Dryleys

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Highlights

The sequence of estuarine sediments in the former clay pit at Dryleys has yielded an important fossil fauna which, in conjunction with geomorphological and sedimentary evidence from the adjacent area, provides a detailed picture of sea-level changes and conditions in the marine environment during the Lateglacial.

Introduction

The Dryleys site [NO 709 604] is a former claypit in Late Devensian and Holocene estuarine sediments near Dryleys Farm, north of Montrose. During the latter part of the 19th century, the pit yielded the shells of a largely marine, cold-climate fauna, collected by J. C. Howden. A partial list of the fauna is contained in his account (Howden, 1868) of the sequence of glacial events and relative sea-level changes in the Montrose area. Recent studies by Smith *et al.* (1977), Cullingford and Smith (1980) and Smith and Cullingford (1985) have further contributed to knowledge of Late Devensian and Holocene relative sea-level change in the area, and they enable the Dryleys fauna and deposits to be placed in a more detailed palaeoenvironmental context.

Description

The hillslopes on the northern side of the Montrose Basin are marked by a large number of terraces between Langleypark and Hillside (Figure 14.4). These terraces have been mapped and surveyed by Cullingford and Smith (1980) and Smith and Cullingford (1985). Above 25 m OD, the terraces are glaciofluvial in origin, declining rapidly in altitude eastwards and, from available exposures, are largely composed of poorly sorted sands and gravels. Below 25 m OD, the terraces are marine in origin. Between 10 m and 25 m OD, they are composed of generally fine-grained deposits, largely fine sands and silts, becoming increasingly clayey with depth. These terraces decline only gently eastwards, and at least one appears as the continuation of a higher glaciofluvial terrace, where glacial outwash reached standing water. The marine terraces are, however, fragmentary, being deeply dissected by gullies, most of which formed during the Late Devensian and are now dry. The lower reaches of these gullies are infilled by grey silty clay, reaching a maximum altitude of 6 m to 7 m OD. These sediments underlie a large flat area along the Tayock Burn, reaching the edge of the Montrose Basin. The grey silty clay is similar to the estuarine (carse) clay found in similar areas of central Scotland, and is considered to be the local equivalent of the carse clay. The surface which it forms, here as elsewhere, is distinguished by its uniformity and consistent altitude.

The Dryleys claypit lies on the eastern side of a gully at the eastern margin of this area (Figure 14.4). On the slopes around the gully, terraces formed at approximately 23 m, 19 m, 18 m, 15 m and 13 m OD as relative sea level fell. The claypit is excavated into the 13 m surface which is the main surface in the area, and several exposures, one over 4 m high, occur in the southern face of the pit. This shows laminated sandy silts becoming coarser with depth. These marine sediments are older than the carse clay that occupies the floor of the gully here, although it is not exposed.

During the 19th century, J. C. Howden made a collection of fossil remains from excavations in the Montrose area. This collection was given to the Montrose Museum, where it is still held (1990). Much of the collection was obtained from the carse clay, but from the older terrace deposits above the carselands Howden also obtained a largely arctic fauna, most of which appears to have come from claypits at Dryleys and Puggieston (Figure 14.4). This fauna is listed in Howden's (1868) paper, differing slightly from the museum collection in (Table 14.1).

The following details are also provided by J. D. ranging from slightly weathered to fresh and Peacock (unpublished data). The preservation of unweathered, whereas that of the other fossils is the specimens of *Arctica islandica is* good, poor.

This contrast suggests that the *Arctica* specimens are an intrusion into the high-arctic, fully marine fauna, a conclusion that accords with radiocarbon dating (see above). The specimens of *Yoldiella solidula* and *Y. lenticula* from Puggieston presumably came (as *Leda pygmaea*) from the tympanic bones of the seal *Phoca vitulina* L. (see Howden, 1868, p. 141). The list of ostracods from Dryleys given by Brady et al. (1874) supports the high-arctic affinities of the fauna.

(Table 14.1) Faunal remains (collected by J. C. Howden) in the Montrose area and attributed to a cold-climate environment

Museum specimen	Location	Modern name
Cyprina islandica	Dryleys	*Arctica islandica* (L.)
Leda arctica	Not given	*Portlandia arctica* (Gray)
Nucula tenuis	Not given	*Nuculoma tenuis* (Montagu)
Pecten greenlandicus	Dryleys	*Arctinula greenlandica* (Sowerby)
Saxicava sulcata	Dryleys	*Hiatella arctica* (L.)
Yoldia arctica	Dryleys	*Portlandia arctica* (Gray)
Somateria sp.	Puggieston	
Cythere sp.	Not given	
Ophiolepis gracilis	Dryleys	
Phoca vitellinus	Balwyllo	*Phoca vitulina* L.

An investigation of the Howden Collection in the Montrose Museum showed the following molluscan fauna to be present (J.D. Peacock, unpublished data).

Dryleys: *Arctinula greenlandica* (Sowerby), *Hiatella arctica* (L.), *Mya truncata* (L.) *Nuculoma belloti* (Adams), *Portlandia arctica* (Gray) and *Yoldiella* cf. *lenticula* (Müller).

Puggieston: *Arctica islandica* (L.), *Hiatella arctica* (L.), *Nuculoma* cf. *belloti* (Adams), *Yoldiella solidula* Waren and *Y. lenticula* (Müller).

Ballwyllo: *Arctinula greenlandica* (Sowerby).

Unplaced specimens: *Arctica islandica* (L.), *Arctinula greenlandica* (Sowerby), *Hiatella arctica* (L.) and *Portlandia arctica* (Gray).

(Table 14.2) Radiocarbon dates from faunal remains in the Montrose area

Sample	Location	Age (14C years BP)	Laboratory number
[1]*Somateria mollissima*	Puggieston	10,610 ± 220	Birm–660
[1]*Somateria* sp. or *Melanitta* sp.	Puggieston	11,110 ± 210	Birm–661
[2]*Arctica islandica*	Dryleys		
Outer fraction		3830 ± 140	Birm–737(1)
First middle fraction		4180 ± 120	Birm–737(2)
Second middle fraction		4170 ± 160	Birm–737(3)
Inner fraction		4020 ± 200	Birm–737(4)

[1]Smith *et al.* (1977); Williams and Johnson (1976). [2]Smith (1986).

The principal difference between the faunal list contained in the 1868 paper and the specimens preserved in the museum is the presence of duck bones in the museum, identified as those of Eider (*Somateria* sp.). These bones, collected in 1891 from the claypit at Puggieston, were re-examined by D. Bramwell in 1976 and are believed to belong to two individuals, identified as Eider (*Somateria mollissima* (L.) and either Eider, or Scoter (*Melanitta* sp.) (Smith *et al.,* 1977).

Smith *et al.* (1977) sought to determine the age and environment of the fauna. They examined pollen from the clay in which the Eider bones were embedded, finding evidence of an open habitat, with Gramineae, Cyperaceae, *Empetrum, Artemisia* and Rosaceae pollen grains present. (Table 14.2) gives the radiocarbon dates from the duck bones and a specimen of *Arctica islandica.*

Smith and Cullingford (1985) identified a buried peat beneath the grey silty clay, and, in addition, found a layer of grey, micaceous, silty fine sand within the deposits in several of the gullies, including that at Dryleys. From peat above and below this layer, in the nearby gully at Puggieston, they obtained radiocarbon dates (Table 14.3).

(Table 14.3) Radiocarbon dates on a possible storm surge layer at Puggieston, after Smith and Cullingford (1985)

Sample	Date (14C years BP	Laboratory number
0.02 m thick slice of peat above layer	6850 ± 75	SRR–2119
0.02 m thick slice of peat below layer	7120 ± 75	SRR–2120

Interpretation

The morphology of the area surrounding Dryleys indicates that the pit was excavated in deposits belonging to one of a series of eight Late Devensian shorelines in the region, formed as ice withdrew from the Montrose Basin area. The five terraces surrounding the gully at Dryleys are correlated with shorelines DS3 to DS7 of Cullingford and Smith (1980), with the pit having been excavated in the deposits of DS7. Cul-lingford and Smith identified the nearby deposit at Puggieston as belonging to the same sequence, but related to the lowest shoreline, DS8, one below that at Dryleys. The largely cold-climate faunal remains recovered from the pit during the 19th century are in accord with this interpretation, as is the limited pollen evidence from the deposit. The radiocarbon dates obtained from faunal remains from Dryleys and Puggieston are of limited value. The dates for the *Arctica islandica* shell specimen, although internally consistent, are far too young for a Late Devensian deposit, and since this bivalve has a wide environmental range, the possibility of incorrect labelling in the museum collection must be considered. The dates for the duck bones are older, but apparently also too young, and museum conservation practices may have produced contamination. Thus, in view of the uncertainty of the radiocarbon evidence all that can be said at present is that the deposits are of Late Devensian age.

The gully system at Dryleys is largely dry, and in view of the extensive Holocene estuarine deposits in the floor of the gullies, it seems likely that, by analogy with similar features elsewhere in Scotland (see Sissons *et al.,* 1965), the gully system was largely excavated under periglacial conditions during the Late Devensian.

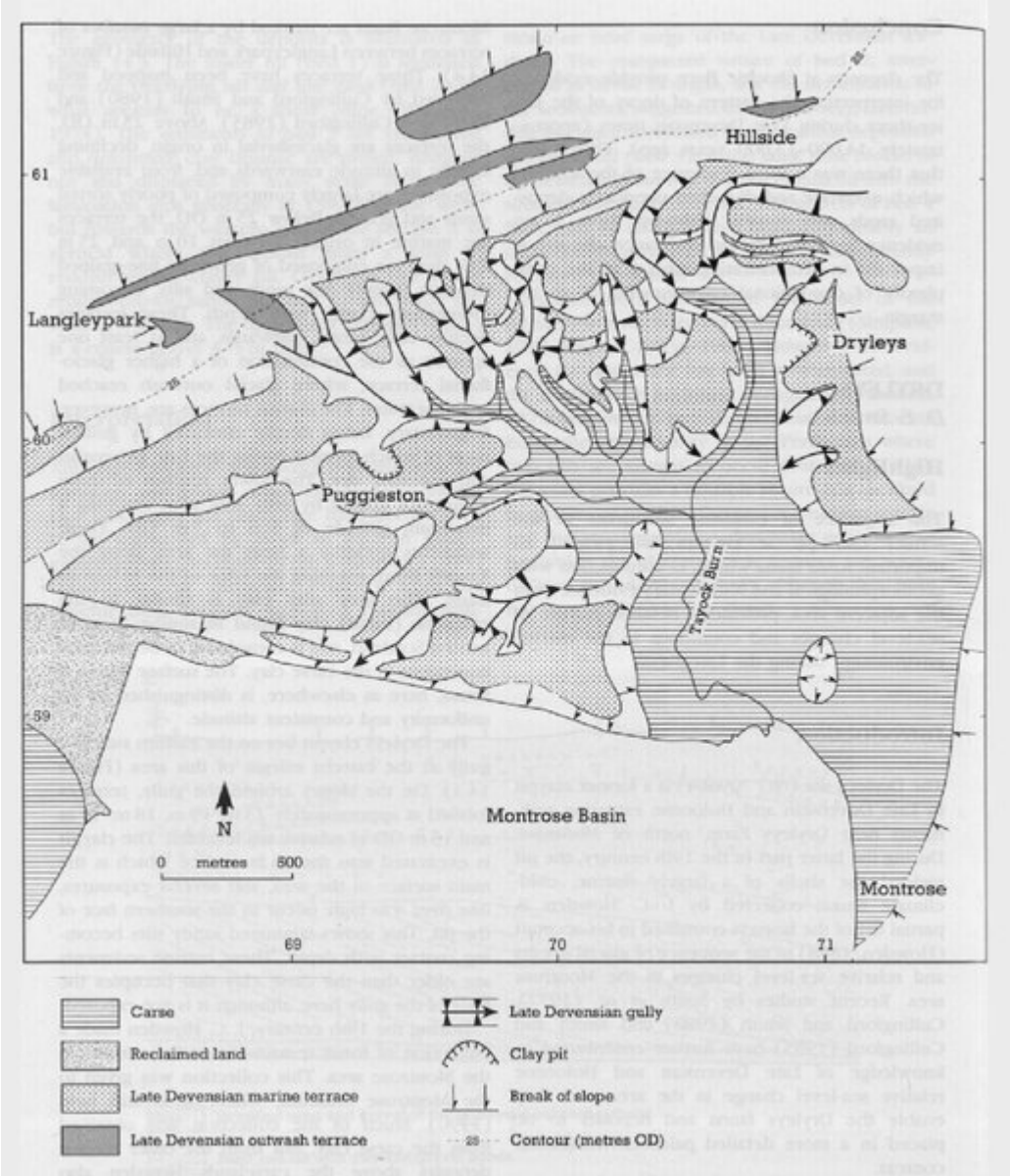
Smith and Cullingford (1985) confirmed that the grey silty clay infilling the floors of the gullies was a Holocene estuarine deposit accumulated during the Main Postglacial Transgression, and that the surface on the deposit was formed at the maximum of that event in the area, correlating with the Main Postglacial Shoreline. A layer of grey, micaceous, silty fine sand was formed in the course of the transgression and then buried by later deposits. This layer has been identified at a number of estuarine sites in eastern Scotland (see Maryton, Silver Moss and Western Forth Valley), and must have been a widespread event (Smith *et al.,* 1985a). It has been interpreted as a storm surge event (Smith and Cullingford, 1985; Smith *et al.,* 1985a; Haggart, 1988b), or more probably as a tsunami associated with a submarine slide on the Norwegian continental slope (Dawson *et al.,* 1988; Long *et al.,* 1989a).

The Dryleys claypit is of great importance for studies of the Late Devensian environment in Scotland. Excavated into a terrace which forms part of a suite of Late Devensian marine shorelines in the area, it yielded during the 19th century a largely cold-climate fauna which is still preserved and available for study; present-day exposures provide the potential for further sedimentological and palaeoecological investigation. In addition, the site lies in an area rich in Late Devensian and Holocene landforms and deposits. The evidence it contains can thus be set in a wider context, in which the relationships between morphology and stratigraphy are clearly demonstrated. There are few other Late Devensian sites in eastern Scotland where such an extensive and varied faunal record has been identified.

Conclusion

Dryleys is important for studies of Late Devensian sea levels in eastern Scotland. The deposits form part of a series of marine terraces that formed during and following the deglaciation of the area (possibly between 16,000 and 14,000 years ago) and were first studied last century. They have yielded a range of fossils which have been used to interpret a cold-climate marine environment at their time of deposition. Adjacent deposits include later Holocene marine sediments. Dryleys is a valuable reference site in an area of long-standing interest for sea-level studies.

[References](#)



(Figure 14.4) Lateglacial and Holocene raised marine deposits in the Dryleys area.

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Puggieston: *Arctica islandica* (L.), *Hiatella arctica* (L.), *Nuculoma* cf. *belloti* (Adams), *Yoldiella solidula* Warén and *Y. lenticula* (Müller).

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