TEINDLAND QUARRY

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Highlights

The sequence of deposits at Teindland Quarry includes a palaeosol which has yielded pollen of both interglacial and interstadial affinites. Sites which preserve such evidence are rare, and Teindland is a key locality for interpreting the Quaternary history of Scotland.

Introduction

Teindland Quarry (NJ 297570) is located in Teindland Forest in lower Strathspey, 5 km south-west of Fochabers at an altitude of approximately 100 m OD. It is one of a few known sites on the Scottish mainland where organic deposits older than the Late Devensian have been both radiocarbon dated and analysed for pollen. Since its original description by FitzPatrick (1965), the site and its interpretation have proved controversial (Edwards *et al*., 1976; Romans, 1977; Sissons, 1981b, 1982c; Caseldine and Edwards, 1982; Lowe, 1984). Despite the significance of the site, no detailed description has yet been published of the full succession.

Description

The section originally described by FitzPatrick (1965) showed 1.8–2.4 m of sandy till and outwash gravel overlying an iron podsol developed on glaciofluvial outwash (Figure 8.7). A radiocarbon date of 28,140 +480/-450 BP (NPL-78) was obtained from the soil.

Figure 8.7: Fossil podsol and overlying organic horizon at Teindland. (Photo: D. G. Sutherland.)

More data were provided by Edwards *et al*. (1976), particularly with respect to the pollen content of the sediments. They described a more complex succession than was recognized by FitzPatrick (1965) (*cf.* Figure 8.8):

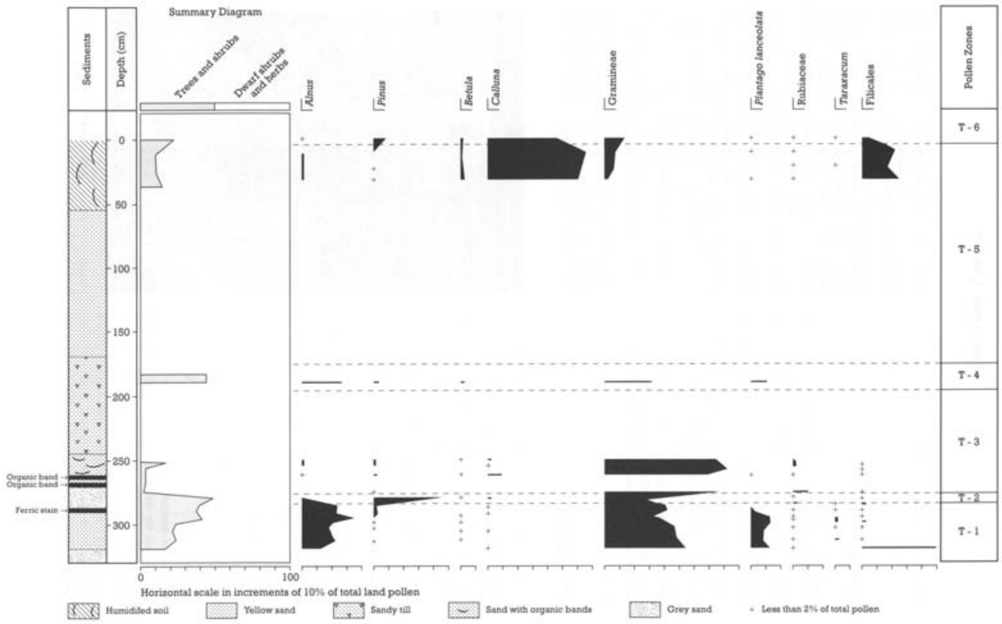

Figure 8.8: Teindland: relative pollen diagram showing selected taxa as percentage of total land pollen (from Edwards et al., 1976; Lowe, 1984).

5.	Humified modern soil layer.	c. 0.56 m
4.	Yellow sand.	c. 1.11 m
3.	Sandy till.	c. 0.74 m
2.	Interbedded sequence of grey and yellow sands and black organic layers.	c. 0.31 m
1.	Fossil podsol developed in a sequence of yellow and grey sands with an iron-rich horizon *c.* 0.17 m below the top of the unit.	0.56 m

Six pollen assemblage zones (Figure 8.8) were recognized by Edwards *et al*. (1976), although the upper two (T-5 and T-6) related to the present soil horizon (bed 5) and a single pollen spectrum (T-4) was from a sandy horizon in the till which was considered to have been reworked from the sands beneath (bed 1). Within the basal sands below the iron-rich horizon, Edwards *et al*. identified a pollen assemblage zone (T-1) that contained high proportions of *Alnus*, Gramineae and *Plantago lanceolata*. Also present were low frequencies of *Betula*, *Quercus* and *Corylus* pollen. One sample had up to 50% Filicales spores. The iron-rich horizon yielded a single pollen spectrum (T-2), markedly different from that in the sand below (zone T-1) with little *Alnus*, high values of *Pinus* pollen, a significant level of *Calluna vulgaris* pollen and a reduced percentage of Gramineae. Above this, and coinciding with the interbedded sequence of sands and organic horizons, pollen counts (zone T-3) were dominated by Gramineae and there was a low representation of tree pollen and an erratic component of *Calluna vulgaris*.

Romans (1977) added the further observations that the A horizon at the top of the buried soil was composed of heavily charred organic material together with coniferous charcoal and that the deposition of this material was contemporaneous with the development of frost cracks in the soil.

Interpretation

FitzPatrick (1965) considered that the degree of soil development was the product of interglacial conditions and cautioned that the radiocarbon date on the soil should be regarded as minimal because of the lack of alkali pre-treatment. The site therefore apparently revealed evidence for a period of glaciation followed by an interglacial (?Ipswichian) then periglaciation and further glaciation (?Late Devensian).

Interpretation of the pollen data was made difficult by the possibilities of reworking during erosion of the palaeosol, differential pollen preservation in soils and downwashing of pollen grains through the sandy sediments. These difficulties notwithstanding, Edwards *et al*. (1976) suggested that zone T-1 represented the vegetation of an interglacial, and drew attention to the similarities in the pollen spectra dominated by *Alnus* and *Plantago lanceolata* and pollen assemblages from the later part of certain interglacial sequences assigned to the Ipswichian in East Anglia (see Phillips, 1976). The sole spectrum comprising zone T-2 was considered most probably to represent the closing phase of the interglacial represented by zone T-1, possibly coinciding with the period of podsol formation.

Zone T-3 was more complex and more difficult to interpret. Edwards *et al*. thought that the basal spectrum in this zone might either indicate cold climatic conditions immediately following the interglacial, or it was part of the sequence of interbedded sand and organic horizons that produced the remainder of the samples in zone T-3. These last were considered to relate to an interstadial phase and, accepting the radiocarbon date of FitzPatrick (1965), this interstadial was assigned a Middle Devensian age. The overlying sediments (bed 3) were considered to be the product of a glacial episode, the fabric of the sandy till indicating ice movement from S60°E to S61°E.

This last interpretation was disputed by Romans (1977), who considered that there was no till exposed at Teindland, but rather that the sediments overlying the buried soil were emplaced by solifluction. He therefore argued that the site had not been glaciated during the Devensian, and inferred a very cold climate during the final phase of soil development from his observations of frost cracks in the soil.

The problem of using the radiocarbon date to infer a Middle Devensian age for part of the sequence was raised by Sissons (1981b). In response, Caseldine and Edwards (1982) provided new radiocarbon age estimates of 40,710 + 2000 BP (UB-2121) and 38,400 + 1000 BP (UB-2209), the material for which had been subjected to both acid and alkali pre-treatment. However, as with other interstadial or interglacial sites (for example, Kirkhill and Fugla Ness), finite radiocarbon dates are not on their own sufficient evidence to assign a deposit to the Middle Devensian (Sissons, 1982c). Sissons went on to suggest that, if indeed the Teindland site did contain evidence for interglacial and subsequent interstadial conditions, then it would be possible to interpret the interstadial as having occurred during the Early Devensian during the period immediately after the last interglacial, a suggestion that had previously been partially advanced by Edwards *et al*. (1976) for the basal sample in their pollen assemblage zone T-3.

Lowe (1984) also raised a number of questions concerning the interpretation of the pollen data from Teindland, considering it necessary to obtain more information before either an interglacial or an interstadial interpretation could be unequivocally upheld. In addition, the published sections for the site are greatly simplified (Sutherland, 1984a, unpublished data) and a complex sequence of sediments overlies the soil horizon.

Despite the controversy surrounding the interpretation of the Teindland Quarry sediments, they hold great potential for providing information on Devensian and possibly earlier environments. The site is one of the very few accessible interstadial or interglacial sites on the Scottish mainland (see for example, Clapperton, 1977). It is one of only a small number of sites in Scotland with deposits to which an interglacial origin has been ascribed (see Kirkhill, Sel Ayre, Fugla Ness, Toa Galson in North-west Coast of Lewis and Dalcharn) and the only site at which both interglacial and interstadial deposits have been interpreted as occurring in superposition. Further research should result in clarification of the stratigraphy and it is apparent that the site should provide important evidence bearing on the question of both Early and Late Devensian glaciation of Scotland (Sutherland, 1984a).

Conclusions

Teindland Quarry is a site of great importance for Quaternary studies in Scotland. The sequence includes a buried soil which pre-dates the last (Late Devensian) glaciation. They appear to comprise sediments formed in both interstadial and interglacial climatic phases (that is, respectively, in a warmer interlude within an ice age (glacial) and a warmer phase between two separate glacials), but their ages are not yet unequivocally established. As one of only a few sites where such deposits are accessible, Teindland is a key locality for further research to amplify the Quaternary history of Scotland. The origin of the sediments overlying the organic deposits is also controversial and has a bearing on the argument about whether parts of north-east Scotland were not covered by the last ice-sheet.

Reference list

Caseldine, C.J. and Edwards, K.J. (1982) Interstadial and last interglacial deposits covered by till in Scotland: comments and new evidence. *Boreas*, **11**, 119–22.
Edwards, K.J., Caseldine, C.J. and Chester, D.K. (1976) Possible interstadial and interglacial pollen floras from Teindland, Scotland. *Nature*, **264**, 742–44.
FitzPatrick, E.A. (1965) An interglacial soil at Teindland, Morayshire. *Nature*, **207**, 621–2.
Lowe, J.J. (1984) A critical evaluation of pollen-stratigraphic investigations of pre-Late Devensian sites in Scotland. *Quaternary Science Reviews*, **3**, 405–32.
Phillips, L. (1976) Pleistocene vegetational history and geology in Norfolk. *Philosophical Transactions of the Royal Society of London*, **B275**, 215–86.
Romans, J.C.C. (1977) Stratigraphy of buried soil at Teindland Forest, Scotland. *Nature*, **268**, 622–3.
Sissons, J.B. (1981b) The last Scottish ice sheet: facts and speculative discussion. *Boreas*, **10**, 1–17.
Sissons, J.B. (1982c) Interstadial and last interglacial deposits covered by till in Scotland: a reply. *Boreas*, **11**, 123–4.
Sutherland, D.G. (1984a) The Quaternary deposits and landforms of Scotland and the neighbouring shelves: a review. *Quaternary Science Reviews*, **3**, 157–254.