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DOI:
10.1016/j.jas.2003.07.002

Document Version
Publisher's PDF, also known as Version of record

Citation for published version (Harvard):
Smith, D & Howard, A 2004, 'Identifying changing fluvial conditions in low gradient alluvial archaeological landscapes: can Coleoptera provide insights into changing discharge rates and floodplain evolution?', *Journal of Archaeological Science*, vol. 31, pp. 109-120. https://doi.org/10.1016/j.jas.2003.07.002

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Journal of Archaeological Science 31 (2004) 109–120

Journal of Archaeological SCIENCE

http://www.elsevier.com/locate/jas

Identifying changing fluvial conditions in low gradient alluvial archaeological landscapes: can coleoptera provide insights into changing discharge rates and floodplain evolution?

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Received 27 August 2002; received in revised form 6 June 2003; accepted 8 July 2003

Abstract

Using examples from dated alluvial deposits in the Trent basin, UK, this paper suggests that the waterlogged remains of insects, mainly beetles, can be used to detect the occurrence of varying discharge and changing patterns of flood-plain evolution in low gradient alluvial landscapes of Holocene age. This approach may provide invaluable data where the finer-grained nature of sedimentation means that other types of information such as coarse boulder berms are lacking. Comparison of Coleoptera assemblages from three high-energy and two lower-energy deposits indicates that a number of distinctive characteristics can be identified and criteria can be set for the distinction of these two contrasting depositional environments. This approach is tested using Coleoptera remains recovered from a palaeochannel fill at Spalford Meadows in the Lower Trent Valley. The application of this methodology could contribute to the reconstruction of river histories, a key factor in understanding the distribution of valley floor archaeological settlement patterns.

Keywords: Palaeoentomology; Flood-plain evolution; Discharge rates; River Trent

1. Introduction

Intensive research focusing on the Holocene fluvial evolution of British river basins suggests that periods of increased river activity can be correlated with periods of climatic deterioration, a process exacerbated in the middle to late Holocene by the effects of human activity [4,5,12,19–21,24]. Similar patterns of fluvial response to climate change have been described from elsewhere in the world including the USA [16]. Analysis of these data is critical to understanding the distribution of archaeological settlement upon valley floors, particularly the influence of periods of erosion and deposition on human decision-making [1,2]. In northern and western Britain, where high-gradient upland and piedmont river reaches transport cobble and boulder materials, identifying sedimentary deposits and landforms indicative of higher-energy alluvial events is relatively straightforward [11,22,25]. Even fine-grained channel fills in these steep gradient environments contain clear evidence of higher-energy events from changes in grain size and lithology [26].

In contrast, reconstructing fluvial histories in the lower gradient river systems of southern and eastern Britain, where fine gravel, sand, silt and clay transport is dominant, is more problematic. This is further complicated from the mid-to late Holocene by human activity enhancing sediment delivery to valley floors and the alteration of natural channel planforms through engineering. The combination of low channel gradients, subdued floodplain relief and fine-grained sedimentation provides few obvious indications of the scale and effects of changing discharge rates especially away from the active channel zone. With a few exceptions, such as at Runneymede, where Bronze Age floods have been recognized in fine-grained alluvium [27], the majority of

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doi:10.1016/j.jas.2003.07.002

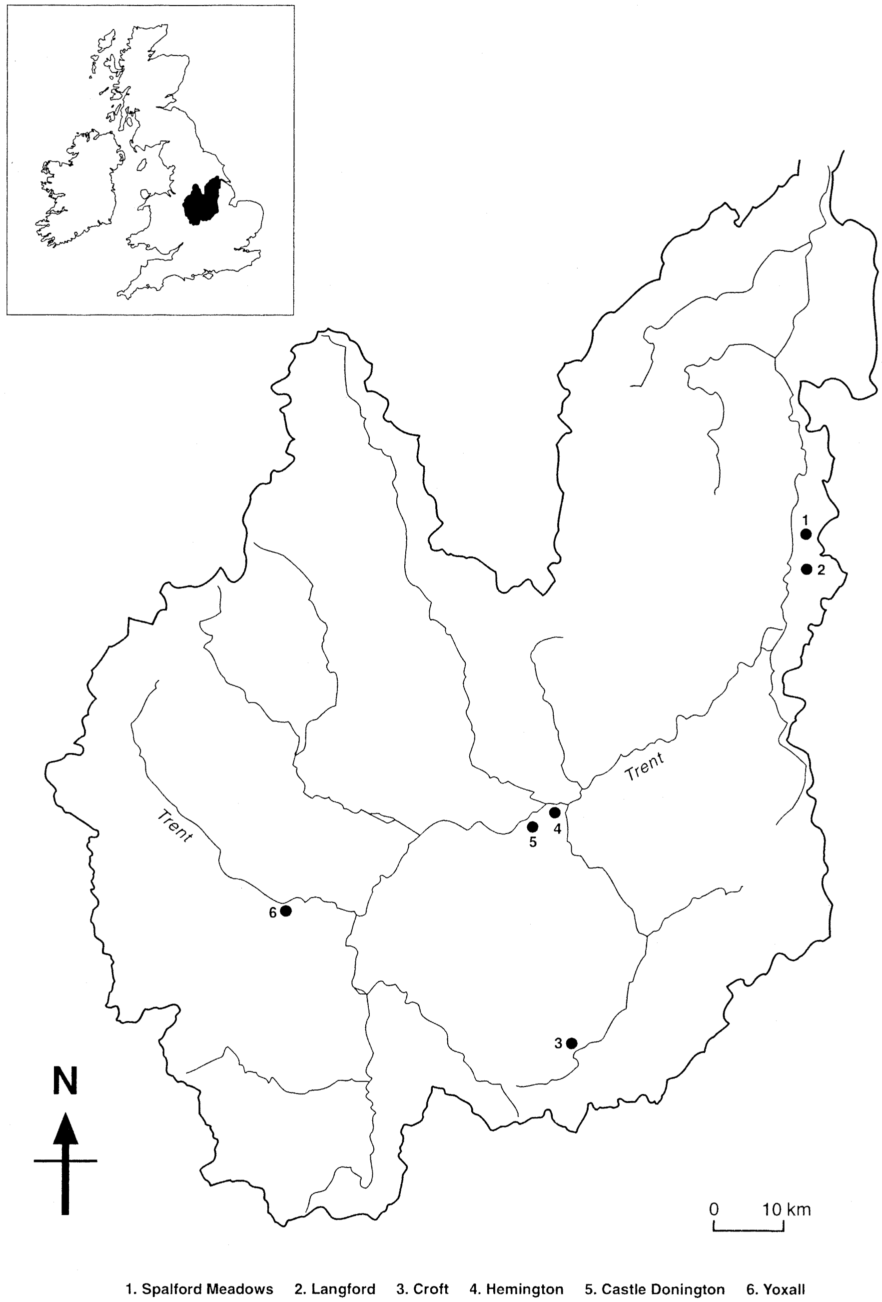

Fig. 1. Map showing site locations.

studies in lowland contexts have used a combination of documentary [17], geochemical/sedimentological [23] and novel palaeomagnetic [9] techniques to reconstruct fluvial histories over the recent historic period.

Recent research by Moores et al. [26] has demonstrated the potential of high-resolution sedimentological and bioarchaeological analysis of individual palaeochannel fills and proximal floodplain environments for interpreting changing discharge rates. When combined with detailed archaeological information, this approach provides the opportunity to relate local cultural behaviour with basin-scale fluvial events. Using examples from the Trent basin (Fig. 1), the aim of this paper is to demonstrate the contribution that sub-fossil Coleoptera remains might play in the reconstruction of fluvial histories in low gradient river systems.

1.1. Background to research area

The River Trent rises on the Staffordshire moorlands and flows essentially eastward in its upper and middle parts as far as Newark on Trent, from where it turns directly north to the Humber Estuary and the North Sea. It drains an area of approximately 7490 km^2 and is approximately 149 km long [37]. Although its catchment area is the second largest in England and Wales, the river has the highest mean annual discharge (82.21 m^3 s^{-1}), reflecting the input of tributaries draining large upland zones, principally the Dove, Derwent and Soar in the middle reaches of the valley.

The Trent is ideally suited for assessing the usefulness of sub-fossil Coleoptera assemblages for the reconstruction of changing discharge rates since: (1) the high discharge and its potential for variability makes the river particularly sensitive to the effects of climate change, especially during the last circa 5000 years [4]; (2) a number of reaches within the drainage basin have been the focus of detailed geomorphological and geoarchaeological investigations, which have led to the identification, interpretation and dating of a number of discrete fluvial units [4,5,13], as well as more general valley floor chronologies [31,32].

1.2. Methodological approach

The approach taken in this research has been to examine Coleoptera faunas recovered from three sites (Langford, Hemington and Croft) where sedimentological and archaeological evidence suggest that deposition has occurred under high-energy conditions. These faunas are compared with those recovered from two sites (Yoxall Bridge and Castle Donington) where the deposits, and hence fauna, appear to have been deposited under lower energy conditions. This comparison has allowed the identification of characteristic ‘type’ faunas for each environment, which in turn offers, the potential for reconstruction of fluvial conditions where other indicators may be absent. To test this ‘type’ fauna hypothesis, the characteristics of insect remains recovered from an additional site (Spalford Meadows) were established and an assessment made of the conditions of deposition.

In most cases, the material examined was sampled by one of the authors (DNS). Usually between 10 and 15 kg of sediment was collected and coleopterous remains extracted using the standard method of paraffin flotation described in Kenward et al. [15]. Insect remains were identified by direct comparison with the Gorham and Girling collections housed at the Institute of Archaeology and Antiquity, The University of Birmingham. The taxonomy follows that of Lucht [18]. In order to allow comparison between field sites, the ecology of the Coleoptera recovered has been summarized into a number of ecological groupings based on those established by Robinson [29,30]. However, for clarity, the synanthropic groupings have been excluded and descriptive labels have been used rather than Robinson’s numerical codes (Table 1).

Table 1
Ecological groupings for Coleoptera used as part of this study

Ecological grouping	Robinson [29,30] code
Aquatic	1
Fast flowing/aquatic	No equivalent
Waterside	5
Dung and foul terrestrial	7
Grassland/terrestrial	2 and 11
Woodland/terrestrial	4

2. Site locations and characteristics

2.1. Langford Quarry, Lower Trent Valley

Langford Quarry (SK 815605) is situated adjacent to the contemporary river, approximately 5 km north of Newark on Trent (Fig. 1). Sedimentary exposures comprise Mercia Mudstone bedrock overlain by 4–6 m of massively bedded sands and gravels, in turn blanketed beneath 2–3 m of fine-grained red-brown silt and clay alluvium [13]. During 1995, quarrying led to the discovery of human and animal bones within a 15 m wide palaeochannel infilled by over 2 m of planar and trough cross-bedded sands and gravels. Abundant large woody debris in the top of the channel, suggested that the sequence and its associated archaeological material formed in a ‘log jam’ [13]. This conclusion is supported by: the absence of in situ peat deposits indicative of local reed-bed or still water backswamps; the preservation of tree trunks with intact root boles probably incorporated into the channel through tree throw during bank undercutting; and the lack of abrasion or mechanical damage to the human bone, some of which was still semi-articulated, suggesting rapid deposition. Radiocarbon dating of a single piece of human rib provides an age estimate for the deposit of 2350–2030 cal. BC at 2σ (Beta-87093). A dendrochronology curve was also established with dates spanning the period 2424–2143 BC.

Two samples (103/ES4 and ES 103) of insect-rich silts and sands were taken from behind the log jam, whilst a third sample (102) came from sediments preserved within a tree bole. Ecological summaries of all three samples are presented in Table 2 and Fig. 2. The total minimum number of individuals and the number of species recovered is presented in Table 3 and Fig. 3.

2.2. Hemington Quarry, Middle Trent Valley

Hemington Quarry (SK 460300) lies adjacent to the modern river close to its confluence with the River Derwent (Fig. 1). Basal exposures comprise 3–5 m of periglacially modified sand and gravel over the Mercia Mudstone rockhead. These Late Glacial sands and gravels are cut and reworked by a number of major channels showing avulsion behaviour between the 10th

Table 2
The ecological groupings of the Coleoptera from Langford, Hemington and Croft quarries

Site	Langford			Hemington			Croft	
Sample	102	103/ES4	103	7	42	45	Neolithic/40	Iron Age/22
% Aquatic	5.8	8.4	8.9	8.2	5.5	8.4	30	15.5
% Fast flowing/aquatic	23.8	23.6	30.9	30.8	36.2	28.7	28	36.8
% Waterside	6.8	11.1	9.7	6.3	8.1	6.5	6.4	12.8
% Dung+foul/terrestrial	14.1	11.5	8.00	14.4	15.5	11.8	5.6	7.1
% Grassland/terrestrial	2.5	14.1	32.00	19.3	31.1	17.8	6.7	16.1
% Woodland/terrestrial	35	17.9	12.00	1.5	0.7	1.8	23.6	7.1

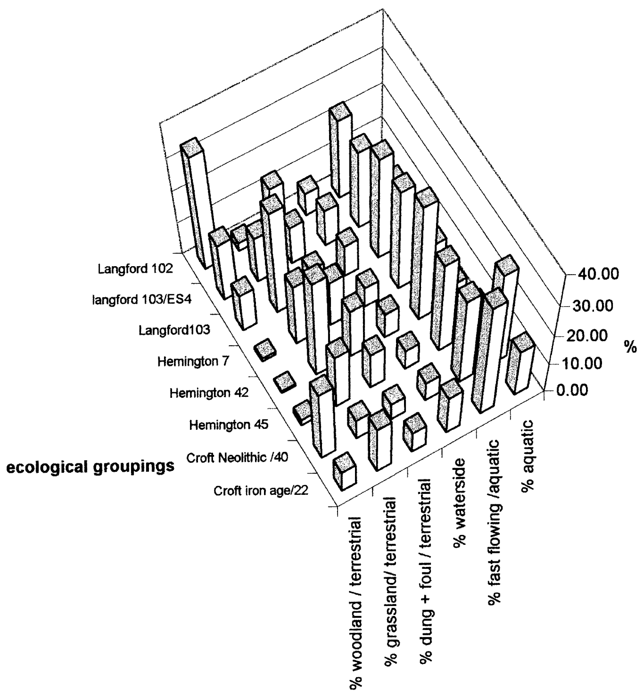

Fig. 2. The ecological groupings of the assemblages of Coleoptera from Langford, Hemington and Croft quarries.

and the 16th centuries AD [5,31]. Subsequently, the area was blanketed by 1–2 m of fine overbank alluvium [9].

During quarrying in 1993, three Medieval bridges marking former crossings of the Trent were uncovered at Hemington [7]. Three insect-rich samples were recovered from a sand and gravel fill behind a wattle hurdle placed against one pier of an 11th century bridge. A high-energy depositional environment [5] is supported by: the sedimentary structures; the absence of in situ peats; the rotation of the bridge pier adjacent to this unit, possibly as a result of rapid severe erosion and undermining; and the correlation of dendrochronological dates for pier structures with historical records of severe flooding [4].

Ecological summaries for the faunas of the three samples (Hemington 7, 42, 45) are presented in Table 2 and Fig. 2. The total minimum number of individuals and the number of species recovered is presented in Table 3 and Fig. 3. The full insect fauna recovered from this site will be presented elsewhere [6], although aspects of it have been discussed in Smith [34].

2.3. Croft Quarry, Upper Soar Valley, Trent Basin

The quarry lies adjacent to the Thurlestone Brook (SK 517968), about 15 km to the southeast of Leicester (Fig. 1) and is only a few hundred metres away from its confluence with the River Soar. Full details of the palaeoenvironmental and geomorphological work undertaken at this site are reported in Smith et al. [35]. However, in summary, Mercia Mudstone bedrock is covered by a veneer of glacial till, in turn overlain by a sand and gravel terrace probably aggraded during the Late Glacial period. During the Holocene, the brook migrated across this terrace surface leaving a series of palaeochannels between 4–15 m wide and 1–3 m deep. Two of these channels have been radiometrically dated, one to the Neolithic (3800–2900 cal. BC to 2030–1610 cal. BC [Beta 74199 and Beta 78006]) and the other to the Iron Age to Romano-British period (350 cal. BC to 350 cal. AD [Beta 78005]). Pollen, plant macrofossil and insect analyses from sediments within these channels broadly corroborate these dates [35]. Both channels contain coarse gravels fining upwards into organic-rich sand fills. The absence of in situ peats suggests deposition in an active channel environment.

Ecological summaries for the faunas of the two samples, one collected from the middle of the Neolithic channel (40), the other collected from the middle of the Iron Age channel (22) are presented in Table 2 and Fig. 2. The total minimum number of individuals and the number of species recovered is presented in Table 3 and Fig. 3.

2.4. Yoxall Bridge, Upper Trent Valley

The site at Yoxall Bridge (SK 132178) lies adjacent to the River Trent, approximately 2 km downstream from its confluence with the River Blythe (Fig. 1). Excavations associated with the construction of a new gauging station by the Environment Agency revealed a

Table 3
The number of individuals and number of taxa from Langford, Hemington and Croft quarries

Site	Langford			Hemington			Croft	
Sample	102	103/ES4	103	7	42	45	Neolithic/40	Iron Age/22
No. of individuals	189	144	113	519	577	568	251	172
No. of species	90	88	63	146	168	150	86	63

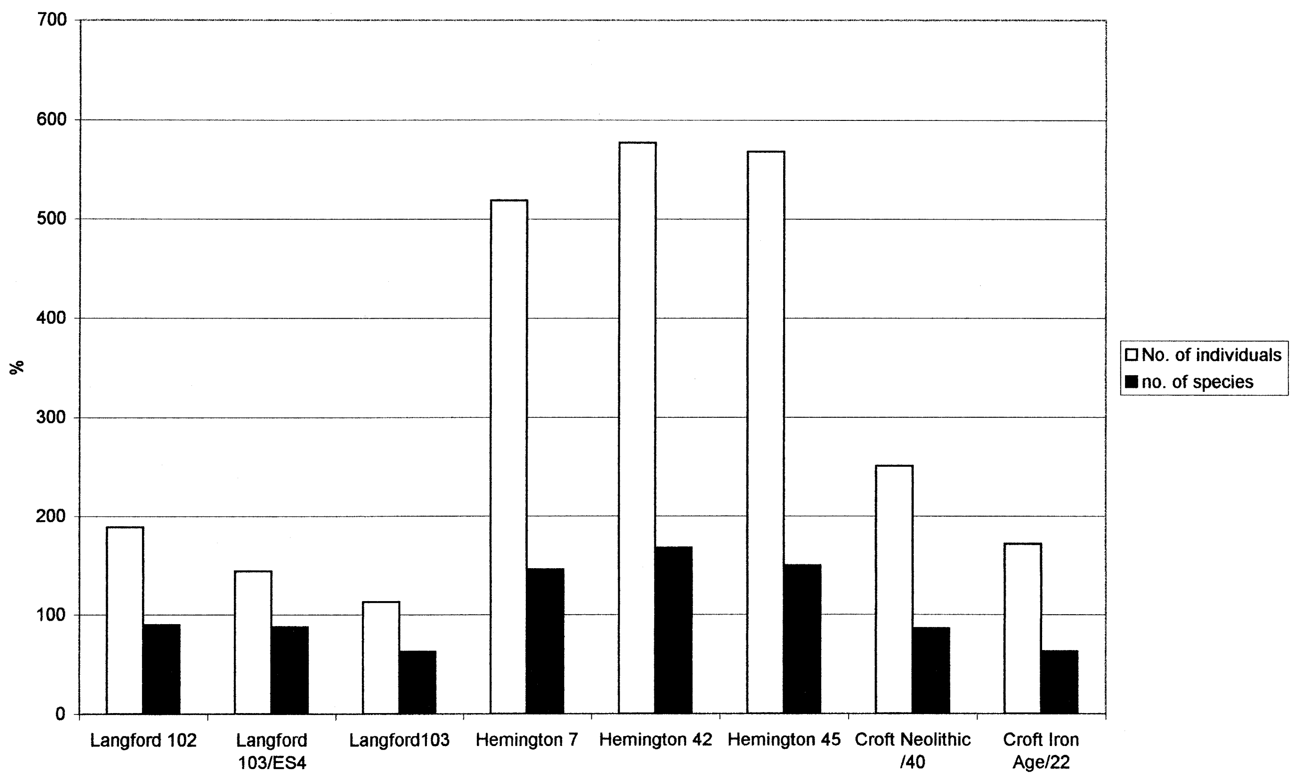

Fig. 3. The number of individuals and taxa in the assemblages of Coleoptera from Langford, Hemington and Croft quarries.

shallow palaeochannel, approximately 4 m wide and half a metre deep, truncating grey, horizontally bedded gravels. The channel was infilled by a silty fibrous peat, which at the base was interleaved around an accumulation of small, worked and un-worked timbers. The peat was sealed beneath circa 1 m of clay alluvium. Radiocarbon dating of a sample of timber from the base of the channel provides an age estimate for the deposit of 1049 to 810 cal. BC (Beta-73350). Two factors indicate that sedimentation occurred in a low-energy environment: (1) the grain size was uniformly fine; and (2) the majority of the organic material consisted of fragments of *Phragmites* stem and roots. Ecological summaries for the fauna are presented in Table 4 and Fig. 4. The total minimum number of individuals and the number of species recovered is presented in Table 5 and Fig. 5. Full details of the insects recovered from Yoxall are published in Smith et al. [36].

2.5. Castle Donington, Middle Trent Valley

The site at Castle Donington (Willow Farm, SK 445288) is located approximately 3 km upstream of Hemington Quarry (Fig. 1), in the present floodplain, approximately 400 m from the contemporary channel. During archaeological excavations, a series of palaeochannels were identified either side of the site of a Bronze Age burnt mound. A section through the channel immediately adjacent to the prehistoric site suggested that it was approximately 60 m wide and 2 m deep, and infilled by silty peat sealed beneath grey clay alluvium. Fire-cracked pebbles and other cultural material from the site had been incorporated into the channel fill. A radiocarbon date from the silty peat at the base of the channel gave an age determination of 1705–1410 cal. BC (Beta 119653). Two further dates on the silty peat straddling a stone layer in the channel

Table 4
The ecological groupings of the Coleoptera from Yoxall and Castle Donington

Site	Yoxall	Castle Donington Burnt Mound Channel									Castle Donington Western Palaeochannel			
Sample		CD64	CD63	CD62	CD61	CD60	CD59	CD58	CD57	CD56	CD 0–10	CD 10–20	CD 30–40	CD 50–60
% Aquatic	42.50	20.5	48.6	13.9	33.3	31.3	43.2	31.7	19.3	31.9	17.0	21.9	46.7	37.7
% Fast flowing/aquatic	3.50	5.1	5.7	2.8	10.0	5.1	7.4	12.2	7.0	0.0	6.8	2.9	0.0	1.4
% Waterside	23.90	20.5	20.0	27.8	13.3	10.1	12.3	14.6	15.8	27.7	12.5	8.6	2.7	11.6
% Dung+foul/terrestrial	4.60	4.8	0.0	30.0	7.7	3.8	13.3	17.6	12.1	21.1	12.5	10.0	21.1	14.7
% Grassland/terrestrial	17.20	19.0	0.0	10.0	0.0	11.3	10.0	17.6	6.1	15.8	14.3	11.4	0.0	17.6
% Woodland/terrestrial	2.20	4.8	11.1	0.0	0.0	1.9	6.7	5.9	3.0	0.0	0.0	2.9	0.0	2.9

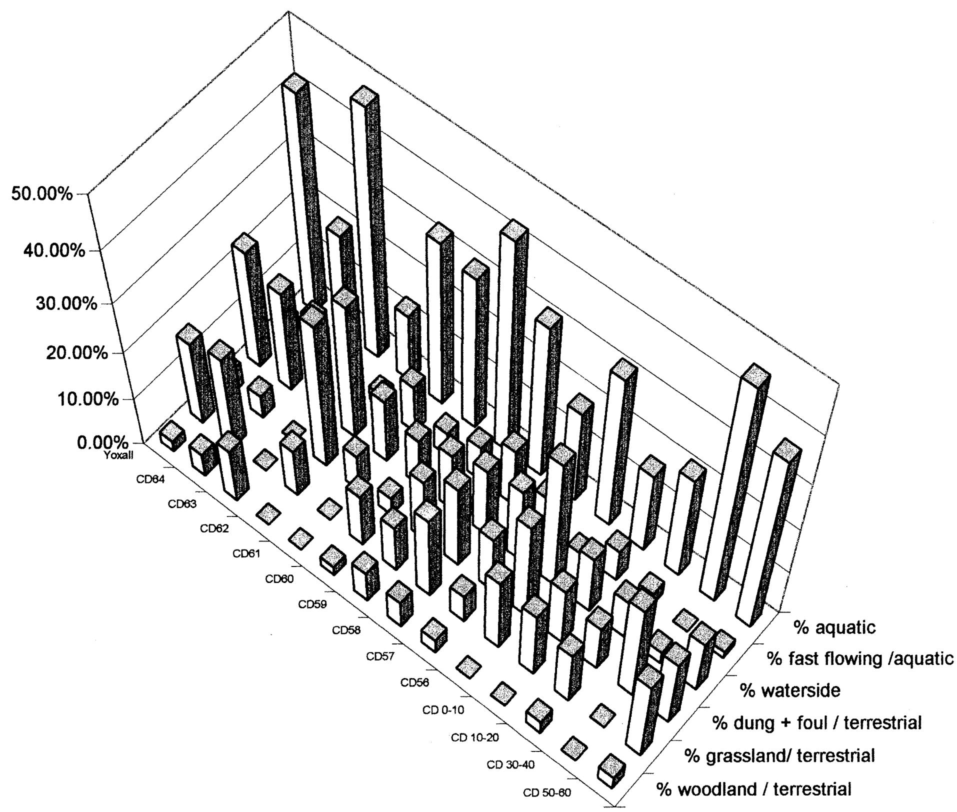

Fig. 4. The ecological groupings of the assemblages of Coleoptera from Yoxall and Castle Donington.

Table 5
The number of individuals and number of taxa from Yoxall and Castle Donington

Site	Yoxall	Castle Donington Burnt Mound Channel									Castle Donington Western Palaeochannel			
Sample		CD64	CD63	CD62	CD61	CD60	CD59	CD58	CD57	CD56	CD 0–10	CD 10–20	CD 30–40	CD 50–60
No. of individuals	263	39	35	36	30	99	81	41	57	47	69	75	105	88
No. of species	86	30	19	27	20	49	46	27	29	28	41	38	54	48

section, which could be traced back into the layers of the burnt mound, provided dates of 1390 to 910 cal. BC and 1145 to 835 cal. BC (Beta 119651 and Beta 119652). Insect-rich samples of silty peat were collected from this channel fill (CD 64 to CD 56).

A second section of this palaeochannel, approximately 40 m wide and 3.5 m deep was excavated approximately 40 m to the west of the burnt mound. The channel fill comprised silty peat overlain by grey, clay alluvium. A radiocarbon date from silty peat at the base

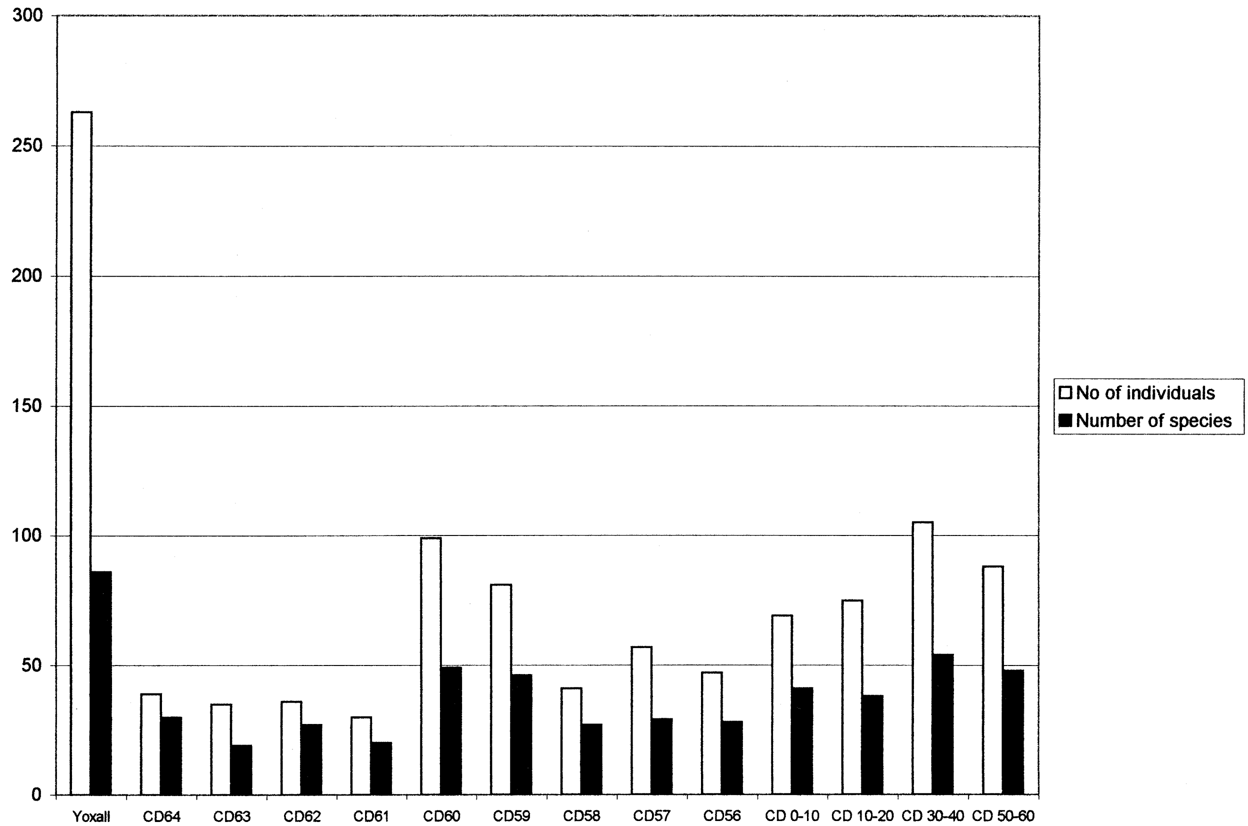

Fig. 5. The number of individuals and number of taxa in the assemblages of Coleoptera from Yoxall and Castle Donington.

of this channel provides an age estimate of 1135–830 cal. BC (Beta 119648). Insect-rich samples of silty peat were collected from the channel fill (samples CD 0–10 and CD 50–60). Low-energy conditions are indicated by the abundance of stems, roots and other organic matter indicative of marsh vegetation and the uniform fine-grained nature of the sediment. Ecological summaries for the faunas are presented in Table 4 and Fig. 4. The total minimum number of individuals and the number of species recovered are presented in Table 5 and Fig. 5.

The sites at Langford, Hemington and Croft appear to represent deposition under high-energy fluvial conditions, whereas as those from Castle Donington and Yoxall are believed to represent lower-energy environments.

3. Results

3.1. The contrasting characteristics of faunas from high and low energy fluvial environments

The coleopterous faunas from the three high-energy environments (Langford, Hemington and Croft) and the two from the low-energy environments (Yoxall and Castle Donington) have a number of contrasting ecological characteristics. Although the details may differ, the compositions of the faunas within the two broad groups of fluvial environments are similar in terms of ecological and numerical criteria. Where differences are present, these can be explained by changes in the nature of the prevailing landscape during the Holocene rather than by differences resulting from the prevailing channel conditions at the time of deposition. Longer-term records for the Lower Trent Valley have been described from Bole Ings, Nottinghamshire [3,8]. Greenwood and Smith [10] provide a detailed discussion of how these temporal trends are represented in the wider palaeoentomological record of the Trent Valley.

Three contrasting characteristics can be recognized.

3.1.1. Diversity and abundance

All of the faunas from sites indicative of high-energy conditions contain relatively large numbers of individuals representing a wide range of taxa (Table 3 and Fig. 3), when compared to those from both Yoxall and Castle Donington which are less diverse. Kenward has suggested that with terrestrial deposits, a highly diverse insect assemblage is usually derived from allochthonous sources (sensu [14]). It would therefore seem that the same may be true of diverse fluvial faunas.

3.1.2. The nature of the water beetles recorded

At the three sites held to be indicative of high-energy conditions, the water beetles present are dominated by taxa associated with fast flowing waters (represented by the fast flowing aquatic group in Tables 2 and 4 and Figs. 2 and 4). These species can account for 20–40% of the total fauna present at the high-energy sites. These taxa are absent from the sites representing low-energy environments.

The grouping of species associated with high-energy conditions comprise species such as the dytiscids, *Stictotarsus duodecimpustulatus* (F.) and *Potamonectes depressus* (F.) and a wide range of elmid "riffle beetles". In samples from both Langford and Hemington quarries, this latter group includes numbers of the now rare species, *Stenelmis canaliculata* (Gyll.) and *Macronychus quadrituberculatus* Müll [33]. Though some of these rare species are absent from Croft, this probably reflects the comparatively small-scale of this headwater tributary channel. Probably the determining factor in terms of *S. canaliculata* and *M. quadrituberculatus* is the channel depth and the occurrence of scour holes in the riverbed rather than channel width alone.

However, the presence of these fast water species alone may not specifically indicate periods of higher magnitude flow. These species would have been part of the standard 'suite' of insects found in the middle reaches of any lowland river during the early and mid-Holocene, where fast flowing, clear water ran across sandy and gravelly beds, conditions similar to those commonly found in riffle zones. However, in Britain, their presence in lowland river systems appears to become restricted after the onset of catchment-scale alluviation [28,34] and therefore, their usefulness for reconstructing fluvial histories is restricted to the early and at the latest, middle Holocene. Equally, it may be possible that these assemblages, and indeed the contrast between them, may be present in the same contemporary middle Holocene floodplain system. This is certainly a hypothesis which needs to be explored more fully, but would require the systematic large-scale investigation of a range of sedimentary and bioarchival sequences at the reach level. This is an issue that is highlighted in this paper, but is beyond the present scope of the dataset.

3.1.3. The relative dominance of terrestrial species recorded

The sediments developed at the three sites under high-energy fluvial conditions contain a relatively high proportion of species indicative of terrestrial environments including forest/woodland or pasture. This suggests that the majority of species recorded are derived not from the river channel itself, but from areas of the surrounding floodplain and valley slopes. In contrast, the species present at Yoxall and Castle Donington are predominately from aquatic and reed swamp ecologies (the waterside grouping in Table 4 and Fig. 4) and include the chrysomelid *Donacia* and *Plateumaris* 'leaf beetles' and the curclionid *Notaris* and *Thyrogenes* 'weevils', which are represented in numbers.

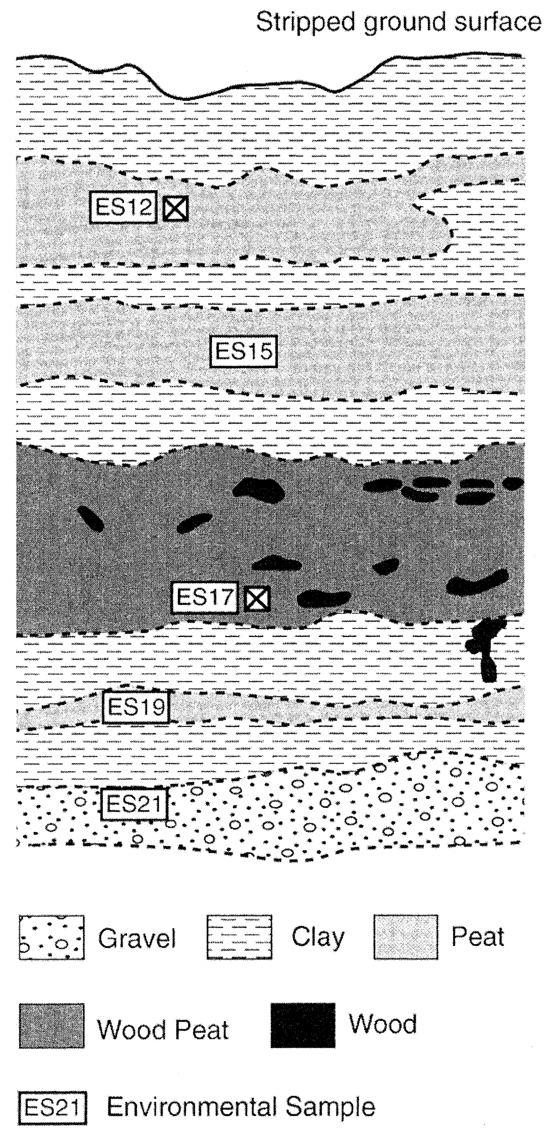

Fig. 6. The stratigraphy of recorded section at Spalford Meadows.

4. Discussion

4.1. Distinguishing high-energy and low-energy deposits

The results of analyses from the three sites (Langford, Hemington and Croft) associated with high-energy conditions and the two sites (Yoxall and Castle Donington) associated with lower-energy conditions suggest that the faunas from these two types of river conditions are intrinsically different and contrasting. This information

Table 6
The ecological groupings of the Coleoptera from Spalford Meadows

Sample	12	15	17	19	21
% Aquatic	30.6	51.4	41.2	0.0	0.0
% Waterside	10.2	15.7	6.5	0.0	0.0
% Grassland/terrestrial	4.1	5.7	31.1	0.0	0.0
% Woodland/terrestrial	0.0	0.0	2.4	0.0	0.0
% Moorland/terrestrial	2.0	0.0	0.2	0.0	0.0

could be used to reconstruct episodes of changing discharge in low gradient river systems where medium to fine gravel, sand, silt and clay transport predominates.

In order to test this hypothesis, an opportunity arose to sample a large, 20–30 m wide palaeochannel of the Trent at Spalford Meadows, approximately 15 km downstream of Newark on Trent. Exposures at the site revealed a channel infilled by intercalated beds of clay and peat (Fig. 6). Sediment samples for insect analysis were taken from several thin beds of peat (samples 12, 15, 19 and 21), and a thicker continuous peat unit exposed in the middle of the section (sample 17). This latter layer included large woody debris consisting of larger tree limbs, roots and branches. The ecological groupings for the coleopterous faunas from Spalford Meadows are presented in Table 6 and Fig. 7. The numbers of individuals and species for the samples are displayed in Table 7 and Fig. 8.

The Coleoptera assemblages from samples 12, 15, 19 and 21 are similar in character to the faunas derived from the lower-energy deposits at Yoxall and Castle Donington in that they appear to contain a low density of remains from a restricted range of fauna. Ecologically, most of beetles present are characteristic of slow and stagnant aquatic conditions. Equally there are very few species from terrestrial environments. As with the samples from Yoxall and Castle Donington, the water beetles and reed bed taxa present appear to represent only the local conditions in the channel at the time of deposition.

In contrast, sample 17 from the wood-rich peat appears to have a different set of characteristics, which includes a high concentration of individuals and a much wider range of taxa recovered (see Table 7 and Fig. 8). Most of the terrestrial species are not derived from the local reed bed, but from the wider landscape, in this case from meadowland and pasture. Despite the large amount of woody debris within the peat, there are no species indicative of woodland (Table 6 and Fig. 7). This suggests that much of the wood present in the channel was not derived from an in situ fen carr, but was transported into the area. This most probably indicates

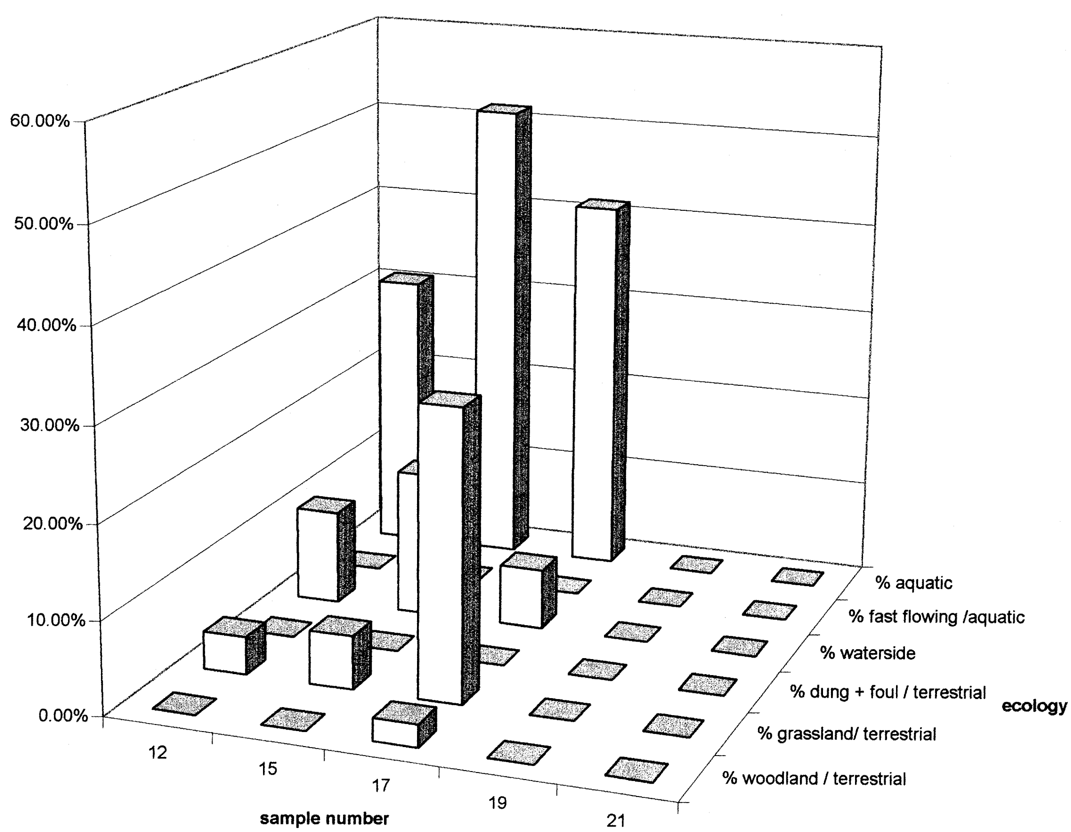

Fig. 7. The ecological groupings of the assemblages of Coleoptera from Spalford Meadows.

Table 7
The number of individuals and number of taxa from Spalford Meadows

Sample	12	15	17	19	21
No. of individuals	49	70	538	0	0
No. of species	33	30	109	0	0

deposition of the fauna and associated sediments under higher-energy conditions. The insect fauna recovered from sample 17 certainly more closely resembles the characteristics of the samples collected from the high-energy units at Langford, Hemington and Croft, than the lower energy deposits described from Yoxall and Castle Donington.

5. Conclusions

This study has demonstrated the potential for the development of a methodological approach to distinguish local low-energy and high-energy fluvial depositional environments on the basis of their associated Coleoptera faunas. Such a technique is particularly useful for the reconstruction of fluvial histories in low gradient river systems where the finer-grained nature of sedimentation may prevent the identification of high-energy events away from the contemporary channel. However, although the test samples from Spalford Meadows appear to support this methodological approach, a number of key issues still require further investigation by the palaeoenvironmental community before this technique can be widely applied.

- First, there are too few palaeoentomological datasets from low gradient alluvial contexts dating to different periods of the Holocene, an issue preventing rigorous statistical testing of this hypothesis. To date, most coleopteran analysis of riverine deposits has been undertaken on Neolithic and Bronze Age deposits, primarily reflecting the abundance of both cultural and environmental archaeological remains from these periods encountered during quarrying and rescue excavation. Too often, other finer-grained alluvial units exposed within sections, which may be insect-rich, are considered as overburden.
- Second, this hypothesis is based primarily on trends observed from coleopteran remains. These results should be corroborated by parallel studies of other biological evidence including pollen, plant macrofossils, mollusca, diatoms and bryozoa.
- Third, too few palaeoenvironmental sites are set within a secure radiometrically dated stratigraphic framework. Systematic sampling and analysis of organic deposits across a range of floodplain topographic contexts would help to determine if the trends observed within our dataset actually could reflect changes in widespread discharge patterns through time or only reflect locally changing conditions in the same contemporary floodplain environment.
- Fourth, there is not enough information from modern ecological analogues concerning particularly, the relationship between fluvial discharge and composition of the resulting insect fauna. This information could be helpful in the estimation of the scale of discharge events recorded.

As well as providing important data for use by the geological and geomorphological communities,

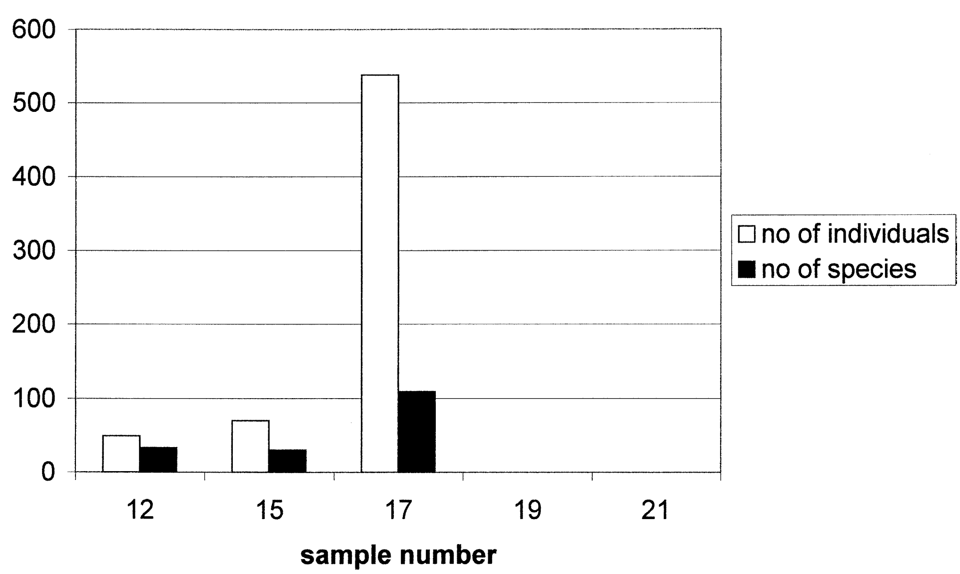

Fig. 8. The number of individuals and number of taxa in the assemblages of Coleoptera from Spalford Meadows.

particularly in extending and deciphering floodplain histories, this approach has the potential to provide critical information for archaeologists attempting to understand settlement patterns in lowland alluvial environments.

Acknowledgements

The authors would like to thank the following archaeological units (and many of their individual staff) for allowing us to present the data on which this paper is based, and for inviting us to join many of their excavations in the Trent Valley and surrounding environs: Birmingham University Field Archaeological Unit; Trent and Peak Archaeological Unit and the University of Leicester Archaeological Service. The paper was read at various times by Wendy Smith whose comments were, as always, invaluable. Fig. 1 was compiled with the help of Malcolm Greenward. We would like to thank Harry Kenward and an anonymous second referee for their helpful comments on a draft of this paper.

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