

The following paper is a slightly modified version of a dissertation in geography submitted to Kingston Polytechnic (now Kingston University, London) in 1976 by Colin Nelson, a copy of which he deposited at Doncaster Museum & Art Gallery. We feel that his work, which concerns areas where there is now little peat, deserves a wider audience.

Colin Nelson, who has been a respected geography teacher at the McAuley School in Doncaster for many years, has generously given permission for the Forum to make the dissertation available in electronic format on our website.

The Forum would like to express its thanks to Colin Nelson for allowing us to make the dissertation more widely available

# THE VEGETATIONAL HISTORY OF TWO ROMANO-BRITISH SITES AT POTTERIC CARR AND SANDTOFT NEAR DONCASTER

Colin Nelson

## INTRODUCTION

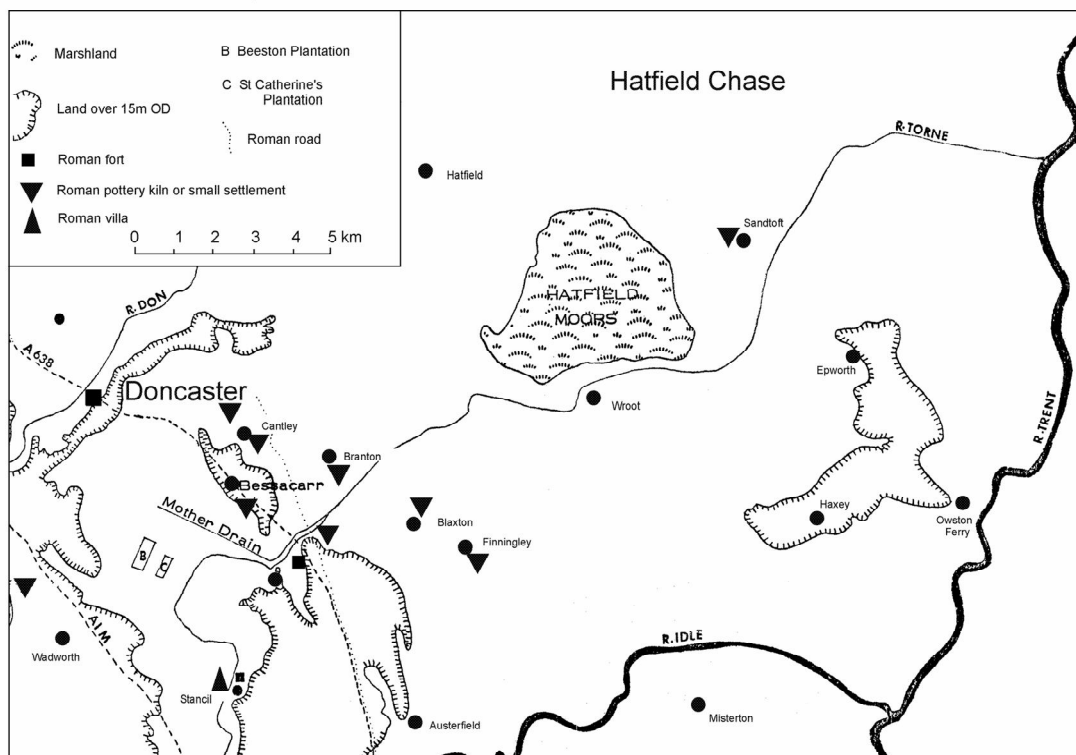
The aim of this project is to compare the vegetational history of two Romano-British sites south-east of Doncaster since late Bronze Age times, using pollen analysis as the principal method of investigation. A wide range of Flandrian environments are to be found east of Doncaster where there is also much archaeological evidence of human occupation.

The detailed investigation of the first area at Potteric Carr was stimulated by the juxtaposition of alluvial deposits with deserted field systems of probable Roman and medieval origin. Doncaster Museum proposed to dig a large Roman site at Sandtoft and the waterlogged peats preserved there promised to give details of the levels in the Roman period. Therefore the second site at Sandtoft was investigated with the intention of extending the scope of this project to obtain comparative material.

This study has involved elements of several disciplines including the field investigation and description of Flandrian sediments, archaeology and palaeoecology. The combined evidence has provided an outline of the vegetational history of south-east Doncaster in relation to man's activities since late Bronze Age times to the modern period.

## GEOGRAPHICAL SETTING

The main physiographic features and settlements of the region east of Doncaster have been shown on Map 1. Much of the area to the north-east and south-east of Doncaster is low-lying carrland drained by the rivers Idle, Torne and Don. To the south of this lowland, Triassic marls and sandstones form higher ground, and to the north the low-lying raised mire at Hatfield Moors extends into the Vale of York. North and north-west of Bawtry, a ridge of Bunter Sandstone and the line of the Magnesian Limestone escarpment respectively define the westward boundary of carrland. The eastern boundary is well defined by the valley of the Trent. The levels south east of Doncaster are of glacial construction and are largely comprised of morainic materials, outwash gravels, lacustrine clays, alluvium and peats, although the Triassic bedrock is exposed in places for example at Wroot.



Map 1. The Carrlands east of Doncaster

Eastwards on the Isle of Axholme the lacustrine silts are overlain by extensive aeolian cover sands. Poor drainage and the constantly changing courses of the north-easterly flowing streams and rivers resulted in the seventeenth century drainage schemes carried out by Vermuyden.

There seems to have been a "deterministic relationship" between the physical environment and the pattern of rural settlement. Early settlement was sporadic occurring around the edges of lakes and carrs on the isolated islands of Triassic rocks and post-glacial sands, such as the sandy ridge upon which Hatfield stands and the higher ground of Axholme where the market towns of Epworth and Haxey lie. Palaeolithic peoples tended to favour the dry limestone country to the west as well as the well drained islands of sand and gravel around Finningley and Rossington. There was considerable Roman settlement at Bawtry and Finningley and large pottery industries at Rossington, Cantley, Branton and Blaxton utilising the Torne to distribute their wares. The settlement on the levels at Sandtoft may have had Iron Age antecedents, as did those further west at Edlington Wood on the Magnesian Limestone (Corder 1951; Ramm 1973). Anglo-Saxon and later Danish settlement from

the fifth to eleventh century A.D. can be inferred from place name evidence. Those places incorporating the element "ley" or "field" include: Bentley, Cantley, Finningley, Hatfield and Austerfield. The place names imply that the Anglo-Saxons settled in well-wooded countryside which was gradually cleared for cultivation.

The modern vegetation is a poor form of carr with an undergrowth of rushes, *Juncus* spp, sedges, *Carex* spp, bracken, *Pteridium aquilinum*, and purple moor grass, *Molinia caerulea*, and a scrub layer of willow, *Salix* spp., alder, *Alnus glutinosa*, and birch, *Betula* spp. The Levels have few woods, trees or hedges, and dykes serve both to drain and divide the fields.

## METHODS

The reconstruction of past vegetation depends to a large extent on the preservation of pollen grains in a favourable environment of deposition. Where such environments are not available stratigraphic evidence from a series of pits and borings may elucidate the conditions of deposition. The mapping of field systems identified from air photographs by Buckland, the records of work undertaken by Doncaster Museum at the site of the Rossington Bridge Roman pottery kilns, and by the interstratification of fragments of Romano-British pottery in the sediments at Sandtoft, has provided valuable supplementary evidence for the conscious modification of the landscape by man.

In the field it was necessary to obtain a detailed record of the stratigraphy for both Sandtoft and Potteric Carr so that the best location could be found for the collection of samples for analysis. Since it is safest and easiest to collect uncontaminated samples directly from exposed profiles, a pit was excavated at Rossington Bridge, where preliminary borings had shown the succession to be most complete and where waterlogging was never a problem. At Sandtoft a series of trenches cut by mechanical excavators during the archaeological work undertaken by Doncaster Museum were utilised and freshened and deepened with a spade. At Rossington Bridge the peat face was prepared for sampling by the horizontal cleavage of the peat with a clean spade and small glass tubes were then pressed into the peat wall to collect the samples. These were then sealed in a tube by a screw-on top. It was often necessary to work from the surface because of the problems of water seepage. Where these problems prevailed the samples were obtained by a Hiller peat borer. In some instances the sandy nature of the deposits prevented the use of the Hiller sampler, which was then replaced by a screw auger. The samples were carefully numbered and recorded in a notebook together with notes about the nature of the deposits and sites. More samples were collected than were required for analysis. The samples were processed in the laboratory and finally mounted ready for counting. The

use of a mechanical stage allowed the slides to be moved from one side to another under the microscope and all the pollen grains observed were noted. Counting was carried out using a Vickers M75 microscope at a counting power x600. At least 150 tree pollen grains were counted from each level except for the sandy and clayey samples where there was little or no pollen.<sup>1</sup>

## SITES INVESTIGATED

### A. POTTERIC CARR

The first area of detailed field investigation was Potteric Carr which consists of sixteen hundred hectares of land stretching three kilometres south from Doncaster to Rossington and three kilometres west from High Ellers beyond Wadworth (see Map 2), and includes the Yorkshire Naturalists' Trust Nature Reserve. Potteric Carr is an area of alder carr and marshland which has become fragmented since the eighteenth century as a result of drainage and division. The area has a diverse plant community with a great variety of herbs, grasses and sedges as well as areas of stunted carrland dominated by birch and alder.

The stratigraphic investigation of Potteric Carr was seriously hampered by physical constraints, especially the high water table, which resulted in the flooding and subsequent abandonment of pits constructed in the peaty deposits adjacent to the Mother Drain to the south of the Warren Golf Course (Site 2, see Map 2). Similar problems were encountered during the investigation of the deposits of the Old Eaa, a former lake (Site 6), where the infill of slurry into the borehole contaminated the sediment recovered from the Hiller chamber.

The sandy gravels encountered beneath the clays at several localities prevented further penetration by both the Hiller peat borer and screw auger and therefore defined the basal limit of this investigation. Nevertheless from the series of borings using the Hiller peat borer and screw auger and from the sections a detailed picture of the recent stratigraphy of Potteric Carr was obtained. The locations of all the sites investigated are shown in Map 2.

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<sup>1</sup> The interpretation of the pollen diagrams involved certain limitations. Some parts of the diagram are of more use than others, particularly at Sandtoft, where the poor preservation of pollen in the sands and clays necessarily introduces some degree of bias into the diagram. The rate and type of sedimentary accumulation has varied considerably from sands to peats and it is likely that some of the pollen will have been derived from overlying sediments or deposited from reworked materials. The pollen data and stratigraphic descriptions of the sites investigated are included in the appendix.

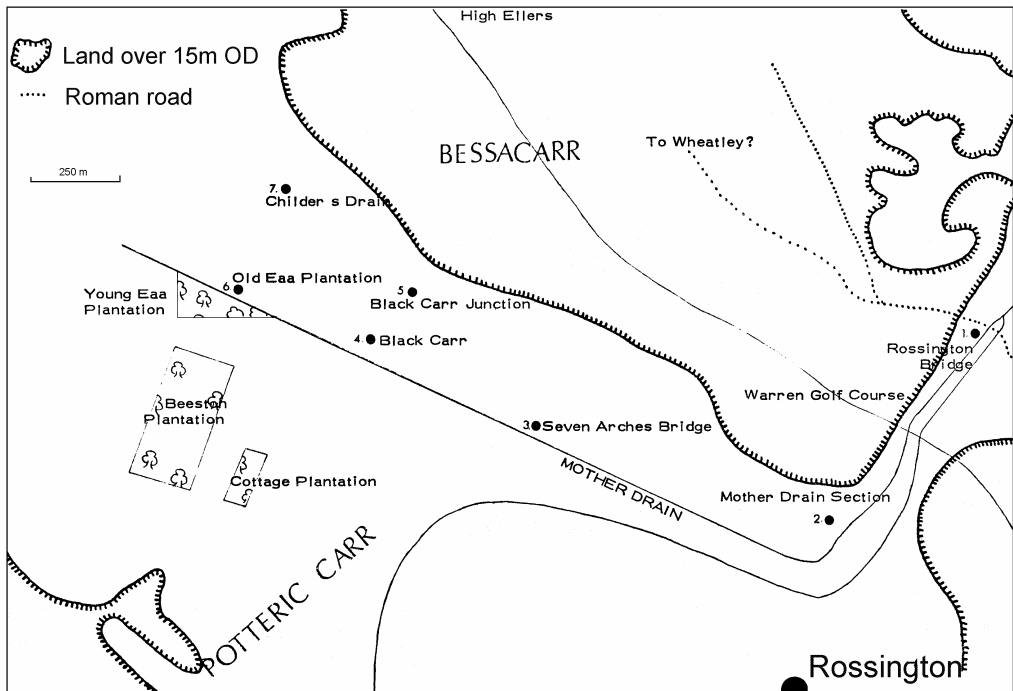
The first section at Rossington Bridge is located alongside the River Torne, where the Roman Lincoln to York road crossed the river. This site was the location of a Roman pottery industry from the first to third century A.D. <sup>2</sup> The section at Rossington Bridge was over three metres deep and clearly showed the changing nature of the sedimentary environment through Roman times to the modern period (see Fig. 1). Most of the sediments were suitable for pollen analysis. Beneath the shallow top soil occur compact peats composed of greatly humified, oligotrophic plant communities up to a depth of 45 cm. Beneath the alder-*Molinia* peats occurs a thick sequence of peaty clays containing alder detritus and other poorly preserved organic material.

It is possible to identify horizons within the peaty clays where the peat takes on a coarse macroscopic structure composed of large fragments of herbaceous plants and woody material. Purple moor grass and alder fragments are commonly preserved in these peaty clays. The bands of coarser material appear to represent former surfaces of inundation. The fairly rapid submergence of the bog community at these horizons has preserved intact remains of purple moor grass, reeds, sedges and alder fragments which were later compacted by accumulations of amorphous organic material deposited during periods of bog growth. The position of the Roman occupation horizon is uncertain in this section but on the basis of work previously undertaken at this site by Doncaster Museum it is known that the Roman horizon is in the proximity of 168 cm. At this level a matted platform of alder wood was encountered but this may simply represent a natural surface of accumulation. The Roman occupation horizon lies close to the junction between the peaty clays and organic clays which have been arbitrarily separated on the basis of decreasing organic content. At a depth of 2.8 m, the peaty clays are underlain by 30 cm. of fine quartz sands and coarse sandy gravels of unknown thickness.

West of Rossington Bridge the stratigraphy of Potteric Carr is dominated by lacustrine clays and silts of variable character reflecting the changing environment of deposition and the ephemeral nature of the small lakes and bogs developed there. A detailed account of the deposits at each of the sites investigated is to be found in the appendix.

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<sup>2</sup> Excavations by Doncaster Museum have revealed five kilns with associated workshops and living areas. A great deal of occupational debris including pottery, glass, slag, coal, kiln rejects, brooches and tools have been discovered at c. 168 cm. below the surface.



Map 2. The sites investigated on Potteric Carr

Using air photographs, Doncaster Museum has identified several field systems in the vicinity of Potteric Carr (see Map 3). At Cottage Plantation, a series of irregular ditch and field systems, together with a 'D' shaped enclosure, are possibly of Iron Age or Roman date. Westwards at St. Catherine's Hospital, the field pattern is obscured by pasture and the joint pattern of the Magnesian Limestone, but even so, a system of small sub-rectangular fields is discernible which continue eastwards across Loversall and Potteric Carr towards Bessacarr and Rossington. The view that these field systems are of probable Romano-British date is supported by fragments of Romano-British pottery which have been found north-east of Loversall village. Peat has accumulated at a rapid rate since the Roman period, as peat deposits up to 90 cm deep overlie probable Roman field systems west of Black Carr and c. 170 cm of peat overlies the Roman occupation horizon at Rossington Bridge (see Fig. 1 and Fig. A2b). The importance of these field systems is two-fold. Firstly they prove conclusively that the carlands of south-east Doncaster were suitable for arable crop production during the Roman period. Secondly, the relative rates of peat accumulation can be deduced for certain areas. The area of greatest peat growth occurred in the south-east at the

Mother Drain and Rossington Bridge sites. The rapid accumulation of sediment and peat since the early third century A.D. has probably resulted from the rising water table.<sup>3</sup>

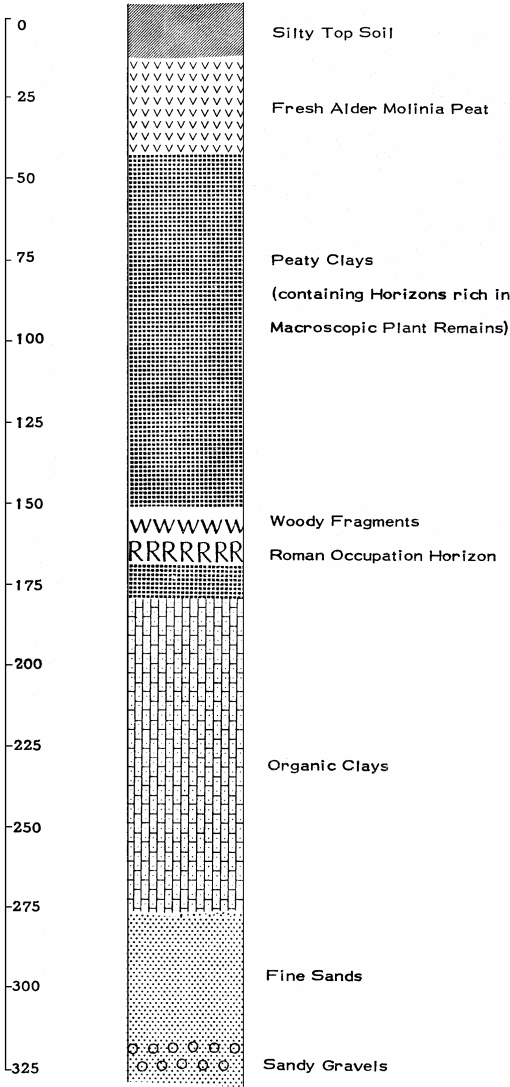


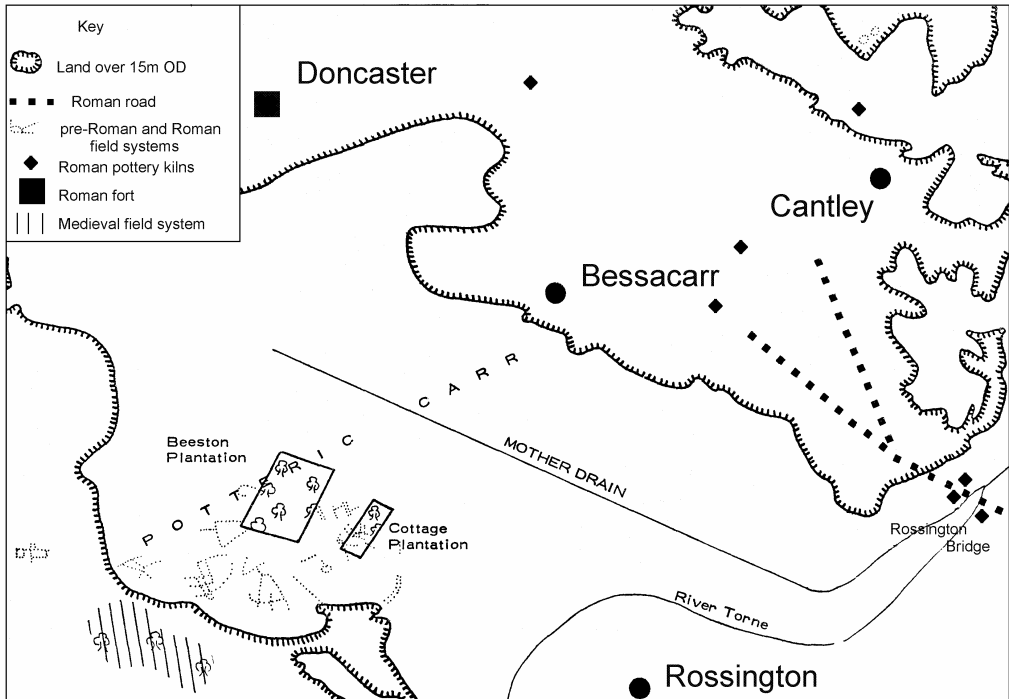
Fig. 1. Section at Rossington Bridge (Site 1)

<sup>3</sup> The accumulation of c. 170 cm. of peat at Rossington Bridge since the end of the Roman period at c. 410 A.D. gives an average increment of material in the order of 10 cm. per decade. This figure is somewhat nebulous since it is likely that peat growth proceeded at very different rates during the course of 1700 years and the greater compaction of the lower horizons has not been taken into account.

The pollen diagram for Rossington Bridge (Fig. 2) is based on counts of 150 tree pollen grains. The results are expressed as a percentage of this total. The diagram is post-Boreal with the pollen of thermophilous species such as *Quercus* (oak), *Ulmus* (elm) and *Tilia* (lime) well represented and *Alnus* (alder) pollen is everywhere abundant. The boundary between Pollen Zones VIIb and VIII has been drawn in the region of 230 cm, where there is a decrease in the curve for *Quercus*, although there is an increase in *Alnus* at the same horizon. The curve for *Pinus* (pine) is never prominent in the diagram and from a value rarely exceeding 2% the curve gradually diminishes. *Betula* (birch), *Ulmus* and *Tilia* also decline at this horizon. The relative proportion of non-arboreal pollen to arboreal pollen increases at this level. The marked expansion of *Alnus* is probably related to the local expansion of alder carr, and is therefore likely to be over-represented in the pollen diagram. Bearing this in mind the relative increase of non-arboreal pollen (N.A.P.) will be more significant than indicated by the diagram. Inevitably the location of the VIIb/VIII zone boundary is somewhat artificial as archaeological evidence shows that human activity in this area has been continuous since Palaeolithic times. The vegetation had been greatly modified by man at the time when the earliest deposits investigated were forming. The division of the pollen diagram into Zone VIIb and VIII at one point is an arbitrary division. Nevertheless it is clear from the pollen diagram that the historic period is fundamentally different from the Pre-Roman period and it was decided to place the boundary where there is evidence for the decrease of arboreal pollen and an expansion of N.A.P. at 230 cm. Zone VIIb has a wide representation of herbs and agricultural weeds such as Poaceae, Chenopodiaceae, Asteraceae, *Artemisia* and *Plantago*. The proportion of herbs and agricultural weeds increases in Zone VIII. The presence of agricultural weeds at this level implies that agricultural practices were already decimating the woodland cover as clearances were made to provide land for tillage.

Pollen diagrams from Hatfield Moors, eight kilometres north-east of Rossington Bridge (Smith 1958) show a similar pattern for Zone VII which Smith suggests is the result of early Neolithic activity. The significant representation of agricultural weeds and grasses at Rossington Bridge would imply that a system of agricultural activity was here well established probably related to the near proximity of the Magnesian Limestone and cultivable dry islands at Rossington and Finningley.

Here concentrated finds of archaeological material indicate the former importance of man. It is viewed that the first polleniferous sediments at Rossington Bridge are related to the late Neolithic/Bronze Age influences since agricultural activity is already advanced.



Map 3. Distribution of ancient field systems and Roman pottery kilns in the vicinity of Potteric Carr

The pre-Roman sediments at 1.85 m show a regeneration of woodland possibly related to drier conditions as the expansion of *Quercus* takes place at the expense of *Alnus*. It would seem that alder carr was locally giving way to mixed oak woodland at this level. *Ulmus* pollen is present in small quantities (1.5%) and *Betula* shows a slight increase. The pre-Roman deposits show the first appearance of cereal pollen at c. 2.30 m, which gradually increases until Roman times reaching c. 8% of the pollen total, together with an increase in the percentage of *Plantago*, demonstrating the systematic intensification of crop husbandry since late Neolithic times.

The Roman occupation horizon shows a significant decline in woodland cover which is well identified by the pollen diagram. The pollen curves for *Quercus* show a marked decline with *Alnus* and *Betula* showing a slight decline. *Tilia* and *Ulmus* are present in small quantities (3% and 1.5% respectively) and *Corylus* (hazel) and *Salix* (willow) undergo a marked decline. The pollen curve for cereals, *Plantago* and other agricultural weeds all show peak values and constitute c. 60% of the total pollen at this level indicating that this was a period of increased agricultural activity.

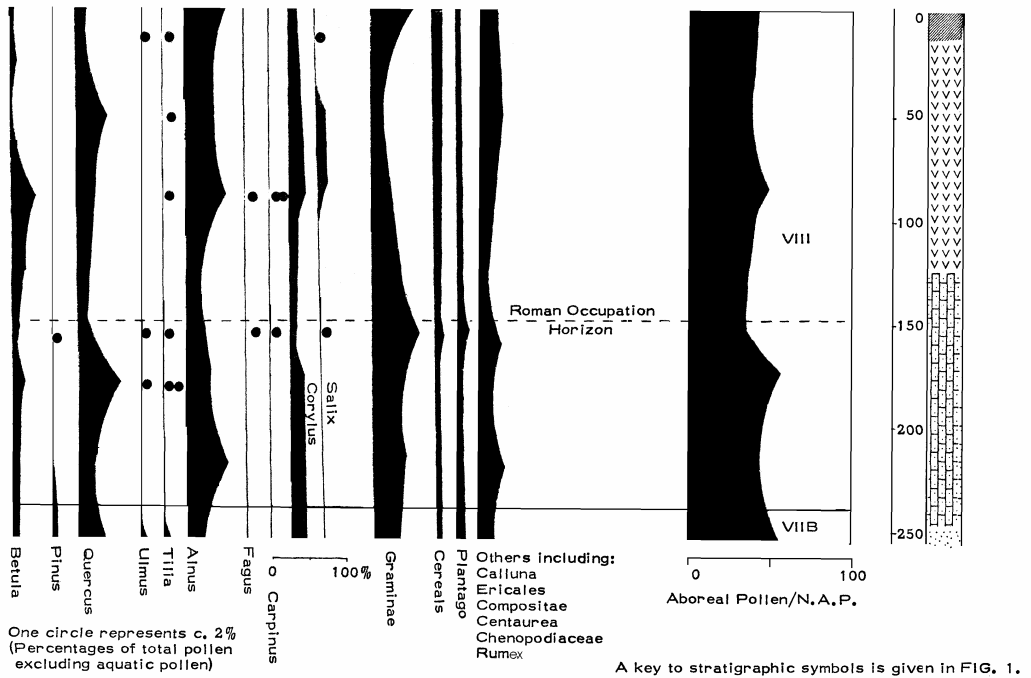


Fig. 2. The pollen diagram from Rossington Bridge

The post-Roman period is associated with a gradual increase in the curve for arboreal pollen, especially the expansion of *Betula*, *Salix*, *Alnus* and *Quercus* although *Quercus* does not reach the peak values attained prior to the Roman period when it frequently comprised from 25% to 50% of the pollen total. The high values for *Betula* (30%) and shrubs (20%) are notable and may reflect the ability of these species to invade and colonise clearances rapidly. The pollen curve for cereals is maintained above that of the pre-Roman period, but shows a decrease since Roman times. The curve for Poaceae shows a consistent decline until the modern period.

A final phase of agricultural intensification has been identified at a depth of 23 cm. below the zone of modern sedimentation. This level shows a marked reduction in the values for *Quercus*, which constitute less than 20% of the pollen and an increase in the value for *Alnus*. The values for cereals, *Plantago*, *Artemisia* and other agricultural weeds all increase. This period is probably related to the local expansion of alder carr in the valley bottoms with the increased clearance of woodland on the better drained sites to the west as at Loversall, where a series of medieval field systems have been

identified (see Map 3). The local expansion of *Alnus* at this level tends to distort the pollen diagram so that arboreal species are over-represented.

The distance between Rossington Bridge and Sandtoft is 13 km. This gives a chance for elucidating local differences between the sites, although with a similar geology and disposition it is likely that differences would be small and the pollen spectra from Potteric Carr and Sandtoft may largely represent the regional vegetation as opposed to the local vegetation.

## B. SANDTOFT

Sandtoft is 17 km north-east of Doncaster on the western edge of the Isle of Axholme. The diverted course of the River Don is to the north of Sandtoft and the River Torne lies to the east. The contemporary landscape is a low-lying featureless plain divided into regular fields by ditches. The site (N.G.R. SE729085) is adjacent to the channel of the old River Don, which was diverted northwards during the seventeenth century. A system of rectangular ditches probably of Roman origin was identified by Doncaster Museum, who decided to excavate and examine the site in detail during the summer months of 1975<sup>4</sup>. This provided an excellent opportunity to obtain material for analysis and comparison with the Roman deposits at Rossington Bridge. By early September, the investigation of the site by the Museum was well under way. The overburden of plough soil up to c. 33 cm. had been cleared by a mechanical earthmover to a level where the pattern of a ditch network could be clearly defined. The infill of post-Roman material was generally less compact and sandier than the enclosing materials and it was therefore an easy task to excavate the series of ditches. Two additional trenches were cut to the north of the settlement site using the mechanical excavator in order to examine the bedded deposits of the old River Don. Further investigations of the riverine sediments were accomplished by deepening the trenches with a spade. The sandy deposits were totally unsuitable for investigation by the Hiller borer and soil auger. A further problem was that the field investigation of the sediments was seriously hampered by a high water table which resulted in the flooding of the excavated trenches and also because of the tendency of the sands to flow in a process similar to spontaneous liquefaction at a depth of c. 100 cm. Nevertheless the nature of the stratigraphic sequence was established after detailed recording and measurement.

At Sandtoft the River Don has cut through a top layer of sands (which are indicated as aeolian on the geological map) into the underlying laminated clays which have been interpreted as late Weichselian lacustrine clays of Lake Humber (Gaunt *et al.* 1971). In response to a slow and

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<sup>4</sup> Project directed by John Samuels, on behalf of Humberside County Council.

intermittent rise in sea level, a series of clays, alluvial sands and peaty horizons have been preserved in the channel of the old Don (see Fig. 3). During the fieldwork at this section, fragments of Roman pottery were found near the top of the riverine sediments but underlying the modern infill of fine clays and plough soil. A second detailed section was examined nearby.

Samples were collected for pollen analysis from both sections at intervals of 8 cm. but the peaty clays and peats found in the section of the River Don seemed more likely to have preserved pollen in sufficient quantity for analysis. The ditches excavated by Doncaster Museum proved useful as most of them contained bands of peaty clay or sandy peats intercalated between the sandy infill. Many of these deposits could be related to occupational debris, such as the sherds of pottery which were recovered by the Museum. A sequence of Roman and post-Roman peat horizons could be identified on this basis. The morphology of the ditches varied from roughly square shaped to 'V' shaped with compound ditches having features in common with both (Fig. 4). The square shaped ditches have been ascribed to a pre-Roman period whilst the 'V' shaped ditches are Roman. The compound ditches prove the continuity of occupation at the site from late Iron Age to early Roman times. Samples for pollen analysis were obtained from several ditches.

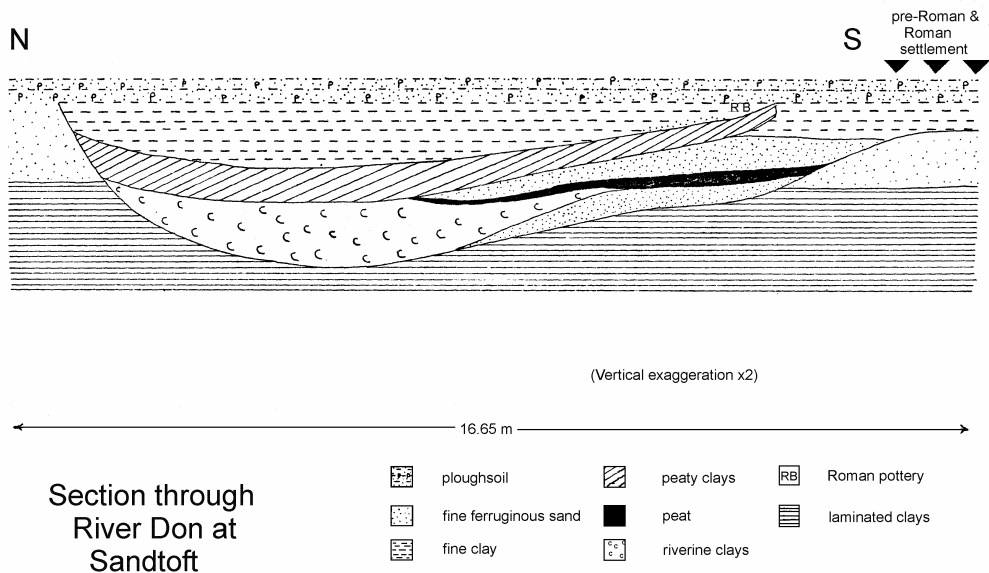


Fig. 3. North-South section across the former channel of the river at Sandtoft.

At Sandtoft the relationship of the pollen samples of the stratigraphic sequence is more complicated than that at Rossington Bridge. Firstly, because the samples taken at various depths are not necessarily in correct time sequence, for example, the bands of peat sampled from the infilled ditches are between 50 cm and 60 cm are below the Roman horizon and therefore the post-Roman sediments occur below the sediments of Roman date.<sup>5</sup> A second problem at Sandtoft is the restricted occurrence of peat. The few pollen grains preserved in the sediments at 2.45 m are mostly herbs. The pollen of other species is likely to have been more vulnerable to decay giving an overall over-representation of herbs, or the pollen grains might easily have been derived from overlying horizons and concentrated at this level.

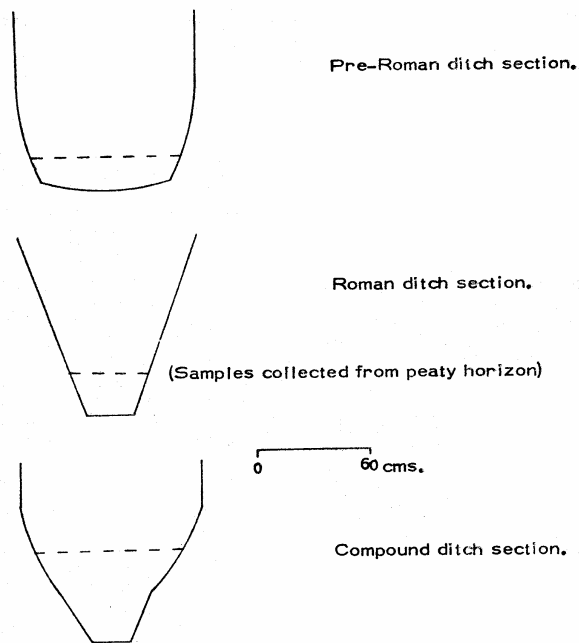


Fig. 4. The excavated ditch sections at Sandtoft

<sup>5</sup> For the purpose of this study the Roman datum has been identified using two main criteria. The excavation of Romano-British and Roman ditches by removing the top 32 cm. of soil reveals a surface of uniform height at which the material filling the ditches is exposed. The discovery of Roman pottery scattered at this level reinforces the sedimentological evidence provided by the ditch-sections and the inclusion of pottery fragments found independently during the investigation of the Don sequence in undisturbed sediment on the south bank of the Don was again at a depth of 38 cm - 43 cm.

The pollen diagram is based on counts of 150 tree pollen where possible, but where there is a paucity of pollen, smaller counts have had to suffice. In some instances pollen was not present.

The sandy nature of sediments below 1.2 m precluded the preservation of pollen except for occasional grains. Whilst the values obtained from the sediments at 2.45 m have been plotted on the diagram, they are considered to be unrepresentative and an unreliable guide to the nature of the vegetation at that time. Therefore in Fig. 5, the values of the pollen curve below 1.20 m have been indicated by a broken line.

The earliest deposits sufficiently rich in pollen to be reliable show high values for arboreal pollen with *Quercus* (20%) and *Alnus* (30%) well represented, and *Betula*, *Pinus*, *Ulmus* and other trees and shrubs of mixed woodland composition are everywhere present. At 1.20 m there is a strong representation of cereals and agricultural weeds including *Plantago* and *Artemisia*, suggesting that agricultural activity was advanced and implying the relatively modern nature of the deposits. From this horizon, there is a marked decrease in the curve for arboreal pollen with both *Quercus* and *Alnus* decreasing. The values for *Ulmus* which have never exceeded 3% remain fairly stable whilst the curves for *Betula*, *Corylus* and *Salix* show a slight increase. The values for *Ulmus* pollen probably represent a regional pollen component derived from the limestone and base rich soils to the south-west since the sands at Sandtoft are deficient in nutrients and are easily cleared. The N.A.P. values show a small increase but the values for Poaceae show a large expansion possibly related to increased grazing pressure from domestic livestock. The values for cereal pollen production do not show a commensurate increase so it would appear that there was no corresponding intensification of arable production. In the absence of archaeological material and other criteria, it is difficult to ascribe a date to this period, but on the basis of palynological evidence, demonstrating the importance of forest clearance and small scale cereal production, it would appear that the deposits are of late Neolithic/Bronze Age. They certainly pre-date the Iron Age settlement for which there is undisputed archaeological evidence.

At 67 cm the pre-Roman deposits show a regeneration of the woodland cover with notable increases for *Quercus* and *Alnus*. At this horizon the curve for Poaceae shows a marked diminution, but at the same level there is an expansion of cereal pollen.

The Roman deposits have the lowest value for arboreal pollen (c. 20%), since *Betula*, *Quercus*, *Alnus* and *Salix* show a substantial decline at this horizon. This period is associated with an increase

in the pollen curves for Poaceae and agricultural weeds and the values for cereals (22%) reach their peak at this level.

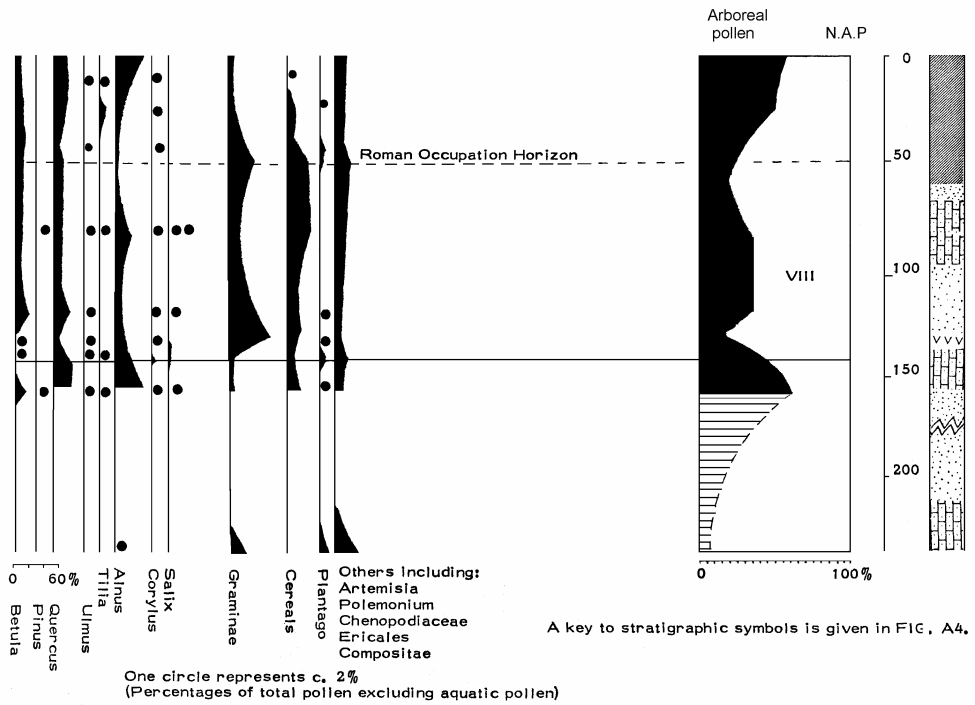


Fig. 5. Pollen diagram from Sandtoft (see Map 1)

Early post-Roman sediments are preserved in the infilled ditches, but elsewhere the sequence has been disturbed by ploughing. The end of the Roman occupation period is associated with a sharp decline in the production of cereal pollen together with that of Poaceae. The values for *Quercus*, *Betula*, *Pinus*, *Alnus* and other arboreal pollen increase. It is probable that the decline of agriculture is related to the end of the Roman occupation or to deteriorating physical conditions as the peat accumulation would imply, or perhaps to both.

## DISCUSSION

The evidence provided by the sedimentary sequence, the vegetational history and the archaeological material combine to demonstrate the importance of physical and anthropogenic controls on the vegetation of the carlunds east of Doncaster. The level of the water table has always been the determining factor controlling the rates and types of sedimentary accumulation, the location of settlement and the exploitation of the natural vegetation by man.

The succession at Rossington Bridge is more complete than that at Sandtoft. At Rossington, the discovery of a hand axe (Lacaille 1944) shows evidence of human activity from the Lower Palaeolithic time and there are much more numerous Mesolithic finds in the region (cf. Buckland & Dolby 1973). However, the earliest sediments analysed at Rossington Bridge are clearly much younger than this as the woodland is already greatly impoverished and there is every indication that settled agricultural activity was established probably related to a pastoral and hunting economy. This early period of forest clearance and disturbance has been tentatively ascribed to the Late Neolithic period as archaeological evidence shows that earlier cultures such as the mesolithic peoples westwards at Edlington Wood were primarily interested in hunting and fishing. At Rossington Bridge there is no definite proof of Late Neolithic influences as the stratified presence of Neolithic artifacts is absent but a number of other sites have been tied in with Early Neolithic cultures. A Creswellian site has been excavated in Edlington Wood (Mellars 1973), and artifacts have also been found on Hatfield Chase and at Misterton Carr (Buckland & Dolby 1973).

The Late Neolithic period is associated with wetter conditions which at Rossington Bridge gave rise to the accumulation of peaty clays, whilst the area to the west was the site of a water body, the Old Eaa, where silts and clays and little organic material accumulated. On the basis of the decline of *Quercus*, *Pinus*, *Ulmus* and *Tilia* and the increasing importance of non-arboreal pollen, the boundary between Zone VIIb and VIII has been identified at c. 2.40 m. The decline of *Quercus* is reciprocated by the expansion of *Alnus* as local conditions periodically favoured the expansion of alder carr. The expansion of *Alnus* at Rossington Bridge may have resulted from a decrease in the water level of the area occupied by the Old Eaa and the colonisation of *Alnus* over the newly exposed area. Alternatively, the onset of wetter conditions would favour the expansion of *Alnus*. At Rossington Bridge, the first appearance of cereal pollen is made at c. 2.28 m, together with an increase in *Quercus* pollen and a decrease in *Alnus* pollen. It would seem that at this horizon local conditions allowed the expansion of *Quercus* and brought about a decline in the extent of alder carr. The improved conditions were advantageous for tillage and the cultivation of cereals on a small scale.

That there existed incipient agriculture in the area south-east of Doncaster is clearly demonstrated by the early pollen record at Rossington Bridge and sedimentological evidence supports this view. The destruction of the natural vegetation cover by man could be expected to have repercussions in the sedimentary sequence. There is abundant evidence of inwash from the lightly cultivated soils surrounding the Potteric Carr basin of lacustrine sedimentary accumulation (see Appendix). At

Potteric Carr the change in lithology from lacustrine clay muds to arenaceous clay muds with sandy bands is the salient feature of the stratigraphy at all the sites investigated west of Rossington Bridge, which lie in close juxtaposition with pre-Roman and Roman field systems. The lithological transition between organic clay and peat at Rossington Bridge is similarly in sympathy with human activity and is coincidental with the post-Roman agricultural decline and woodland expansion. The evidence of mineral inwash from the exposed soil implies that Late Neolithic influences were already modifying the landscape. Nevertheless, climatic and physical controls were still of paramount importance restricting the activities of man, and lithological change may be related to increased precipitation and surface runoff. The presence of a change in sediment lithology would suggest that there was a change in the precipitation:evaporation ratio. The increasing organic content of the clays exposed in the Rossington Bridge section show that the water level was a critical factor giving rise to a valley-bog community by post-Roman times. In brief it would appear that the synergetic effects of man and climate have been largely responsible for the post-Neolithic impoverishment and reduction of the woodland cover south-east of Doncaster.

The deposits at Sandtoft are of limited value since many of them contained little pollen. Nevertheless the pre-Roman and early post-Roman sequence of peats at Sandtoft have preserved pollen and here the vegetational history compares well with the sequence at Rossington Bridge.

The Iron Age deposits are marked by an increase in arboreal pollen particularly the expansion of *Quercus* which is most clearly evident in the Rossington Bridge section. Cereal pollen from this level indicates that agricultural activity was relatively advanced by this time. Both at Sandtoft and Rossington Bridge the expansion of *Alnus* at this point is probably related to forest clearance, and represents a phase of secondary woodland regeneration following the abandonment of agricultural clearances in the wetter sites. Similarly *Betula* is well represented because of its competitive nature as a pioneer species. In general the pre-Roman period can be divided into a period of forest depletion with evidence for early arable cultivation, followed by a period of forest regeneration when *Quercus*, *Ulmus* and *Tilia* are well represented in the pollen diagram and arboreal pollen constitutes c. 60% of the total pollen. There is no evidence of a decline in agricultural activity since Late Neolithic and Bronze Age times so it would seem feasible to associate the expansion of woodland with an ameliorating climatic regime. The base rich soils of the limestone escarpment provide a suitable environment for the expansion of *Tilia* and the slight increase of *Ulmus*. Further evidence to support a climatic cause for the expansion of deciduous woodland comes from the poor expansion of *Alnus*, which is possibly related to the lack of suitable open and wet sites for colonisation. A period of

woodland decline and increased agricultural activity marks the Roman period which is clearly defined by interstratified occupational debris at both sites.

The Roman period marks the watershed between a period of dominantly physical control on the secondary vegetation, when alder carr and mixed deciduous woodland expanded or declined in response to the local water table, which also dictated the pattern of arable land use, and a period in which the systematic intensification of agriculture related to the Roman agrarian economy. The requirements of the Roman pottery industry were a response to a new culture and technology. Subsistence agriculture could no longer be the mainstay of the food requirements of the population, and the Roman period may be regarded as a threshold which forced farming to become more intensive in order to feed the extra population. At both Rossington Bridge and Sandtoft, the Roman occupation horizons show a phase of agricultural intensification with peak values for cereal pollen and agricultural weeds including *Plantago*, *Rumex*, Asteraceae and *Artemisia* are well represented. A series of Roman field systems has been identified at Potteric Carr which now underlie 90 cm. of peat, and Roman estates are found along the valley of the Torne, such as the one at Stancil (see Map 3). At Sandtoft, the site is adjacent to the former valley of the Don implying that the water table was at this time stable and low enough to allow the cultivation of cereals on many of the low-lying carrlands. The Romans did not cultivate virgin land at Sandtoft, for there is clear archaeological evidence demonstrating the continuity of occupation from at least Iron Age into Roman times. The Romans merely intensified the indigenous farming system and expanded cereal production significantly as the pollen diagrams show. At the same time the marked reduction of arboreal pollen is probably a response to two main factors. Firstly, the clearance of woodland to create more land for arable tillage and increased pressure from animal grazing. The discovery of a complete sheep skeleton and the fragmented remains of other herbivores preserved in the Roman sediments at Sandtoft shows that grazing animals were an integral part of the Roman agricultural system. A second important factor was the depletion of woodland for fuel required to supply the pottery kilns which were widespread in the district (see Map 3). It is probable that over a period of c. 300 years the remaining woodlands of the district were largely destroyed. The curves for *Quercus*, *Betula* and *Alnus* show a marked decrease and at Sandtoft the curve for *Corylus* shows a significant decrease as well. Fragments of *Quercus* and *Corylus* were preserved in the occupation horizon at Rossington Bridge.<sup>6</sup> It is likely that both *Alnus* and *Corylus* provided important sources of the smallwood required for domestic fuel and the pottery industry.

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<sup>6</sup> Unpublished data, Doncaster Museum

The end of the Roman period (c. 50 - 400 A.D.) shows a decline of agricultural pollen and an increase in arboreal pollen. The curtailment of agricultural activity at this period may reflect the abandonment of Roman estates and a deterioration of agricultural productivity as old methods of animal and crop husbandry were reinstated. Alternatively the decline of agriculture in the carrlands may be related to increasing wetness. At the close of the Roman period there is an expansion of *Betula*, *Quercus*, *Corylus* and *Alnus* with the expansion of *Salix* represented at Sandtoft. Poaceae and cereals decrease significantly and there is also a decrease for other herbs and a slight decrease of *Betula* at Sandtoft. The accumulation of peat post-dating the Roman field systems at Potteric Carr, and the intercalation of peat in the ditches at Sandtoft would imply that the local ground water table was rising leading to the formation of peat. At Rossington Bridge there is a gradual transition from peaty clays to *Alnus* and *Molinia* peat at a depth of c. 1.25 m. It appears that the process of agricultural decline was intimately linked with deteriorating physical conditions and possibly also to the abandonment of land formerly under the control of the Romans.

Conditions favouring peat accumulation and the expansion of alder carrland continued into the modern period when the area was drained and systematically given over to arable production. A period of agricultural expansion can be clearly identified at Rossington Bridge with a reduction in arboreal pollen excluding *Alnus* and *Betula* and an expansion of Poaceae, cereals and agricultural weeds. The curve for *Betula* shows a slight expansion which is possibly related to the medieval expansion of agriculture at Loversall Carr giving favourable conditions for colonisation by *Betula* as areas were abandoned. The curve for *Alnus* continues to show a slight expansion which indicates that the medieval period of agricultural expansion was probably unrelated to an improvement of physical conditions everywhere but an occupation of poor land related to land hunger and pressure. The modern drainage of the carrlands has resulted in a marked decrease of marshland but everywhere the land is frequently inundated by water and in most instances the uppermost horizons have been disturbed by ploughing and human activity. Several sites at Potteric Carr showed concentrations of woody charcoal in the top few centimetres implying that much of the area had been burned in preparation for tillage.

## CONCLUSION

The vegetational history provided by the pollen diagrams for Sandtoft and Rossington Bridge is clearly incomplete, as the woodland's composition and character is already modified and periods of agricultural activity are discernible. There has been no mature primary forest in the lowland area of Doncaster for at least 2000 years. The sites investigated are both dominated by the local level of the water table and this major physical constraint has been of critical importance to the human utilisation of the land. Using the Roman occupation horizons as a datum level, it appears that the history of land use is broadly synchronous with the late Bronze Age/Early Iron Age, Roman and medieval clearance phases dominating the pollen diagrams. The area must have been dry land from *c.* 100 - 300 A.D., since there is evidence at both sites for Roman settlement, industry and agriculture during this period, and the subsequent accumulation of peat implies less favourable conditions. The change from the Roman to the medieval period does not appear to be one of absolute abandonment, but rather a gradual decline of agricultural activity leading up to a second period of intensive agriculture possibly related to the transition from the non-nucleated Romano-British pattern to concentrated settlements, such as at Loversall, where secondary woodland already well modified by grazing and the collection of brushwood was cleared and tilled. The area has potential for future research in conjunction with the discovery of new archaeological sites beneath the alluvium and peat which should provide additional evidence for the early clearance of primaeval woodland by man.

## ACKNOWLEDGEMENTS

I would like to thank Paul Buckland and the Staff of Doncaster Museum for the co-operation and assistance given in the preliminary field investigation and also for their kind permission to investigate the site at Sandtoft.

To Dr. John and the staff of the Geography Department at Kingston Polytechnic I would like to express my gratitude for their encouragement and interest which has been invaluable to this study. This project has also greatly benefited from the discussion and criticism of others.

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## APPENDIX<sup>7</sup>

### POTTERIC CARR

#### Site 2

The stratigraphic sequence at site 2 adjacent to the Mother Drain is similar to the Rossington Bridge succession. A pit was dug to a depth of c. 1.50 m, but subsequent flooding resulted in the abandonment of the initial site and all subsequent investigation was made with a screw auger (Fig. A1). Valley bog peat has been preserved in a small amphitheatre-shaped basin deeply incised in the glacial clays. The *Molinia*-alder peat was marginally thicker at this site than at Rossington Bridge and a thin sequence of grey clays, more in sympathy with the sediments to the west, replaced the peaty clays found at Rossington Bridge. A platform of alder branches and twigs occurred at 1.37 m. The base of the sequence is marked by sands and gravels from 2.10 m.

#### Site 3

Site 3 at Seven Arches Bridge was dominated by alder and birch woodland with a thick undergrowth of reeds and purple moor grass. The sequence begins with a modern surface horizon of organic rich silts grading into grey laminated clays which are locally rich in quartz with ferruginous sandy banding (Fig. A2a). A horizon of pale sandy quartz was encountered at a depth of 61 cm and at 91 cm, there was a further band containing charcoal fragments. Below 1.40 m the sediments are predominately lacustrine clay muds and silts.

#### Site 4

West of Black Carr Junction, a top layer of *Molinia* peat up to 90 cm deep had largely been excavated by the Yorkshire Naturalists' Trust using mechanical excavators. The sediments below the excavated peats were investigated by boring with a screw auger. Beneath the peat, a 30 cm layer of sandy clay grades downwards into a thin sequence of organic muds. The organic muds were underlain by pure grey clays which appeared to be lacustrine and little affected by silty hillwash. At 1.93 m the grey clays passed into sands and gravels similar to those encountered in the Mother Drain and Rossington Bridge sections (see Fig. A2b).

#### Site 5

Site 5 at Black Carr Junction was predominantly an area of birch woodland. The influence of topography has clearly asserted itself as lacustrine deposits preserved against the flanks of the sandy plateau are here poorly developed (Fig. A2c). Better drainage has prevented the development of peat, but pure sandy bands derived from the Triassic sands are common. At a depth of 1.60 m coarse sandy gravels were encountered giving only a moderate depth of lacustrine sediment.

#### Site 6

The centre of Potteric Carr was formerly the site of a lake, the Old Eaa, which persisted well into the eighteenth century (Miller 1804). The high level of the water table, despite the dry summer of 1975, made the physical investigation of the stratigraphy difficult. The vegetation was composed of sedges

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<sup>7</sup> Refer to Map 2 in the text for the location of sites.

and rushes. The surface consists of a black structureless slime, formed under anaerobic conditions, overlying a thick sequence of laminated lacustrine silty clays which pass into grey sandy clays at depth (Fig. A2d).

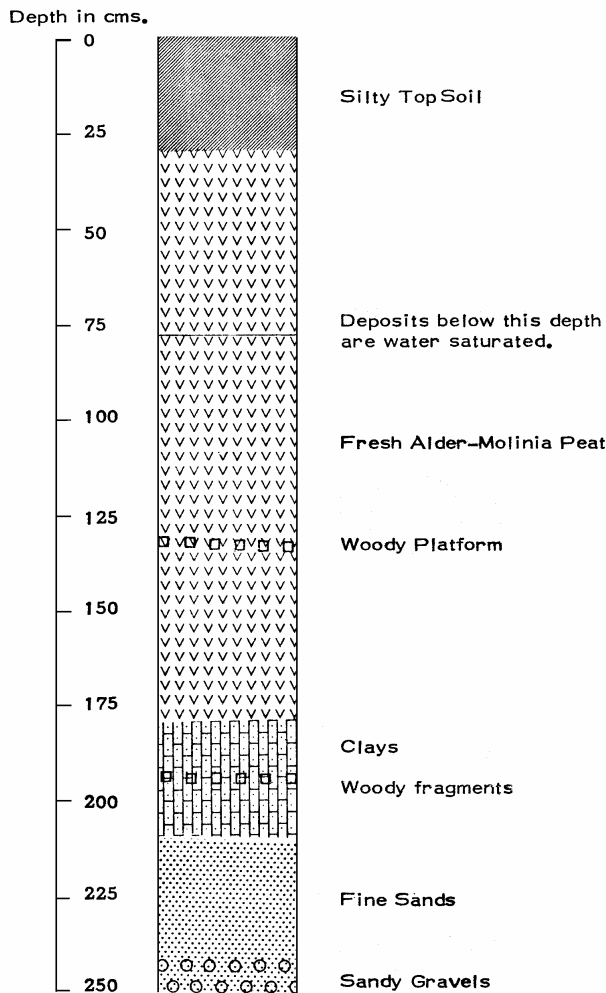


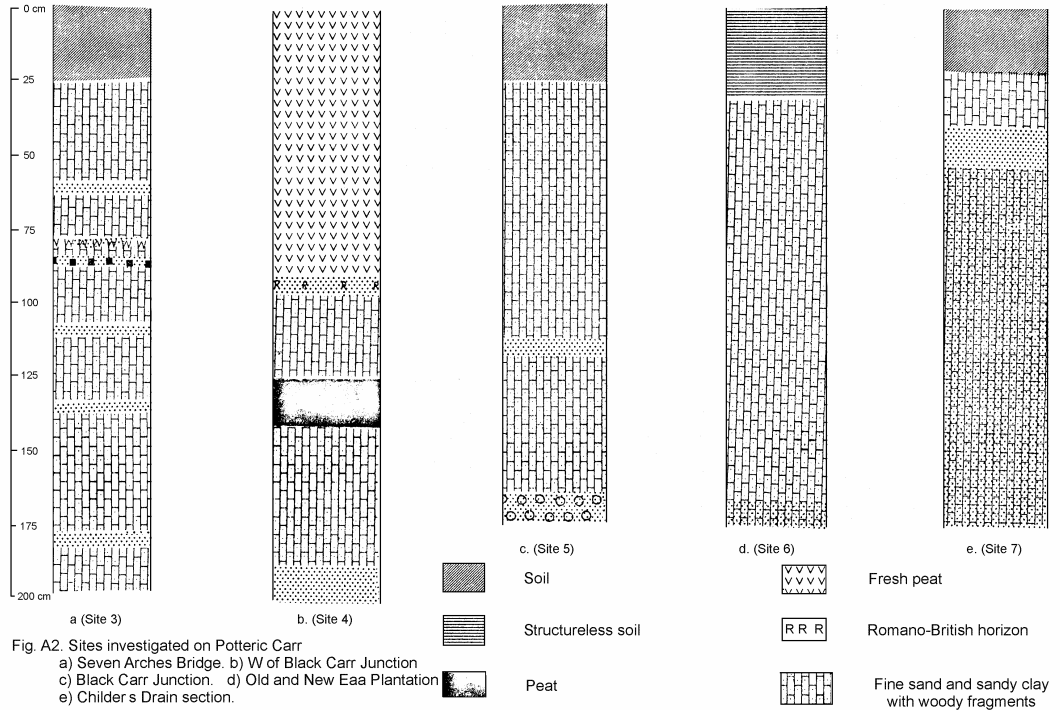
Fig. A1. Mother Drain section (South-east of Warren Golf Course)

The unbroken sequence of lacustrine sediments implies that this area had experienced a long history of deposition forming the stratigraphic centre of the Potteric Carr area of sedimentation.

Site 7

The Childers Drain section to the south of the railway marshalling yards at Doncaster was the northernmost site investigated (Fig. A2e). Beneath a shallow layer of modern peat, the succession was dominated by grey silty clays with a pronounced sandy band at 35 cm. - 53 cm., probably

derived from the sands outcropping to the east and north. The lacustrine clays continued to a depth of at least 180 cm.



## SANDTOFT

At a depth of 2.30 m the basal stiff laminated clays are overlain by 35 cm. of coarse grey sands (see Fig. 3). The grey sands were replaced by ferruginous sands speckled with charcoal fragments in the lower layers, whilst the upper horizons remained free from charcoal. At 1.09 m the sands were followed by a buff coloured clay which had been disturbed by ploughing.