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The River That Swallowed the Ringwood Prehistoric Landscape: Geoarchaeological investigations in advance of the development of the A31, Hampshire, England

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In March 2022, two geoarchaeological boreholes were drilled within the Avon Valley at the site of Jubilee Gardens, Ringwood, Hampshire. The works were commissioned from Connect Archaeology by VolkerFitzpatrick on behalf of their client, National Highways, as part of the A31 road widening and junction improvement works. One sequence was selected for palaeoenvironmental analysis and radiocarbon dating, aiming to provide evidence for landscape development in an area where such records are sparse. The results highlight two temporally removed phases of deposition. The early Neolithic base of the sequence illustrates the presence of alder carr and herbaceous wetland in the lower valley, with the higher land home to open grassland with copses of primarily hazel. Beyond the scheme footprint, Neolithic long barrows and Bronze Age barrow cemeteries were constructed among the higher grasslands, standing as prominent monuments overlooking the floodplain. It is possible that changing climate of the 2.8 ka event, bringing colder and wetter conditions, may have pushed people from the region as the rivers grew more powerful and eroded the ground around them. Such an event may explain the decline in regional human activity during the Iron Age period, as well as an absence of the channel's depositional sequence. By the early medieval period, conditions returned to deposition within the river channel, with herbaceous wetlands spreading through the lower valley, bringing a decline in alder carr, as agricultural field systems became prominent across the upper valley. Evidence for land reclamation and flood alleviation is shown throughout the 20th century as Ringwood grew.

Extended Summary

Two geoarchaeological boreholes were drilled in March 2022 at the site of Jubilee Gardens, which lies between the River Avon to the north and west, and the town of Ringwood to the east, within Hampshire. The works were commissioned from Connect Archaeology by VolkerFitzpatrick on behalf of their client, National Highways, under the advice of Stantec and the Hampshire County Council Archaeologist, as part of the A31 road widening and junction improvement works.

Deposit data, both historic and newly gathered as part of the scheme Ground Investigation programme, were utilised to produce deposit models illustrative of past landscape development that can be interpreted to identify former land surfaces, and features that contribute to accretion or erosion of sediments. Modelled topographies, valley cross sections, and 3D landscape reconstructions are used to illustrate and combine the project's findings. The deposit model contextualises an area of low-lying Pleistocene gravels within the site, perhaps representative of former channel positions, or of inlet or backwater environments, which enabled the formation of deposits that preserved valuable palaeoenvironmental remains in an area where they are generally absent.

The westernmost of the two sediment sequences was selected for further palaeoenvironmental investigations (pollen, diatoms, and ostracods/foraminifera) and radiocarbon dating owing to its thicker, more coherent waterlogged Holocene sequence. The basal infill of the possible channel identified comprises coarse material, predominantly silty gravel at the base, overlain with organic sand and gravel, then silt and gravel. The basal Holocene deposits were subject to radiocarbon dating, which demonstrates deposition in the Early Neolithic (3530 to 3370 cal BC).

Plant macrofossils and pollen from the Neolithic deposits reveal a local environment dominated by *Alnus glutinosa* (alder) and *Carex* sp. (sedges), accompanied by other taxa typical of woodland and wetland environments. The pollen assemblage indicates the environment of the low-lying valley floors comprised wetlands of grasses, sedges, and reeds along the riverbanks, shadowed by woodland of alder, willow and hazel. The pollen assemblage also provides insight about the vegetation of the wider landscape; the valley slopes were seemingly occupied primarily by open grassland, with small pockets of mixed woodland. Elm and lime are found in unusually low numbers for the time period, and the abundance of hazel may indicate woodland clearance and recolonisation with low shrubby taxa.

Diatom evidence from the Neolithic and later sediment indicates an overall shallow freshwater environment with periods of drying and also a peak in rheophilous taxa, representative of flowing water. This suggests the channel or inlet to have been intermittently active at this time. Further up the sequence, conditions become more consistent with shallow freshwater, represented by dominantly benthic and non-planktonic species.

Gravel deposits continue upward to 12.45m OD, accompanied by silt and a hiatus in the pollen record. It is possible that this, coming above the Early Neolithic (3530 to 3370 cal BC) date, reflects the climatic changes associated with the 4.2 ka event when conditions are hypothesised to have become more arid and colder (Roland *et al.* 2014).

A sudden change in lithology at 12.45m OD to finer grained silt and clay is accompanied by a change in the pollen profile. Poaceae (grasses) become dominant overall, and tree and shrub pollen show a decline compared with that of the lower sequence, demonstrating a change to more open conditions. The tree pollen shows a more diverse population, because of a decline in *Alnus glutinosa* (alder). An expansion of Cyperaceae (sedges) reflects the overall rise in water levels and more continuous inundation within the minor channels, allowing for greater wetland development. Alder is likely to have populated the banks of the channels, alongside willow.

Radiocarbon dates of 900 to 1035 cal AD on charred rye/wheat caryopses at *c*. 12.8m OD, suggest deposition within the early medieval period. A hiatus between the prehistoric and medieval periods reflects either an erosional period or a cessation in deposition. Hemp/hop pollen is identified at *c*. 12.8m OD in this part of the sequence and is either hemp grown during this period for cordage or represents hop growing locally as a native of wetland environments. A mixed agricultural landscape of pasture and crop cultivation is evident within the wider landscape. There is evidence for wheat and barley presence, and rare rye is also noted, indicating cultivation or processing took place on or close to the site. This is suggested owing to the lesser representation of these taxa in pollen spectra in comparison with pastoral indicators.

The sediment lithology at 12.93m OD, indicates that a foreshore river margin environment next developed. The diatom assemblage indicates a reduction of water flow to standing or slow-moving conditions. The introduction of molluscs, anthropogenic material (e.g. ceramic building material), and presence of iron staining, indicate rubbish dumping and periodic drying.

Victorian to modern OS mapping shows the site to have been on the fringes of a water meadow during the 1840s to 1880s, one that became drier between 1937 and 1961 as the settlement of Ringwood expanded. The large area of wetland was replaced by numerous small channels, which were greater in number than in the present-day. This indicates a decline in the water levels across this portion of the floodplain and therefore suggests flood management to have taken place after this time.

Previous archaeological investigation in the Ringwood region of the Hampshire Avon valley has led to little discussion of the relationship between human activity and the changing environment, often because of an absence or sparsity of Holocene sediment sequences to provide such insights. Despite the lack of direct evidence of archaeology found within Jubilee Gardens or nearby, the opportunity has therefore been taken to apply the rare palaeoenvironmental record and 3D landscape reconstructions from this site to the consideration of archaeological remains found along other parts of the Hampshire Avon valley in order to provide these remains with a contemporary environmental context, to elucidate the potential interplay between past human activity and the developing environment, and to highlight areas or periods for future work.

1. Introduction

The Avon Valley presents an extensive series of well-preserved river terraces and is home to some of Britain's most significant Palaeolithic archaeological records (Egberts 2016). These terraces represent the impacts of cyclic climatic fluctuations on the fluvial system, with repeated aggradation and incision resulting in a series of 14 gravel terraces (Egberts *et al.* 2020). The Avon Valley forms part of an 80km corridor through southern England, which was utilised by both hominins and animals during the Pleistocene (Egberts 2016). The draw of the valley did not wane with the onset of the Holocene, and archaeological remains of Mesolithic to modern age have been encountered within the valley and its surrounds.

The close of the Pleistocene brought climatic amelioration, resulting in the slowing of river flow and deposition of finer grained sediments. Well-preserved organic and palaeoenvironmental or archaeological indicators that would enable investigation of the interrelationships between humans and their environment occur rarely in this part of the Avon Valley (AOC Archaeology 2022).

In March 2022, VolkerFitzpatrick commissioned Connect Archaeology to carry out a geoarchaeological borehole evaluation on behalf of their client, National Highways, under the advice of Stantec and the Hampshire County Council Archaeologist. The work was carried out at the site of Jubilee Gardens (NGR: 414343, 105245: Figure 1). The site is situated to the west of Ringwood, Hampshire, and is bounded to the north by the A31, to the west by the River Avon, to the east by the Bickerley Millstream, and to the south by a channel extending between the two.

The geoarchaeological boreholes and subsequent palaeoenvironmental works aimed to investigate the Holocene sediments deposited within the site, and to determine their potential for characterising environmental change and providing context for archaeological remains in the vicinity of the site.

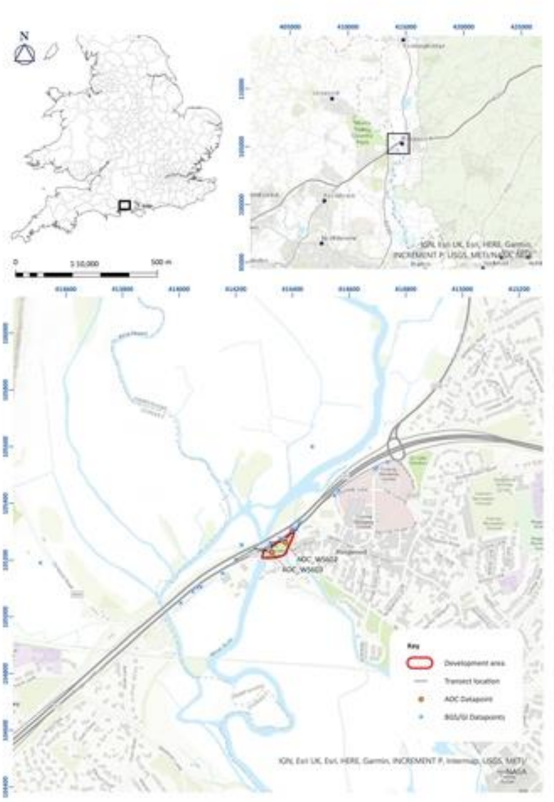

Figure 1: Site location, showing data points and transect. Image credit: AOC Archaeology

1.1 Geology and topography

Jubilee Gardens lies within the low-lying floodplain region of the Avon Valley, at an elevation of approximately 16m above Ordnance Datum (m OD). The western slopes of the rising valley are situated over 1km from the site, marking the edge of the Avon's historic floodplain. To the east, a sharp rise in elevation is mapped *c*. 5.0km from the site and marks the opposing floodplain limit and valley side. Ringwood town is situated immediately east of the site, on a gradual slope reflecting what may be a moderate topographic high within the floodplain or between channels.

British Geological Survey mapping indicates the site overlies bedrock of Selsey Sand Formation. This unit comprises sand, silt, and clay in varying proportions. It is bioturbated, glauconitic, and locally calcareous having been deposited during late Lutetian marine transgression (48.1-41 Ma BP).

Overlying the bedrock, two superficial units are mapped. The earlier unit is 'River Terrace Deposits, 4', comprising sands and gravels deposited under high energy, cold stage fluvial conditions during the Pleistocene period. The unit is formed of beds and lenses of finer and coarser material reflecting changing environmental conditions throughout the Devensian, between approximately 130,000 and 11,500 BP (Lowe and Walker 2015). More specifically, River Terrace Gravels 4 have been dated and shown to be the youngest of those within the

Avon Valley, with deposition suggested to be between 14±1 kya and 25±3 kya (Egberts *et al.* 2020).

Holocene alluvium is also mapped by the BGS, overlying the River Terrace Gravels. It is described as comprising clay, silt, sand, and gravel with beds and lenses reflecting the depositional energy and environment from the Early Holocene onwards (*c*.11,650–8,276 BP/9,700–6326 BCE). Lenses of peat may survive within or beneath this unit and, as such, these deposits were investigated for their potential for the preservation of palaeoenvironmental proxies, such as pollen, diatoms, and ostracods, as well as potentially preserving archaeological remains associated with the procurement or utilisation of wetland and river resources, for example jetties or fish traps, trackways, or flint scatters.

The site lies on the eastern edge of the mapped alluvium, indicating that the limits of Holocene floodplain conditions extend to this position and ceases as river terrace gravels gradually rise in elevation towards the east.

1.2 Onsite boreholes

The investigation comprised the drilling of two boreholes using a modular windowless sample rig, which was chosen for its relatively light weight in order to safely cross the foot bridge into Jubilee Gardens (Figure 2). The positions of interventions were proposed by Connect Archaeology in agreement with the local council's archaeological advisors.

Continuous sediment core samples of approximately 100mm diameter and 1m in length were retrieved through the full Holocene sequence to a depth of approximately 4m Below Ground Level (m BGL, and sampling the basal, Pleistocene river terrace gravels to prove them to be *in situ*. The geoarchaeologist photographed and logged the Holocene sediments revealed in the boreholes according to standard geological practice (Jones *et al*. 1999; Tucker 2003).

Figure 2: Modular style of rig used to carry out onsite borehole evaluation. Image credit: AOC Archaeology

1.3 Deposit modelling

Deposit modelling involves the utilisation of sediment data to produce extrapolated models of below-ground archaeological deposits and geology, which can be interpreted to predict the presence and extent of target stratigraphy. In order to create the deposit models for the site, the data acquired from the borehole evaluation was entered into a digital database (RockWorks 20) alongside local Geotechnical Investigation (GI) and BGS deposit records. The sediments were then assigned to stratigraphic units based on their lithological descriptions. These stratigraphic units represent certain depositional environments, and as such represent lateral and temporal environmental changes (AOC Archaeology 2022).

The original deposit modelling incorporated a total of 16 sediment records, including two sediment sequences from within the site, as well as an additional 14 GI logs from the vicinity of the site. Further stages of the investigation were able to utilise additional datapoints following updates to the BGS records and an expansion to the modelling area, resulting in a total of 32 borehole records included in the presented models. This means 16 BGS datapoints have been added at this stage, to take the total from 16 to 32.

These models are used to map the distribution and survival of stratigraphic units, which can be used to interpret the potential for preservation of archaeological and palaeoenvironmental remains (Historic England 2020). The stratigraphy is utilised to produce surface and thickness plots, as well as transects, to illustrate the likely below-ground geology, indicating where landscape zones existed and thus where potential for identification and recovery of archaeological and palaeoenvironmental remains is likely. The initial deposit models produced during the project were utilised to interpret areas in which potential for preservation of archaeological or palaeoenvironmental remains were anticipated. Later stages of the modelling included reconstruction of landscape development based on palaeoenvironmental and lithological changes identified.

[INTERACTIVE IMAGE _ ONLINE ONLY]

Figure 3: Transect south-west to north-east across the site, showing thickness and extent of below-ground geology, and landscape development throughout the Holocene. B) Early Neolithic landscape. C) Early medieval landscape. D) Modern landscape. For A) see topographic model in Figure 5 [Download image]. Image credit: AOC Archaeology

1.4 Palaeoenvironmental work

The longest and deepest Holocene sequence (WS603) was selected for palaeoenvironmental assessment (AOC Archaeology 2023), and later analysis, to understand the vegetation and hydrology of the landscape. Radiocarbon dates were also sought from this sequence, to place the palaeoenvironmental findings within a temporal context.

Initial assessment was carried out on six samples for ostracods, diatoms, and pollen, throughout the sequence. Two bulk samples were also assessed for plant macrofossil remains and radiocarbon dated. Suitable depths for these samples were selected based on lithological and stratigraphic boundaries, and the samples sent to specialists for the assessment.

Initial radiocarbon dating and plant macrofossil assessment were deemed sufficient, yielding suitable results to support the analysis of pollen and diatoms. A total of 12 pollen samples and 8 diatom samples underwent analysis (Cameron 2024; Langdon and Scaife 2024).

2. Deposit Model Discussion

In combination, the palaeoenvironmental analysis, radiocarbon dating, and lithological descriptions allow for an interpretation of significant landscape changes attributed to far removed periods of time. Stratigraphic units determined from the lithological descriptions, and therefore used for the basis of the models, are presented in Table 1. Some deposits have been grouped for modelling purposes owing to the small dataset and the low frequency in which certain units are present. These include the combinations of alluvium with organic deposits, and of topsoil with made ground. Greater lithological detail, such as the position of organic deposits, is presented in higher resolution in the transects produced across the site (Figure 3).

Table 1: Summary of identified stratigraphic units (subdivision of the Holocene based on Walker *et al*. 2012, modified from AOC Archaeology 2023)

Stratigraphic unit (facies)	**Lithology/Description**	**Chronology**	**Environment of deposition**
Selsey Sand Formation	Medium dense to very dense grey to brown sand and gravel, with some interbedded firm sandy clay. Gravel is of flint.	Palaeogene (*c*. 41 to 48 million years ago)	Shallow seas
River Terrace Gravels, 4	Grey to orange gravel and sand, sometimes silty. Beds and lenses of coarse- to fine-grained deposits.	Devensian (Late Pleistocene, *c*.33,000-12,000 years ago) - between 14±1 kya and 25±3 kya (Egberts *et al*. 2020)	Glacial deposit
Holocene Alluvium	Grey, yellow, and brown silts and clays, occasionally organic with sand, gravel, and anthropic debris.	Holocene (up to *c*.11,650 BP or 9700 BCE)	Temperate floodplain deposit
Topsoil	Turfed topsoil.	Post-medieval to modern (19th century CE onwards)	Coarse sediments either infilling low-lying channel areas or banked/reworked units around bedrock islands or shingle formations
Made Ground	Macadam and concrete. Mixed. Frequently also gravel and sand deposits. Black, grey, orange, and brown.	Post-medieval to modern (19th century CE onwards)	Temperate wetland development within a floodplain environment

The geoarchaeological boreholes (AOC_WS602 and WS603) encountered the Pleistocene river terrace gravels at 11.85m OD (2.60m BGL, WS602) and 11.63m OD (2.75m BGL, WS603) overlain with Holocene alluvium 1.85m (WS603) to 2.00m thick (WS602), and subsequently made ground and topsoil of 0.60m (WS602) and 0.90m (WS603) thickness. Across the wider area, the Pleistocene surface is situated between 13.80 and 18.00m OD, the higher of these values representing the slopes of the valley sides and the lower the Avon floodplain. Alluvium and organic deposits reach a maximum of 1.85m in thickness, identified on site (WS603). Made ground deposits reach approximately 4.0m in thickness, generally in association with the A31. These deposits often directly overlie the Pleistocene river terrace gravels, and as such indicate probable modern truncation of the Holocene sequence. In some cases, particularly to the north and east of Jubilee Gardens, deposits of peat are described in GI interventions, which suggest some localised survival along the route.

The Holocene sequence was found to be between 2.60m and 2.75m thick and comprises primarily minerogenic material, although organic silt was identified in the west of the site towards the modern route of the River Avon. The Holocene deposits within the site become finer towards the top of the sequence, which is shown as an abrupt change in lithological descriptions from predominantly silt to gravel-based sediments, to clay and silt. In the west of the site the sequence is sealed with made ground deposits, comprising friable silt with gravel, concrete, brick, and roots, and subsequently a turf layer. In the east, a more developed topsoil and subsoil sequence seals the underlying geology.

The alluvial sequence is shown to be of two depositional phases, the lower Holocene sediments deposited during the Early Neolithic and the upper sequence during the early medieval. Such a late beginning to the sedimentation within the channel indicates that it was likely still relatively high in energy during the early Holocene, not providing conditions conducive to accretion. These high-energy conditions are also reflected in the large grain size of the initial in-channel Holocene deposition. A hiatus, likely representative of a period of increased erosion, is identified between these dated deposits, resulting in a sharp transition from coarse, gravelly alluvium to fine-grained silty alluvium grading upwards to clay. This transition represents significant change in the energy of the Avon between the prehistoric period and the medieval.

Radiocarbon dates taken from the sequence within each of the lower, coarser sediments and the higher, finer sediments indicate two far removed periods of deposition occurring in both the Early Neolithic and the early medieval periods. The results of the radiocarbon dating are presented in Table 2.

Table 2: Summary of radiocarbon dating results (radiocarbon dates in the text have been rounded according to Historic England 2022)

Top elevation (m OD)	Base elevation (m OD)	Sample (m BGL)	Lab. code	Material/pre-treatment	$\delta^{13}C$ ratio (relative to VPDB)	Radiocarbon conventional age (BP)	Calendar calibration (95.4% probability)
12.88	12.68	WS603: 1.50-1.70	SUERC-107891 (GU62614)	Charred caryopses: Rye/wheat	-22.7 ‰	1044±24	(3.2%) 901-916 cal CE (92.2%) 975-1034 cal CE
11.84	11.64	WS603: 2.54-2.74	SUERC-107892 (GU62615)	Waterlogged wood: Alder	-26.3 ‰	4690±24	(25.5%) 3528-3484 cal BCE (70%) 3475-3372 cal BCE

2.1 Reconstructing the prehistoric landscape

Approximately 11,700 years ago, the glacial conditions of the Pleistocene came to an end. The ground surface for this time, comprising river terrace gravels and bedrock of Selsey Sand, has been modelled (Figure 5a) and indicates that a greater number of river channels passed through the area as part of a braided system. Such a channel system would have dried out as meltwaters reduced, resulting in some channels remaining active and some becoming abandoned. Those abandoned provided low ground capable of holding pooling water and becoming suitable for wetland formation and subsequently peat deposits.

The low-lying parts of the modelled surface of the Pleistocene or earlier deposits are presented in Figure 5a. This model is based on the deposit data and represents the assumed topographic surface at the start of the Holocene (*c*. 11,700 years ago); this formed the basic skeleton on which the Holocene environments and sediments developed, and was the type of landscape encountered by early prehistoric communities. Figure 5a suggests that two of these Early Holocene channels are predicted to have run through the Jubilee Gardens site in a north-west to south-east alignment, one to the east of the modern River Avon channel (CH2) and one adjacent to the Bickerley Millstream (CH3). A slight rise in surface elevation to 12.65m OD is modelled here, representing a probable gravel island, or eyot, between the two channel routes. It may have provided a position from which to access the resources of the river, as well as a mid-point route for traversing the river channels if the two routes were active at the same time. Another channel is indicated to the north-east at the A31, also aligned with the Bickerley Millstream (CH3). This channel is separated by a dry land zone of raised gravels (to 14.70m OD) at the north-eastern site boundary, which would have provided a stable position from which to access and process riparian resources during the Late Pleistocene and into the Holocene. This rise in elevation is of approximately 2m, occurring over a distance of *c*. 50m laterally.

The onset of the Holocene brought a transition to more hospitable conditions conducive to the colonisation and establishment of more complex ecological environments. The palaeochannel (CH2) at the western side of the Jubilee Gardens provided a sediment sequence that has been the subject of palaeoenvironmental analysis and radiocarbon dating. The high-energy fluvial deposition of sand and gravel gradually declined resulting in finer grained sedimentation, and fluvial channels became more laterally constrained and reduced to a lesser quantity. Basal channel infilling – comprising primarily gravel and silt – reflects the falling energy of the river, depositing its load as its velocity reduced with changing environmental conditions. The dark grey, slightly sandy silt and gravel, identified between 11.63 and 11.68m OD is likely to represent the leaching of finer alluvial sediment into the voids between clasts in the surface of the river terrace gravels. Organic material is recorded within the gravels above this from 11.68 to 11.88m OD, suggesting more significant soil development to have occurred. These two deposits have been radiocarbon dated to the Early Neolithic period (SUERC-107892 (GU62615), 3530-3370 cal BCE, 4690±24 BP, Table 2), suggesting either a lack of deposition prior to this, or a period of erosional activity removing any earlier Holocene material. The probable prehistoric sequence is situated between 11.63 and 12.45m OD, at the top of which is a change in lithology from a soft grey silt. The lithological change is accompanied by an absence of palaeoenvironmental evidence to confirm the change in environmental conditions. Although there is an absence of pollen here, the samples above indicate significant change in environment and are dated to the early medieval period (SUERC-107891 (GU62614), 900-1035 cal CE, 1044±24 BP, Table 2). This will be discussed in Section 2.2.

The sequence is placed within local pollen assemblage zone 1 (Figure 4: l.p.a.z. RING:1), for which a cross-section of the deposits (Figure 3b) and schematic 3D landscape model has been produced (Figure 5b). This cross-section and 3D model combines the topographic surface modelled for this Early Neolithic period, along with the vegetation types as suggested by the pollen data, and their likely landscape position. The channel routes suggested by the surface modelling (Figure 5a) are evident on the 3D reconstruction (Figure 5b) as discrete but interconnected routes crossing the low-lying floodplain and flowing around areas of high ground, or islands, within the floodplain or at its edges (Figure 3b and 5b).

Pollen records indicate that at this time the vegetational landscape of the site and the surrounding region was one of contrast. Wetlands dominated by grasses, sedges, and reeds flanked the river channels in the shadow of woodland comprising primarily alder, willow, and hazel, which colonised the lower valley and floodplain. Alder carr woodland would have been wet and closely vegetated, with either pools or slow-flowing water between clumps of alder trees. Plant macrofossil work also identified charcoal associated with the Neolithic deposits, indicative of probable human activity in the vicinity of the site. It may be related to vegetation clearance, as the dense alder carr may have hindered visibility and access for hunting and gathering. Further evidence of wetland and woodland taxa support the interpretation of the pollen assemblage, indicating the site to have been under wet and wooded conditions. Alder wood is most common in the plant macrofossil assemblage, with a high frequency of unidentified wood fragments also present. Sedge, indicative of wet conditions, and knotweed, suggestive of shaded conditions, are present alongside moss and violet, which enjoy both of those environments. Elder, as evidenced by elderberries, grows well in undisturbed alluvial soils, and at woodland edges. Together, these components provide a rich environment for human communities to access and utilise for resources and would have provided an enticing position for more continuous activity and perhaps settlement, although no direct evidence of settlement activity survives on site nearby.

[INTERACTIVE IMAGE _ ONLINE ONLY]

Figure 4: Pollen diagrams [Download image]. Image credit: University of Southampton

Pollen from the landscape further from the site is veiled by the intensity of alder and wetland taxa within the assemblages, and as such the wider landscape is not as well represented.

The higher ground of the valley sides was likely predominantly open grassland, with small pockets of mixed woodland, shown in the eastern and western limits of Figures 3b and 5b. For this period, trees and shrubs are unusually low in frequency among the terrestrial taxa represented by the pollen assemblage. This is particularly evident regarding the relatively uncommon occurrences of both elm and lime, although hazel remains prominent, perhaps as part of scrub colonisation following woodland clearance of other species. Sparsity of elm in the assemblages indicates post Primary Elm Decline or post Neolithic deposition, approximately 5500 to 5000 years ago, aligning with the underlying Early Neolithic radiocarbon date (SUERC-107892 (GU62615), 3530-3370 cal BCE, 4690±24 BP, Table 2). Lime is generally found to have been important in central southern England from the Middle Holocene (*c*. 8200 to 4200 years ago) to the Middle Bronze Age period (*c*. 3500 years ago), and as such its absence above the lowest levels of the sediment sequence is unexpected. It is possible that this illustrates a low rate of accretion, and that *c*. 0.35m of sediment up to 11.88m OD represents the period from the Early Neolithic to the Middle Bronze Age at least. At the top of this unit, a peak of alder to 80% of the pollen assemblage is recorded.

A change in lithology from 11.88 to 12.45m OD accompanies the developing pollen profiles, indicating potentially more rapid, fine material sedimentation. In the uppermost prehistoric deposit within which pollen is preserved and identifiable at 11.98 to 11.97m OD, cereal pollen emerges, suggesting the early settlement and developing subsistence strategies of human communities in the area sometime after the Early Neolithic radiocarbon date (SUERC-107892 (GU62615), 3530-3370 cal BCE, 4690±24 BP, Table 2). Decline in alder, likely and primarily associated with rising water levels, and expansion of ribwort plantain, suggesting an opening of the landscape and potentially relating to clearance and field systems for grazing livestock, are also seen in this sample.

The Neolithic dated organic material is overlain by a more minerogenic, silty deposit. This increasing minerogenic component was undoubtedly in part driven by the effects of Relative Sea Level (RSL) rise throughout this period and the regional ponding back of inland waterways (Shennan and Horton 2002; Waller and Long 2010). However, the onset of minerogenic deposition may also have been due to increasing weathering of the land surface, associated with woodland clearance and intensifying cultivation, resulting in possible increased surface runoff and sedimentation. Diatom analysis at this depth (11.98 to 11.97m OD) indicates a freshwater, slow-flowing depositional environment with periods of drying, evidenced by the dominance of freshwater, non-planktonic species and in this sample in particular, traces of open-water planktonic (e.g., *Aulacoseria* sp., *Cyclotello kuetzingiana* agg., *Cyclotella meneghiniana*) and rheophilous species (e.g., *Melosira varians, Mridion circulare, Rhiocosphaenia curvata*), indicative of periods of higher water flow. Aerophilous taxa (e.g., *Ellerbeckia arenaria*, *Hantzschia amphioxys*, *Navicula mutica*) are also identified at the highest frequency within this earlier period of deposition, evidencing periods in which the channel dried out exposing the ground surface. The sample also presents the poorest preservation quality of those throughout the sequence, which is probably associated with the frequency of exposed, dry periods. A range of benthic and other non-planktonic taxa (e.g., *Diploneis ovalis*, *Sellaphora pupula*, *Navicula elginensis*) further evidence the predominantly shallow water environment and are identified in this sample. A sharp decline in tree and shrub pollen is recorded in association with this change, alongside rapid expansion of herbs, with indicators for grassland and pasture such as *Plantago lanceolata* (ribwort plantain), Lactucoideae (dandelion types), Poaceae (grasses), and possibly *Ranunculus* types (buttercups). At this level there is a decline in the prevalence of alder, which is likely the result of increased water levels caused by this increased surface runoff in the vicinity. Broadly, more permanent settlement and field systems are often associated with the Middle to Late Bronze Age, and as such this level may represent this period because more long-term occupation would have had a greater impact on the nearby environment.

Also, of note within this part of the sequence is the presence of *Juniperus communis* (juniper), which is extremely rare within the late prehistoric. It is identified within both this l.p.a.z. RING:1 (Figure 4) and the overlying early medieval sequence. Generally associated with the late glacial and beginning of the Holocene, it is possible that this has been reworked from underlying geologies. However, this is considered to be unlikely. It is more probable for the trees to have survived on agriculturally poor soils.

Based on lithological boundaries, and an absence of palaeoenvironmental data between 11.98 and 12.50m OD, it is interpreted that the prehistoric sequence continues to 12.45m OD, where sediments transition sharply from sandy silt and gravel to soft, grey silt with rootlets. This rapid transition may represent a period of erosion that removed late prehistoric to early historic material, or a cessation in accumulation. It is possible that this is associated with continued intensification of agriculture and woodland clearance, leading to greater velocity within the channel, which at this time appears to have already been periodically relatively fast and energetic due to the presence of occasional coarser deposition within the alluvial deposits. Later deposition would therefore be the result of a decline in river velocity and recommencing deposition of sediment carried within it.

[INTERACTIVE IMAGE _ ONLINE ONLY]

Figure 5: Topographic models. A) Early Holocene surface elevation. B) Early Neolithic schematic landscape reconstruction. C) Early medieval schematic landscape reconstruction [Download image]. Image credit: AOC Archaeology

2.2 Reconstructing the early medieval landscape

A period of assumed depositional hiatus or erosion is marked by a lithological change at 12.45m OD. Above this the palaeoenvironmental samples from 12.50 to 13.15m OD and radiocarbon dating between 12.68 and 12.88m OD indicate an early medieval (SUERC-107891 (GU62614), 900-1035 cal CE, 1044±24 BP, Table 2) period, and an environment much removed from that of the Neolithic.

A deposit of soft, grey, minerogenic silt overlies the prehistoric gravelly deposits up to 12.68m OD and was found to lack preserved pollen. The diatom assemblage at 12.50 to 12.52m OD indicates a more stabilised depositional environment with a more consistent shallow freshwater presence, as well as increasing numbers of non-planktonic species (e.g., *Diploneis ovalis*, *Sellephora pupula*), suggesting continuous waterlogged conditions with input of fine sediment. There is an absence of pollen until 12.72 to 12.73m OD, higher up within the minerogenic silt deposit. The assemblage at this elevation shows significant change from that of the samples in the gravelly deposits attributed to prehistoric deposition. The sequence is placed into a different local pollen assemblage zone (Figure 4: l.p.a.z. RING:2), characterised by dominant and diverse herb assemblages and represented as a cross-section in Figure 3c and schematic landscape model in Figure 5c. The modelling now indicates the channel routes reduced in number but increased in size compared to the prehistoric reconstruction (Figure 5b). A lot of the lowest lying topography (below *c*. 12.6m OD, Figure 3c) has been infilled with sediment and the higher ground to east and west has expanded into the floodplain. In addition, the channels running through the site appear to have combined to form a wider channel route or wetland to backwater environment. This increase in water levels led to the expansion of herb wetland areas, and a reduction in woodland carr environments. Some woodland carr is, however, shown to survive on the riverbanks.

The on-site vegetation environment seemingly comprised a continuation of alder and willow, although significantly reduced in quantity, suggesting survival of some alder carr woodland. This alder carr, along with willow, were likely to have inhabited the floodplain edges or riverbanks, although its further decline is illustrated higher up the profile. A range of marginal and aquatic herb taxa are evidenced among the pollen assemblages within this zone. Marginal taxa include Poaceae (grasses), Cyperaceae (sedges), *Caltha* type (marsh marigold), *Hydrocotyle vulgaris* (marsh pennywort), possible *Oenanthe* type (hemlock water dropwort), *Alisma plantago-lanceolata* (water plantain), *Sagittaria sagittifolia* (arrow grass), *Typha latifolia* (common bulrush) and *Typha angustifolia/Sparganium* (bulrush and/or bur reed). Aquatic taxa indicative of standing or slow-moving water include duckweed (*Lemna*), and *Potamogeton* type (pond weed but also possibly *Triglochin*/freshwater arrow grass).

A peak of rheophilous diatoms (e.g., *Melosira varians*, *Meridion circulare*, to 7%) is seen within the minerogenic silt at 12.71 to 12.73m OD, which decline in frequency upwards through the sequence. This still indicates the presence of flowing water, but perhaps the continued decline in water velocity. Epiphytic taxa (e.g., *Cocconeis placentula, Epithemia turgida*) also peak at this elevation, suggestive of prominent aquatic vegetation. Other non-planktonic diatom taxa decline to 56% in this sample, perhaps further illustrating greater movement of water at this time compared with elsewhere in the sequence.

Vegetation within the wider landscape in the early medieval is suggested to be broadly open with pasture and arable agriculture, and contrasts strongly with that of l.p.a.z. RING:1 (Figure 4). A landscape of largely open arable and pastoral agriculture is indicated, with the cereal pollen primarily comprising *Triticum* (wheat) or *Hordeum* (barley) type. Single samples of *Secale* (rye) and *Cannabis sativa* type (hemp or hop) are also present within the assemblage, the latter being diagnostic of pollen records of the Saxon to medieval periods. Distinction between hemp and hop is not possible owing to their morphology. Hemp was grown for fibre, and as such is diagnostic of medieval deposition because of its widespread cultivation for cordage. Hop, however, is a native species within fen-carr woodland. An important phase of cereal pollen is identified between 12.73 and 12.98m OD, which indicates a period of more intense agriculture in the vicinity of the site. This cereal pollen is present in the company of associated weeds of disturbed ground, including Brassicaceae spp. (crucifers/mustards/cabbage family), Polygonaceae spp. (buckwheats), *Plantago major* type (broadleaf plantain), *Artemisia* (mugwort), and *Solanum* (nightshade – e.g. gooseberries, sorrel). Pastoral land use is indicated by the presence of Poaceae (grasses), which are also likely to be associated with the on-site habitat, as well as a range of other herb taxa including *Plantago lanceolata* (ribwort plantain), *Ranunculus* type (buttercups), possibly *Rumex* (docks), Scrophulsriaceae spp. (figwort), and Asteraceae types (particularly dandelion types, Lactucoideae).

Sediment from between 12.68 and 12.88m OD, corresponding with the early medieval radiocarbon date (SUERC-107891 (GU62614), 900-1035 cal CE, 1044±24 BP, Table 2) is described as soft to firm, slightly organic silt, with occasional large roots. This suggests a stabilisation of conditions and established vegetation on the site. The results of the plant macrofossil results align with the evidence presented by the pollen, indicating a mixed local environment different from that of the Neolithic. Remains of *Secale*/*Triticum* (rye/wheat) caryopses are present in this sample, indicative of nearby cultivation or processing and coinciding with the important phase of cereal pollen identified between 12.73 and 12.98m OD. Remains of *Alnus glutinosa* (alder) support survival of some carr woodland in the immediate vicinity of the River Avon, as suggested by the pollen assemblages for samples within this portion of the sequence. Charcoal, indicative of local human activity, is present as small fragments of less than 4mm in diameter. A variety of weed taxa were identified at this elevation, suggesting wetland and arable land. These include Poaceae (grasses), which may present an open marginal wetland environment or grassland and meadows of pastureland, as well as *Carex* sp. (sedges), indicative of wetland and marginal wetland environments. These are accompanied by *Persicaria* sp. (knotweed), which grows well under shaded, moist environments such as those provided by wooded wetlands, *Apiaceae* sp. (carrot) and *Ranunculus bulbosus L.* (bulbous buttercup). Towards the top of this sample, diatom analysis is indicative of further stabilisation of the depositional environment and is more concurrent with the majority of the sequence. It shows significant frequency and diversity of benthic taxa (e.g., *Diploneis ovalis*, *Sellaphora pupla*), with non-planktonic taxa (e.g., *Achnanthes lanceolata*, *Fragilaria pinnata*, *Cocconeis placentula*) present at between 77-82% from 12.86 to 12.88m OD upwards, indicative of standing or slow-moving water.

Overlying the dated material, a further lithological change is identified from 12.93 to 13.48m OD, where the deposits indicate a foreshore river margin type environment on site. The sediment comprises pale yellow-grey, soft clay, with inclusions of occasional mollusc shell, rare gravel, rare ceramic building material (CBM), and iron staining. The description indicates periods of exposure to air, allowing oxidation of iron within the sediment, as well as surface exposure adjacent to human activity resulting in accumulation of anthropogenic material (CBM). Introduction of anthropogenic material at this time may reflect the expansion of settlement and infrastructure at Ringwood towards the Avon. The diatom assemblage towards the base of this deposit between 12.96 and 12.98m OD show a slowing of water flow to standing or slow-moving conditions, with a reduced abundance of rheophilous taxa (e.g., *Melosira varians*, *Meridion circulare*, *Rhoicosphaenia curvata*) in the upper two samples and high numbers of non-planktonic species. These upper samples also contain greater frequency of *Fragilaria* species, which are able to colonise disturbed habitats. Pollen sampled at this elevation also indicates hydrological change, with a probable wetter phase and growth of grass-sedge fen. Lactucoideae (dandelions) become very important between 12.98 and 13.15m OD, although since they were identified alongside reworked pre-Quaternary palynomorphs and *Dryopteris* type (fern spores), this may be the result of differential preservation with these taxa surviving under more physically demanding conditions such as fluvial transport or colluviation. The transition from a cereal phase to a dominance of pastoral indicators suggests a shift in land use within the landscape, from one of cultivated fields to one of grazing pastures.

Pollen conditions remain to the top of the sampled profile, with Cyperaceae (sedges) reaching their maximum presence at 13.14 to 13.15m OD. Poaceae (grasses) remain dominant overall, although an expansion of wetland margin conditions is evidenced in this upper sequence.

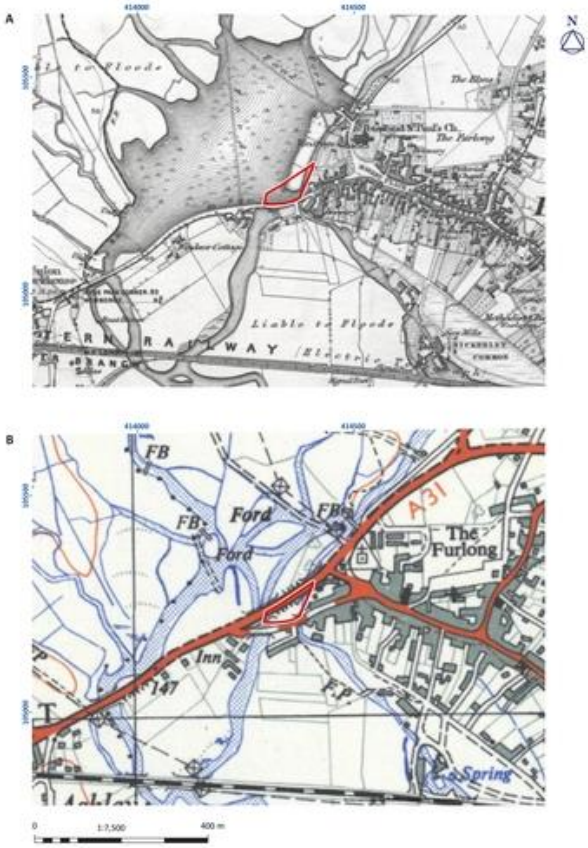

Figure 6: Historic OS maps of the area, showing Victorian to modern development. A) 1830s to 1880s. B) 1937 to 1961. Reproduced with the permission of the [National Library of Scotland](#)

2.3 Victorian to modern development

Historic Ordnance Survey mapping has been superimposed onto the site and its surrounds. This was carried out to determine more recent landscape conditions and human impacts. Two maps have been selected to illustrate most effectively the landscape development that occurred in the area from the Victorian to modern periods (Figure 6).

According to OS mapping from the 1840s to 1880s (Figure 6a), the site was on the southern border of a water meadow during the Victorian period. These conditions may have developed earlier, as suggested in the upper samples discussed in the previous sections, where the two discrete channel routes crossing the site in the prehistoric become a wider channel or backwater during the medieval period. Only a small portion of the site is indicated to be dry land at this time, towards the north-east, which forms part of a later floodplain 'island' region west of the vicarage at the church of St Peter and St Paul. Borehole location WS602 lies within this area, which may explain the more developed topsoil sequence and absence of made ground in the upper portion of its sequence in comparison with WS603 to the south-west, which lies within the water meadow and likely underwent ground raising as part of a later reclamation practice. The heart of Ringwood town is overall similar to the present day, although the A31 is yet to be constructed and land to the south of Jubilee Gardens remains largely undeveloped.

Later, between 1937 and 1961 (Figure 6b), mapping illustrates significant changes to both the 'natural' and 'human' landscapes; the A31 has been constructed, as well as further residential buildings, and the water meadow to the north of the site has transitioned to become numerous small channels rather than one area of broad wetland. These channels are still greater in number than in the modern day, suggesting continuous floodplain management to have been carried out during the later 20th century, which most probably diverted and controlled the channels into fewer routes so that land could be used for agriculture or development.

3. Discussion of Significance

The site lies within the New Forest National Park region, where there is incentive to investigate palaeoenvironmental and archaeological remains due to a low visibility of early Holocene, particularly Mesolithic, material represented in current knowledge (New Forest National Park Authority and University of Southampton 2018). The geoarchaeological investigations at Jubilee Gardens, situated adjacent to the River Avon, indicates that this absence of the Mesolithic may be the result of continuing erosional conditions until the Early Neolithic period, where the alluvial sequence is the only surviving sediment overlying the Pleistocene river terrace gravels.

Previous work in the Ringwood region of the Hampshire Avon Valley includes little discussion of the relationship between human activity and the changing environment, often because of an absence or sparsity of Holocene sediment sequences to provide such insights. Investigation at Nea Farm (Ford 2001), Verwood (Wessex Archaeology 2017), and Bickerley Road (Context One 2017), for example, did not identify suitable quantities of Holocene sediment for palaeoenvironmental work to be carried out, and therefore providing an environmental context for the archaeological remains found was difficult. Although no Holocene palaeoenvironmental remains were identified at Bickerley Road (Context One 2017) or Verwood (Wessex Archaeology 2017), numerous cut features were identified on the site at Nea Farm (Ford 2001) alongside pottery of later prehistoric and post-medieval date, and flints of varying ages from the Late Upper Palaeolithic to the Neolithic/Bronze Age. These remains not only indicate continuous habitation at the site, which is situated on the western side of the valley, but also the importance of identifying palaeoenvironmental remains in the region in order to enhance the understanding of such important sites.

3.1 Wider prehistoric to Roman context

Sedimentation within the palaeochannels of the site began during the early Neolithic period. The landscape of the floodplain and lower valley floor was dominated by alder carr woodland with open areas of herb wetland. Beyond the valley floor, grassland was dominant across higher ground with small pockets of primarily hazel woodland. Some evidence of possible crop cultivation is indicated.

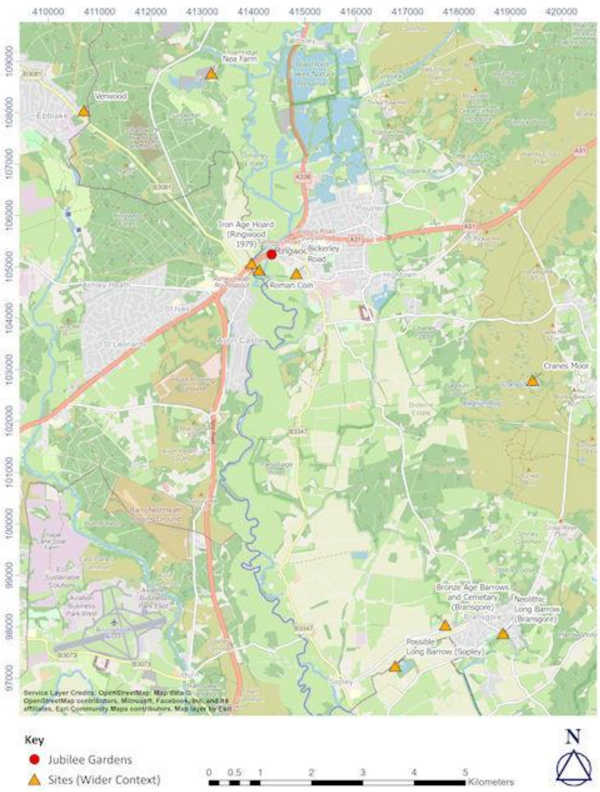

Figure 7: Nearby archaeological sites. Image credit: AOC Archaeology

Approximately 5.5km to the south-east of the site at Cranes Moor, palaeoenvironmental investigation included interpretation of plant macrofossils, pollen, and charcoal with an aim to investigate fire regimes during the early to mid-Holocene between *c*. 10,500 to 5850 cal BP (Grant *et al.* 2014). This period pre-dates that of the Jubilee Gardens palaeoenvironmental evidence, and interpretations of each may be combined to produce more comprehensive records for the Holocene in the region. The moor is situated between approximately 35 to 40m OD, is further from the active channels of the Avon than the Jubilee Gardens site, and palaeoenvironmental remains are derived from peat sequences. Among the plant macrofossil assemblage, a *Sphagnum*-dominated wetland is indicated in the immediate vicinity of the sequence, with cycles of increased and decreased water pooling. The pollen and charcoal assemblage indicated a dominance of *Corylus avellana* type (hazel) and *Pinus sylvestris* (Scots pine) towards the beginning of the Holocene between *c*. 10, 500 and *c*. 9650 cal BP. A reduction in pine is evident from *c*. 9650 cal BP, corresponding with an increase in *Quercus* (oak) and *Betula* (birch), as well as a decline in *Ulmus* (elm), suggesting major change in the woodland landscape at this time. In comparison with the Jubilee Gardens data, this landscape is more closely aligned with the Neolithic woodland species indicated within the wider environment, outside of the lower floodplain and indicating a more stable landscape through the middle Holocene. An expansion of *Alnus glutinosa* (alder) at Cranes Moor is recorded at *c*. 8150 cal BP, which suggests a similar alder carr environment to have developed at this time. Such an environment therefore may have persisted during much of the early to middle Holocene throughout the lower-lying valley floors along the Avon Valley, despite the lack of evidence at Jubilee Gardens.

Neolithic activity is evidenced further south, on the eastern slopes of the Avon Valley, approximately 8 to 8.5km to the south-east of the site. A Neolithic long barrow is recorded on the southern edge of Bransgore (New Forest Knowledge 2024c), and one possible Neolithic Long Barrow has been investigated using geophysical survey near Sopley (Gill 2019), to the south-west of Bransgore. These sites indicate continuous human presence within the valley during this period, and the importance the immediate landscape held for communities of this time and their sense of place. The permanence of such monuments and traces of possible cereal pollen within the lower sequence at Jubilee Gardens indicates that Neolithic settlement within the wider valley is probable, even if no direct evidence survives within the low-lying floodplain at Jubilee Gardens. Bransgore is situated at the base of the sharp incline of the valley slope, whereas Sopley lies close to the Avon immediately east of the modern floodplain. Investigation of the palaeoenvironmental conditions at the Jubilee Gardens site allows a suggested interpretation of the environment within which these burial mounds were constructed. Construction of the Neolithic long barrow at Bransgore would likely have been carried out in largely open grasslands, with small pockets of primarily hazel woodland. At Sopley, however, the environment was likely to have been similar to that of Jubilee Gardens, as it sits closer to the Avon and the floodplain. Although the underlying early Holocene topography, represented by the surface of the Pleistocene or earlier geology, has not currently been modelled for this area, modern surface elevation (see England Topographic Map) indicates the barrow to have been constructed on a relict floodplain. At construction, the environment was likely to have been broadly grassy, with possible areas of herbaceous wetland. Grasslands with hazel-dominated copses would have occupied the slopes to the east, and the wetter floodplain immediately west likely comprised a mixed wetland environment dominated by alder carr. The Bronze Age appears to have brought an expansion of human activity in the Avon Valley. A barrow cemetery survives north-west of the village of Bransgore (Massey *et al.* 2018), approximately 8km to the south-east of Ringwood. This site is north-west of the Neolithic Long Barrow, and it lies approximately 2.3km north-east of the River Avon and as such approximately 1km closer to the modern floodplain. The environment at this time is interpreted to be transitioning to one that is more open, with woodland clearance and intensification of agriculture evidenced in the landscape following the dated early Neolithic sequence. Numerous other Bronze Age archaeological remains are identified within the Avon Valley and the New Forest region (New Forest Knowledge 2024a), indicating the continued importance of the landscape and its natural resources, as well as potentially a continued sense of place as a result of the previous occupation.

Iron Age activity is more pronounced in the vicinity of the site, with remains recorded as close as *c*. 0.5km to the south-west of the site within the low-lying Avon Valley. These remains were of two Iron Age coins, one each of gold and silver (New Forest Knowledge 2024b) This time period likely corresponds with the depositional hiatus within the sampled sequence at Jubilee Gardens. Although this evidence of activity is so close to the site, the hiatus in the sequence means it therefore cannot contribute directly to the understanding of local land use and environment at this time. There is also indication of a decline in local human activity relative to the previous archaeological periods, which may indicate a period of migration away from the Avon Valley. This may be associated with the 2.8 ka cal BP event; an abrupt climatic deterioration bringing lower temperatures and greater rainfall (Bond *et al*. 1997; Charman *et al.* 2006). This increased rainfall may have led to growing velocity of the river channel causing a period of erosion and absence of deposition.

Romano-British archaeological evidence is also generally sparsely represented within the region. However, the Roman Roads Research Association (RRRA 2018) projects the Roman road between Stoney Cross and Otterbourne to pass approximately 735m to the north-east of the site. This projected line, which is situated to the north of the A31, is indicated to be accompanied by an additional more southerly route. This southerly route would have met the Avon within the area of the site, or to the south according to reinterpretation of LiDAR data by the Hampshire County Council Archaeology and Historic Environment Team (Stantec 2021). Although evidence of this has not been identified during this investigation, its potential presence does suggest possible peripheral activity and the road construction could also perhaps explain some of the truncation within the sequence.

3.2 Wider early medieval and medieval context

The palaeoenvironmental record shows vast expansion of agriculture in the area during the early medieval period, including both cultivation and pastoral land uses. Alder carr wetland would have persisted in places along the banks of the rivers, although a herb-dominated wetland seemingly expanded across more of the floodplain than in the earlier Holocene. This reflects the rising water levels associated with the period.

Ringwood was established during the early medieval period, appearing in the Domesday Survey of 1086 (Open Domesday nd), when it is estimated to have been home to around 43 households. However, there are no records of early medieval archaeological remains within the immediate area of the site. Those closest are recorded at Burley, approximately 7km to the south-east of the site (BUARC and New Forest National Park Authority 2021). During this period they are likely to have been set within a landscape dominated by grassland and agricultural fields, overlooking the wetlands of the lower valley. Patches of trees comprising a mixture of taxa are likely to have stood across the landscape. Intense agricultural practice is evident in this early stage of the town's existence. At the time of settlement, it is evident from the pollen profile at Jubilee Gardens that the most common crop cultivation was of *Triticum* (wheat) and *Hordeum* (barley). Single samples of *Secale* (rye) and *Cannabis sativa* type (hemp or hop) are also identified within this portion of the sequence. As previously mentioned, it is not possible to distinguish between hemp and hop, although either taxon is probable for the time period and location. Should hemp be present in the assemblage it may reflect the cultivation of hemp for cordage, a common practice during the medieval period. Hop, however, grows natively in fen carr woodland, and as such likely inhabited the peripheries of the river.

Archaeological remains of medieval date are prolific across Ringwood and its surrounds, mirroring the expansion of settlement. A significant increase in the abundance of Lactucoideae (dandelions), although potentially the result of preferential preservation, could suggest a transition to higher rates of pastoral agriculture over crop cultivation.

4. Conclusions

The study of the sediment sequence at Jubilee Gardens has further proven the survival of Holocene deposits within the Avon Valley, and their suitability for palaeoenvironmental investigations. The sediment sequence was shown to represent two time periods, with a depositional hiatus between the Neolithic and medieval. Palaeoenvironmental analysis of the sequence has revealed the landscape conditions for the site and its surroundings associated with each of these periods which, combined with interpretation of the lithological changes represented by the profile, present a comprehensive illustration of the interrelationship between humans and their environment throughout the Holocene.

Owing to the general absence of palaeoenvironmental data available from other sites within the Avon Valley, the reconstructions of the landscape within the valley and on its peripheries is significant for contextualising archaeological remains identified within the region.

Additionally, the influence of human communities on the environment is tantalisingly indicated in the findings of the investigation. Woodland clearance and the introduction of crop cultivation is evidenced in the lower sequence attributed to the Early Neolithic, possibly extending into the Bronze Age. Intensification of agriculture, and the impacts of human activity within or adjacent to the site is seemingly evidenced in the upper sequence, with the pollen assemblage indicating mixed agricultural land uses to be significant in the wider landscape dominated by grassland, and lithological records suggesting dumping of anthropogenic materials on a wetland surface, perhaps a foreshore river margin area.

The continued evidence for human activity illustrates the importance of the Avon Valley for providing resources for subsistence and landforms appropriate for long-term settlement activities.

The sequences not only provide potential for expanding understanding of other sites in the Ringwood region but also indicate the potential for survival of remains attributed to the Neolithic period in the lower alluvium within the Avon Valley.

Acknowledgements and Data Availability

Thanks to John Athersuch from Biochron for micro faunal work, Jackaline Roberts for plant macrofossil work, Sam O'Leary for graphics support, Virgil Yendell, Melissa Melikian, and Tim Neighbour for project management, David Hopkins at Hampshire County Council for advice, Catherine Barnet from Stantec for technical direction, and Jane Vant and Ryan Parker from VolkerFitzpatrick for commissioning the work, and National Highways for funding the work.

Data utilised for production of the deposit models as part of this project include borehole logs acquired from the British Geological Survey and GI data provided through the client.

The table below displays the general data for each record utilised. The full dataset is available via the ADS archive: https://doi.org/10.5284/1129480

Bore	Easting	Northing	Elevation (m OD)	Source
AOC34537_WS602	414375.8	105261.4	14.45	AOC
AOC34537_WS603	414327.4	105227.1	14.38	AOC
GEOCON_BH502	414325	105261	16.45	Geocon
GEOCON_BH507	414398	105309	16.19	Geocon
GEOCON_BH508	414428	105333	15.97	Geocon
GEOCON_HPIP702	414314.1	105242.8	16.93	Geocon
GEOCON_HPIP704	414414.2	105306.8	16.36	Geocon
NH_BH01	414430.2	105334.7	16.24	North-west Holst
NH_BH01IP	414425.1	105329.5	16.17	North-west Holst
NH_BH02	414397.4	105306.7	16.1	North-west Holst
NH_BH02A	414394.7	105304.5	16.26	North-west Holst
NH_BH02IP	414400.6	105311.8	16.19	North-west Holst
NH_BH03	414325.6	105262	16.52	North-west Holst
NH_BH03IP	414321.1	105260.2	16.26	North-west Holst
NH_BH04	414270.1	105241.9	16.68	North-west Holst
NH_BH05	414199.8	105201	15.98	North-west Holst
SU10NW11	413510	105190	15.5	BGS
SU10NW15	414470	105600	14.7	BGS
SU10NW67	414549	105427	18	BGS

SU10NW68	414691	105520	17	BGS
SU10NW69	414697	105526	16.98	BGS
SU10NW70	414736	105546	18	BGS
SU10NW76	414005	105049	17.17	BGS
SU10NW77	414048	105089	16.47	BGS
SU10NW78	414219	105253	13.8	BGS
SU10NW79	414221	105254	13.84	BGS
SU10NW83	414077	105105	15.25	BGS
SU10NW87	414563	105446	16.2	BGS
SU10NW88	414355	105277	16.51	BGS
SU10NW92	414153	105153	15.23	BGS
SU10NW93	414065	105104	16.15	BGS
SU10NW96	414372	105273	16.52	BGS

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