
Four Ashes

[SJ 914 083]

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Introduction

Four Ashes, Staffordshire, was originally chosen as the type site for the Devensian in Britain (Mitchell *et al.*, 1973) and the site has recently been formally designated as the stratotype for the Four Ashes Formation (Bowen, 1999). The name 'Devensian' is inherited from the Devenses, a British tribe formerly resident in this region. In brief, the sedimentary succession at Four Ashes shows a complex of fluvial sands and gravels (the Four Ashes Formation) overlain by the glaciogenic Stockport Formation. The total thickness of this sequence is 11 m. The sands and gravels contain lenses and beds of organic remains that have yielded important palaeoecological and palaeoclimatological information. The presence of periglacial features both within and below the gravels has also provided important palaeoenvironmental information on the sequence of events during the Devensian. A.V. Morgan (1973) has described the sequence at Four Ashes. A. Morgan (1973) has investigated the insect fauna from the site, and Andrew and West (1977) have conducted pollen analysis on the organic sediments. The palaeoecological data and radiocarbon dates from the site suggest that it is partly Ipswichian in age (Oxygen Isotope Sub-stage 5e) and partly Early and Middle Devensian (Oxygen Isotope Sub-stages 5d to Oxygen Isotope Stage 3) (Bowen, 1999). Shotton (1977) has discussed the difficulties of using type sites such as Four Ashes to delimit the stages of the Quaternary. Four Ashes is referred to in virtually every textbook dealing with the Quaternary in Britain (e.g. West, 1977; Jones and Keen, 1993; Lowe and Walker, 1997a).

Description

Four Ashes is a disused gravel pit on the outskirts of the village of Four Ashes in Staffordshire. Although at the time of writing largely overgrown, the succession in the pit has been documented on the basis of formerly more extensive exposures. The stratigraphy in the pit has been described in some detail by A.V. Morgan (1973). Very briefly, this consists of a lower unit of gravels considered by A.V. Morgan (1973) to have been deposited on a fluvial braid plain, overlain by cryoturbated gravels and till (Figure 5.27). Within the gravel succession, and at its base where it rests on Triassic sandstone bedrock, there are pockets of organic material (largely organic silts and peats). These organic sediments have provided material for radiocarbon dating and palynological analysis. Also present at a number of levels are ice-wedge casts, interpreted as the result of freeze–thaw penetration of the ground under periglacial conditions. The sedimentary succession is outlined in more detail below.

Gravel unit

A.V. Morgan (1973) described the sand and gravel unit as varying between 0.45 and 4.6 m in thickness. It consists almost entirely of Bunter-derived quartzite pebbles and rare erratics of flint, tuff, rhyolite and andesite. The sand and gravel sequence is extremely complex, with evidence of both erosion and deposition in the form of wash-out gullies, minor stratigraphical breaks, and current and graded bedding sequences. At least two layers of intraformational ice-wedge casts and involutions have been described in the gravels and the upper 2.5 m of the gravel sequence is frequently strongly involuted (Morgan, A.V., 1973).

One of the most significant features of the Four Ashes gravel unit is the presence of lenses of sandy detritus peat and organic clays. Organic material infilling bedrock hollows has yielded macrofossils of *Taxus*, *Ilex* and *Alnus*, and a pollen assemblage dominated by *Alnus* and *Quercus* (Andrew and West, 1977). Other organic sediments in contact with bedrock contain a pollen assemblage of *Pinus*, *Picea* and *Betula*. The insect fauna from these sediments was considered in detail by A. Morgan (1973), who described three separate faunal groups. The group 1 fauna was collected from detritus muds lying directly on bedrock and are composed of six species of Coleoptera associated with trees. The group 2 fauna was collected from variable contexts, including detritus peats and clays, although all were located in the lower

parts of the gravel sequence. The characteristic feature of the fauna in this group is that they all contain large numbers of phytophagous beetles not associated with tree species. Group 3 faunas were also collected from variable contexts, but at all levels in the gravel sequence. The assemblages of this group are characterized by large numbers of beetles that live on tundra or open ground.

Diamicton

A.V. Morgan (1973) describes a red diamicton unit overlying the gravels at Four Ashes. The diamicton varies from 0.05 to 2.75 m in thickness and has a high erratic content, including white granite clasts attributed to south-west Scotland. Other erratic lithologies include striated volcanic and slate clasts from the Lake District and Scotland, Eskdale granite, Ennerdale granophyre, occasional limestones, flints derived from Cretaceous chalk, and marine shells. In places, the diamicton is disturbed by periglacial features, including ice-wedge casts and involutions.

Interpretation

Gravel unit

A.V. Morgan (1973) considered the organic deposits at the base of the gravels to be Ipswichian in age. If this interpretation is correct, the Four Ashes Formation must represent deposition during the Lower and Middle Devensian. Thus the gravel unit records 40 000 years (minimum) of deposition in a sequence between 0.45 and 4.6 m thick. From this, it follows that the Four Ashes Formation was deposited by a relatively small stream system with limited discharge. The high content of Bunter-derived clasts points to a local source area. A.V. Morgan (1973, p. 241) envisaged that 'the streams transporting the Four Ashes gravel must have been choked with large quantities of gravel and sand, probably changing direction frequently, anastomosing over the underlying gravel and sands'. The implication of this description is that there was a continuous cycle of erosion and deposition throughout the Devensian. Although this sedimentary description is typical of glaciofluvial deposition, A.V. Morgan (1973) states categorically that there is no suggestion that the Four Ashes Formation is glaciofluvial in origin. The only evidence for climatic deterioration during deposition of the gravel is in the faunal record (Morgan, A., 1973) and the presence of ice-wedge casts.

One of the most important features of the Four Ashes gravel unit is the presence of lenses of sandy detritus peat and organic clays. The organic material infilling these bedrock hollows has yielded macrofossils of *Taxus*, *Ilex* and *Alnus*, and a pollen assemblage dominated by *Alnus* and *Quercus*. Andrew and West (1977) assigned this unit to an Ipswichian (Zone II13) age on palynological grounds. The pollen assemblage of *Pinus*, *Picea* and *Betula* in the organic sediments in contact with bedrock at Four Ashes is comparable with that from Chelford (Morgan, A.V., 1973; Andrew and West, 1977). The insect fauna from these sediments also is analogous to that from Chelford (Morgan, A., 1973). The fauna overall is of continental character, perhaps analogous to that of modern central Fennoscandia (Jones and Keen, 1993).

A. Morgan (1973) interpreted the three insect faunal groups as follows. The overall interpretation of the group 1 fauna is of coniferous forest dominated by *Pinus* and *Picea*, together with *Betula* and possibly *Salix*. Amongst the forested areas there must have been acid swamps and small pools with sedges around the margins. There is very little evidence of a rich herbaceous vegetation or of bare open ground. The environment indicated by group 2 species is one with a fairly luxuriant vegetation of mosses, aquatic and semi-aquatic plants around small pools. The substrate in these swampy areas would have been rich in humus and slightly acidic. There was little open ground, some grassland and a variety of plant species. The Coleoptera in group 2 indicate that this environment remained treeless, except for some dwarf birch and willow. The overall view of the area from the group 3 fauna is of an open, barren environment. Vegetation cover was low and was composed mainly of moss and grass with various aquatic and semi-aquatic plants growing in the moister areas around small pools. All indications point to a treeless environment.

Diamicton

A.V. Morgan (1973) interpreted the red diamicton unit overlying the gravels at Four Ashes as a typical Irish Sea till. The derivation of the erratics in the till indicates source areas in the Lake District and Scotland. The implied ice-movement

direction is from the north-west to the south-east into Staffordshire. Regional mapping indicates that this till is part of a much larger and more widespread till sheet (the Stockport Formation) that thickens from north to south across the Wolverhampton region (Morgan, AN., 1973).

Summary

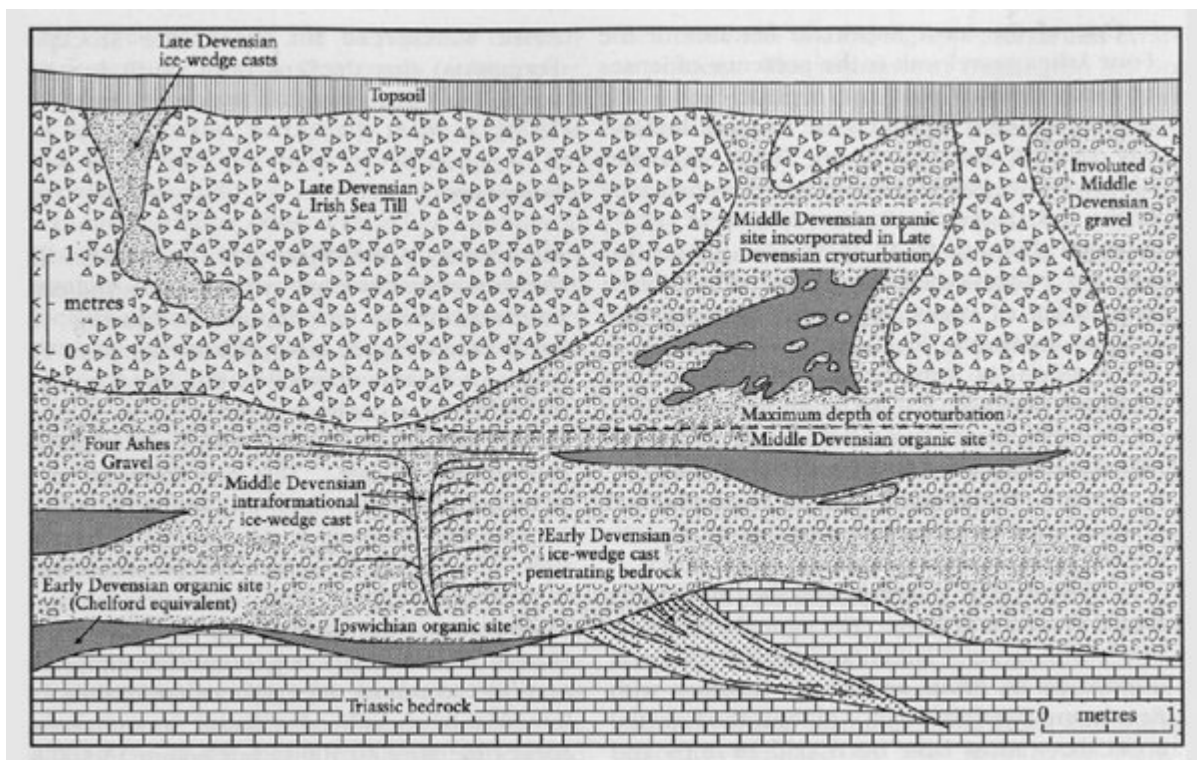
In summary, A.V. Morgan (1973) concludes that the sequence recorded at Four Ashes indicates commencement of deposition during the Ipswichian (Oxygen Isotope Sub-stage 5e). The lenses of organic material in the gravel unit are indicative of a coniferous forest cover and are considered to be Early Devensian (Chelford Interstadial) in age. This was followed by a periglacial episode, which was severe enough to rupture the bedrock at the base of the gravel unit. The Middle Devensian is represented by a number of organic sites indicating climatic amelioration between 42 000 and 38 000 ka (Upton Warren stage). A gradual climatic deterioration and return to periglacial conditions followed this short-lived climatic amelioration. Some time after 30 500 ka but before 13 500 ka a lobe of the Irish Sea ice sheet advanced over the Four Ashes gravel to reach a maximum position near Wolverhampton. Recession of this ice sheet was followed again by periglacial conditions, during which time polygonal patterned ground and involutions formed in the till overlying the Four Ashes gravel.

More recently, Rose (1985) has pointed out that although the biostratigraphical evidence and radiocarbon dates from Four Ashes provide important information concerning Early and Middle Devensian climates, they do not closely constrain the timing of the glacial events during the Late Devensian. Thus the sequence at Four Ashes contains little lithostratigraphical evidence of the Late Devensian glaciation. At Dimlington, on the Holderness coast, Late Devensian glaciogenic sediments are sandwiched between radiocarbon-dated organic material, and provide a more accurate timing for the maximum advance of the Late Devensian ice sheet (Rose, 1985). Rose therefore proposed Dimlington as the type site for the Late Devensian glaciation, although the Four Ashes Formation still remains the formal stratotype for the Devensian (Bowen, 1999).

Conclusions

Four Ashes is a key reference locality because it has been designated as the stratotype for part of the Devensian. The site therefore is critically important to British Quaternary stratigraphy. Although there are difficulties with dating parts of the succession, particularly those at the base that lie beyond the limits of ^{14}C dating, it has proved possible to correlate parts of the sequence at Four Ashes with other localities at Chelford and Upton Warren. Four Ashes remains a stratotype site and a key reference locality against which other British Quaternary sites are compared. It is clearly a site of both national and international importance.

References



(Figure 5.27) General stratigraphy at Four Ashes (after Morgan, A.N., 1973).