons *et at,* 1966). The radiocarbon dates show that the Main Postglacial Transgression associated with this shoreline was in progress at 7140 BP and possibly culminated between about 6983 and 6704 BP. In the context of the age of the Main Postglacial Shoreline, these dates are older than those from stratigraphically similar sites in the Tay estuary and eastern Fife (Chisholm, 1971; Cullingford *et al,* 1980; Morrison *et al,* 1981*; Smith et al,* 1985b), but similar to the dates obtained in the Western Forth Valley (Sissons and Brooks, 1971).

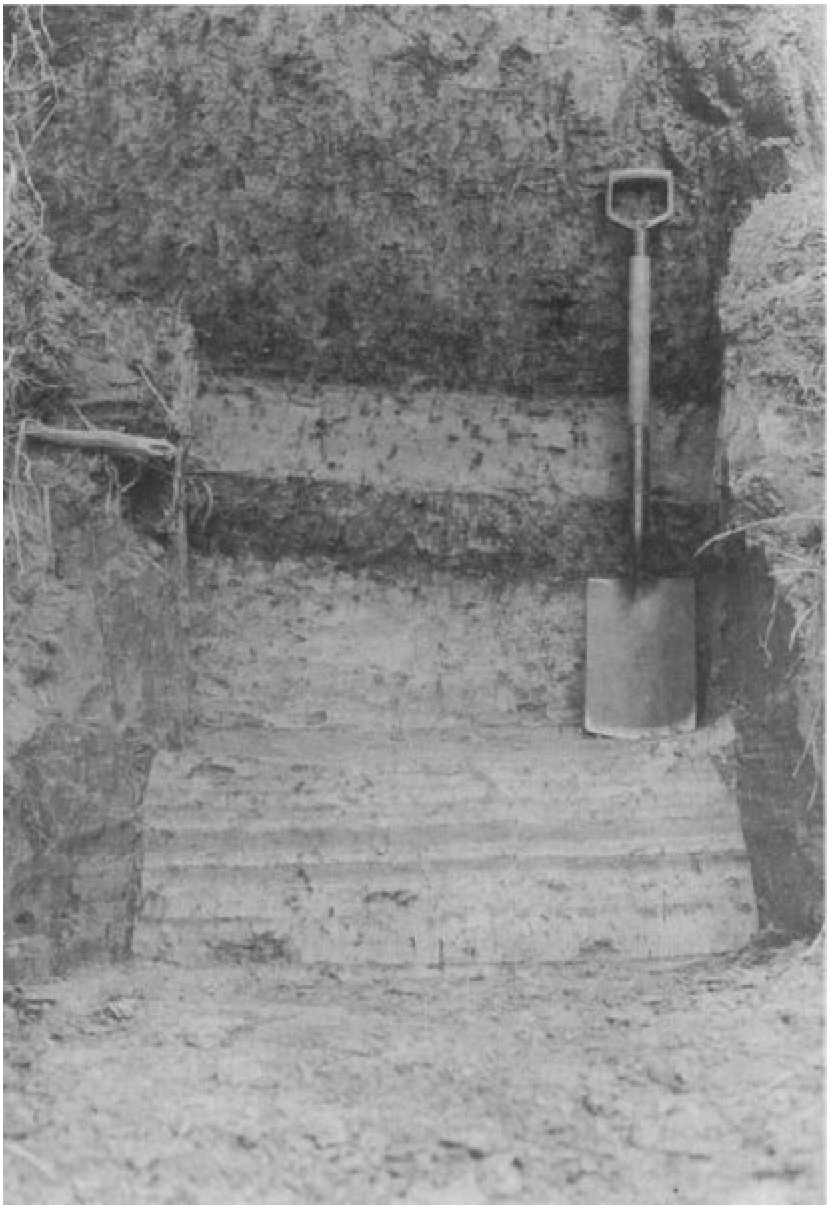
The grey, micaceous, silty sand layer has recently attracted particular attention since it appears to represent a high-magnitude marine event, and Maryton has become a reference site for demonstrating its stratigraphic position and sedimentary characteristics. It has also been identified in boreholes at Fullerton, Dryleys and other sites around the margins of the Montrose Basin. At Puggieston (see Dryleys), the top and base of pests below and above the sand have been dated respectively to 7120 ± 75 BP (SRR–2120) and 6850 ± 75 BP (SRR–2119), dates that are indistinguishable from the similarly placed samples at Fullerton. A similar sand layer occupying the same stratigraphic position and giving approximately the same radiocarbon age has now been detected at a number of sites on the east coast of Scotland ranging from the Beauly Firth in the north to the Carse of Stirling in the south (see Western Forth Valley, Silver Moss and Barnyards). It has been argued that this unique deposit was possibly the result of a major storm surge in the North Sea Basin around 7000 BP (Smith *et al,* 1985a; Haggart, 1988b) or, more probably, a tsunami associated with a major submarine slide on the Norwegian continental slope (Dawson *et al,* 1988; Long *et al,* 1989a, 1989b).

The section at Maryton therefore provides important stratigraphic evidence for Holocene sea-level changes in the Montrose Basin area. It is significant in several respects. First, as one of the best sections in eastern Scotland illustrating the Main Postglacial Transgression, Maryton is an integral member of a network of sites in this area (see Western Forth Valley, Pitlowie, Silver Moss and Philorth Valley) which together have important research potential for establishing the diachroneity of the culmination of the Main Postglacial Transgression and the formation of the Main Postglacial Shoreline and therefore have potential for elucidating the wider regional patterns of glacio-isostatic and eustatic changes. Second, since Maryton is the only location where the tsunami deposit is exposed, it is critically important in further studies of this event. Third, in a historical context, Maryton is also significant for its location in one of a number of key reference areas recognized for over 100 years as illustrating the pattern of Lateglacial and Holocene sea-level change.

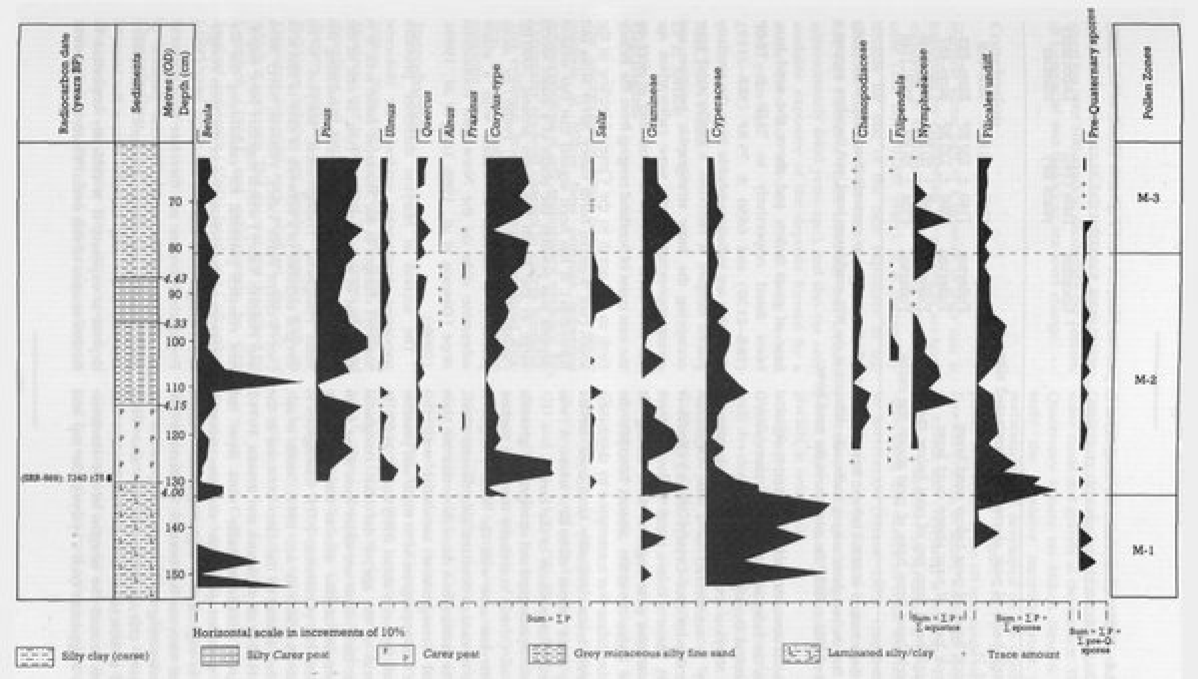
Conclusion

Maryton forms part of a network of sites that is important for establishing the pattern of sea-level variations in eastern Scotland during the Holocene (the last 10,000 years). It is particularly notable for one of the best exposures in the estuarine deposits of the Main Postglacial Shoreline (an extensive raised shoreline that formed approximately 6800 years ago), and also the only available exposure of the deposits formed by a major flood that affected coastal areas around 7000 years ago.

[References](#)



(Figure 14.5) Section at Maryton. Laminated Late Devensian marine clays are overlain by peat then a layer of grey, micaceous, silty, fine sand interpreted as a tsunami deposit. Above the latter is silty peat then carse clay. (Photo: D. E. Smith.)



(Figure 14.6) Marylon: relative pollen diagram showing selected taxa as percentages of total pollen (from Smith et al., 1980).

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