PART 9

Sediments

'As the occupational debris descended the slope towards the lake the organic content was recovered in a progressively better state of preservation: by Zone D rolls of birch bark and disconnected pieces of birch wood began to appear; by Zone E the birch flooring was more intact and animal remains were sometimes in better condition; and by Zone G conditions for the survival of certain organic materials were as good as anywhere on the site.'

(Clark 1954, 1–2)

CHAPTER 20

Sediments and Stratigraphy

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Introduction

Broadly speaking, the sedimentary sequence encountered at Star Carr can be divided into three units: the underlying basal geology, the sequence of wetland deposits that accumulated at the edge of the lake and the deposits that lay beyond the lake shore. These latter two units have been referred to as the 'wetland' and 'dryland' areas, reflecting the character of the environments forming in these areas during the time Star Carr was occupied. However, in reality this distinction is less clear, as wetland processes were responsible for some of the later deposits that formed over the areas of dryland beyond the lake shore. Within these broad groups are other stratigraphic units that are the result of anthropogenic activity, notably the digging and subsequent infilling of features such as pits and postholes. These occur, almost exclusively, on the dryland and reflect the actions of Mesolithic people living at the site.

This chapter sets out the geology of the local area before describing the main stratigraphic sequence of sediments recorded at the site. The results of micromorphology from the dryland have informed our interpretation of the sediments further and will also be reported here. All context records, plans, sections and specialist reports are archived in the Archaeological Data Service (https://doi.org/10.5284/1041580).

Geology

The underlying bedrock is the Lower Cretaceous Speeton Clay Formation of mudstone which formed in an environment dominated by shallow seas, depositing fragments of silicate materials as mud, silt, sand or gravel. This is covered (potentially up to an estimated 35 m thickness) with Quaternary 'superficial' deposits which persist throughout the Vale of Pickering (Ford et al. 2015, 7). These consist mainly of glacial till of presumed Devensian (Weichselian) age, glacio-lacustrine laminated clays and silts, fluvio-glacial sands and other indeterminate sands and gravels which could be river gravels, fluvio-glacial outwash spreads or reworked material

Figure 20 (page 151): South facing section in SC23 (Copyright Star Carr Project, CC BY-NC 4.0).

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from periglacial processes (solifluction). These Quaternary deposits are of variable thickness and are rarely absent from the site's region of the Vale. Boreham et al. (2011a, 2011b) identified pockets of grey clay on site, between the sands, gravels and clayey till. These are probably reworked blocks of Speeton Formation mudstone.

The glacial till of Devensian age is a diamicton (a poorly sorted sediment of highly variable particle size) which was initially eroded from the landscape, and then deposited by the expansion and then contraction of the ice sheets at the end of the last glacial period (see Chapter 4). In a study of the Devensian tills from Holderness, the fine fraction consisted of 60–80% of the deposits, with the dominant minerals in this fraction being kaolinite and illite clays supplemented by quartz (Bell 2002).

Stratigraphy

The sequence of deposits can largely be summarised as presented in Figure 20.1 and Table 20.1. Other contexts which have been assigned to discrete areas of the site are mentioned in the text.

Description	Context number
Topsoil	1
Upcast from Hertford cut	300
Desiccated upper peat	301
Grey/brown clay	302
Hillwash/buried soil	316
Mineral sediment/B horizon	308
Wood peat	310
Reed peat	312
Detrital mud	317
Coarse sand	320
Basal gravel	319

Table 20.1: Key contexts found across the site.

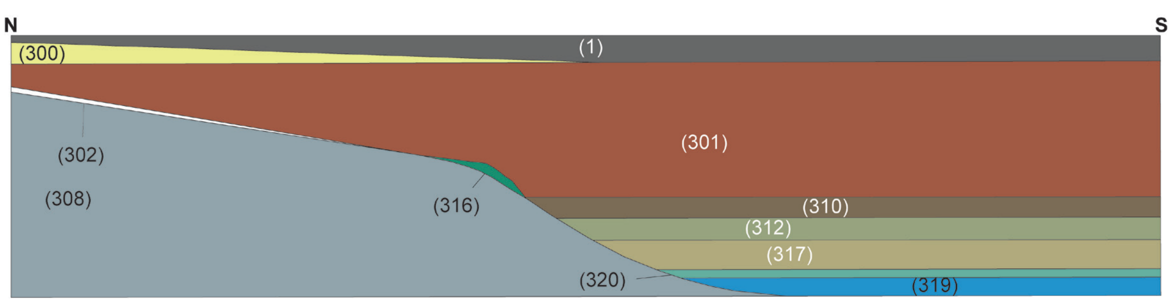

Figure 20.1: Key deposits covering both the dryland and wetland areas (Copyright Ben Elliott, CC BY-NC 4.0).

Figure 20.2 (page 155): Grey marl in the foreground of the trench with the 'enigmatic features' having been excavated. Behind this are the basal sands and stones, and further up slope the remains of the western platform, with the dryland in the top half of the photograph (Copyright Sue Storey, CC BY-NC 4.0).

Wetland stratigraphy

The wetland stratigraphy was first recorded in the series of small trenches that were excavated through the lake edge deposits between 2004 and 2010, and the auger surveys carried out in 2005–6 (see Chapter 3). These focused on the southern edge of the main peninsula, close to the area investigated by Clark (SC04, SC21–22, SC24, SC33, and the re-excavation of VP85A and cutting II), the southern end of the peninsula (SC20) and the eastern side of the peninsula (SC30–31). Initially, these deposits were described and numbered separately within each trench. However, as work progressed it became clear that the stratigraphy was broadly uniform across the site, with the same sequence of deposits present in each of the trenches. It also became apparent that some of the variations within the deposits that were observed in individual trenches, and which had been assigned separate context numbers, actually reflected changing levels of organic preservation and localised differences in sedimentation within what was essentially the same stratigraphic unit. This is particularly true of the reed and wood peats, which had been sub-divided into a series of separate contexts within each trench, but which represented the same broad deposit. From 2013, when trench SC34 was excavated, a standard set of context numbers were assigned across the site, and the earlier stratigraphic records were incorporated into them.

Across the lower-lying areas of trench SC34 (and the trenches within it), the basal mineral deposit was a poorly sorted sandy gravel (319). This extended as far as the c. 23.75 m OD contour, where it was replaced with mixed mineral deposit, varying from clay to a silty gravel (308), which sloped upwards towards the north, forming the lake edge and, beyond this, the dryland. During the 2006 excavations, a thin layer of fine detrital mud (42) was recorded within the sands and gravels in trench SC22. This may represent the remains of a late-glacial interstadial deposit, sealed by the formation of sands and gravels during the subsequent stadial, a horizon also noted at Seamer Carr (Cloutman 1988b).

In the central part of trench SC34, the sandy gravel was overlain by a deposit of marl (477, 501 and 502), a carbonate precipitate, which formed a distinct mound up to c. 0.4 m in depth. A group of 23 possible features were recorded as being cut/eroded into the top of the marl deposits (Figure 20.2). These may be anthropogenic in origin, though given their location in the base of the lake, they are more likely to be the result of natural processes such as localised spring activity. Based on the pollen stratigraphy from comparable deposits elsewhere around the lake (e.g. Cummins 2003; Taylor 2012), the marl may have formed within the first centuries of the Holocene.

Where the marl was absent, the sand and gravel graded into a layer of poorly sorted sand (320), which included a component of fine-grained organic material. This in turn graded into a deposit of fine detrital mud (317) containing a high coarse component of plant material, including the stems and leaves of *Phragmites* reeds and smaller quantities of small, thin twigs. This deposit directly overlay the marl in the central part of the trench. In trench SC24, a thin layer made up almost entirely of very small, thin twigs within a fine detrital matrix (98) was also present over the coarse sand. Subsequent excavation shows this to be a discrete spread of material and forms part of the detrital mud (317).

The coarse component of the detrital mud increased with height, and the deposit graded into a coarse reed peat (312), made up of horizontally bedded herbaceous plant material including the stems and leaves of *Phragmites* reeds, and a smaller component of roundwood (particularly towards the northern end of the deposit). The preservation of the plant material (particularly the herbaceous component) deteriorated towards the top of the deposit, which also contained intrusive root material. The reed peat ended with a sharp transition to a moderately humified wood peat (310), made up of roots, indeterminate woody detritus and a smaller component of poorly preserved herbaceous plant material that extended northwards across much of the dryland area. In several trenches (SC24, SC33 and VP85A) a thin layer of much darker, compacted and humified peat was present within the wood peat. This may reflect a short-lived fall in the local water-table, which caused the peat to dry out and humify before peat formation resumed. Thin layers and discrete lenses of a blue-grey clay were also recorded within the upper parts of the reed peat (312) and the lower wood peat (310) in trenches SC24 and Clark's cutting II and may represent in-washing of mineral sediment from the adjacent dryland area.

In all of the trenches, the wood peat became increasingly humified both with height and with proximity to the shallower parts of the wetland area and the dryland parts of the site. Overlying the deposit was a very humified black, fissured peat (301) that extended across the wetland and dryland parts of the site, over which was a peaty topsoil (1).

A similar sequence was recorded along the western sides of the peninsula, where it forms the side of the embayment (trenches SC2, SC20 and SC21) and its eastern side, where it formed the edge of the main lake basin (trenches SC30 and 31). Here the marl was not present and the detrital muds (317) formed directly over the coarse sand (320).

Dryland

The deposits on the dryland can be broken down into four main units: topsoil (1), humified, desiccated peat (301), a thin layer of grey/brown clay (302), and a mineral deposit, the nature of which varied across the site (308). The flint and bone found on the dryland tended to occur towards the base of the organic clay and within the mineral deposit. At the northernmost end of the Star Carr field a thick layer of redeposited sands and gravels (300) lay beneath the modern topsoil. This derives from cleaning out the River Hertford at regular intervals. Below this upcast was a buried topsoil dating to the early twentieth century (307).

Below the topsoil (or at the north of the site, the buried topsoil) was the humified, desiccated peat (301). This was mid-dark grey brown in colour, friable in texture, and with extensive fissuring, and was made up entirely of a fine grained organic sediment. In places the peat contained patches of iron oxides which had precipitated out of the sediment, forming areas of orange powder (see Chapter 22). In shallower parts of the site the peat contained small patches of the underlying mineral sediment and occasionally, flint artefacts. These are the result of plough damage, which has brought up material from the lower horizons. However, the deposit itself postdates the occupation of Star Carr, probably forming towards the end of the Early Mesolithic (see Chapter 4).

The peat graded into a grey/brown clay layer (302), with bioturbation making the interface between the two indistinct. Micromorphological analysis was undertaken on samples from this layer and the underlying basal mineral deposit (308). This shows that the thin layer of grey/brown clay (302) represents the Mesolithic soil horizon and the top of the underlying sediment (308) is likely to have been a calcitic, very fine sand/silt of a brown earth (Bw horizon) (Figure 20.3). These results match those from an earlier programme of micromorphological analysis undertaken on samples recovered from the dryland area in 1989, which showed that the upper mineral deposits represented an Early Holocene paleosol, and occupation surface (Mellars 1998).

The basal mineral deposit (308) was much lighter in colour (grey or yellow) compared to the overlaying deposits; however, there was a very diffuse interface due in part to bioturbation (notably the actions of roots and microfauna). The composition of this basal mineral deposit varied considerably between the excavated areas but should be considered as part of the same stratigraphic unit. Across much of trench SC34 the sediment was composed of a firm clay, previously identified in auger surveys carried out in the 1990s, where it was interpreted as the fill of a natural channel (Mellars and Dark 1998). In some areas, notably around trench SC24 and the area immediately to the southwest of this trench, this basal mineral sediment consisted of a mixed sandy gravel with a variable clay content. Similar variability was noted during augering of the peninsula.

The gleying/'greying' in 308 is the result of a secondary process which came about through the rise and fall of the groundwater table in the past, which has led to leaching and the depletion/removal of organic matter and other fine material, and the 'homogenisation' of any former soil structure. Eventual permanent waterlogging has caused reduction/air exclusion and the grey colour of this material (Lindbo et al. 2010), combined with the secondary formation of abundant micritic calcium carbonate as the lake margin dried out (Durand et al. 2010) leading to a change in size class and composition.

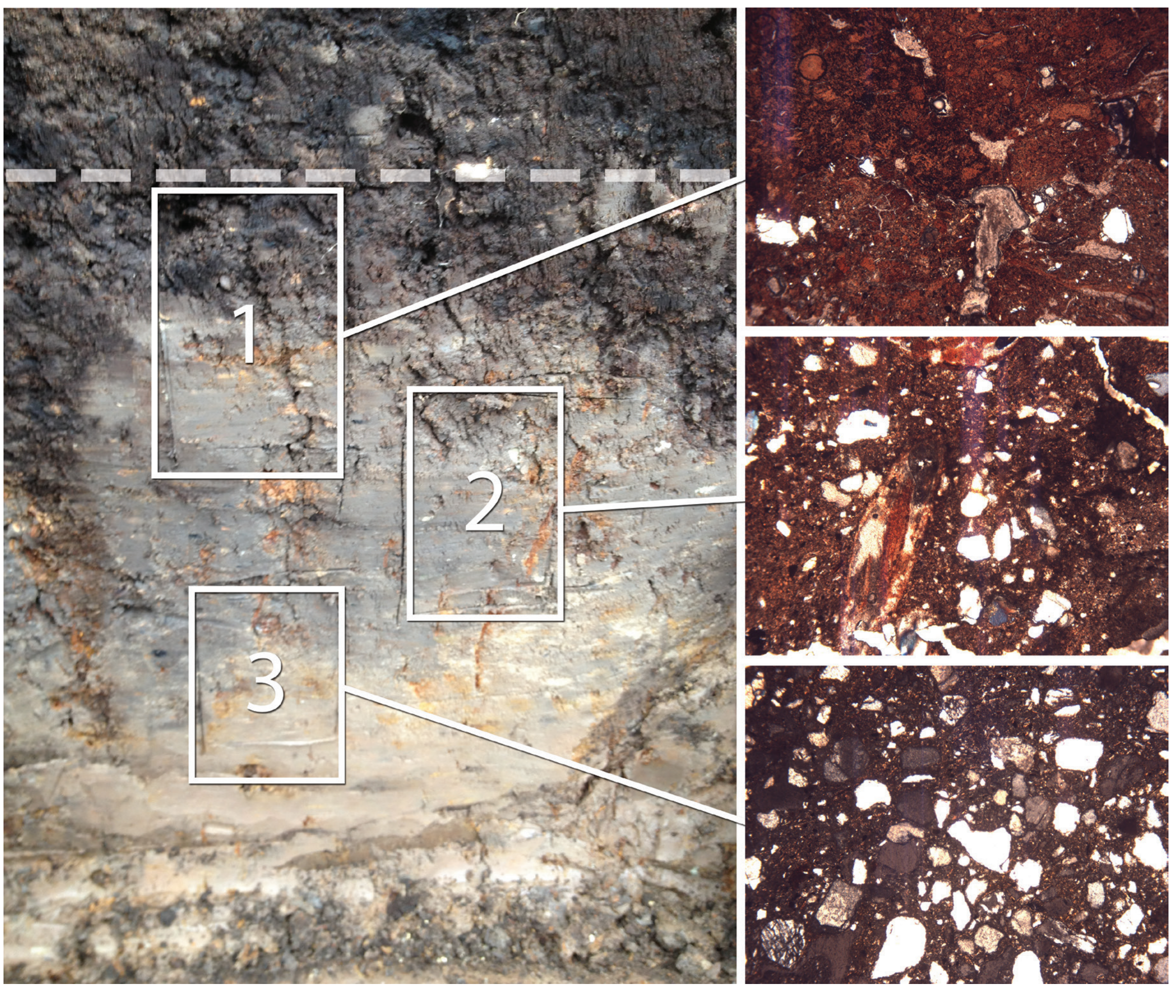

Figure 20.3: Samples taken for micromorphological analysis (sampling: HW, analysis: CF). The dashed line indicates the suggested original Mesolithic surface. The slides show that the grey sediment beneath the highly desiccated peat is a sandy clay loam, and appears to be the remnants of a weakly developed B horizon of brown earth soil (Copyright Star Carr Project, CC BY-NC 4.0).

Anthropogenic deposits

Most of the flint and pieces of bone in this area were found in the deposits (302) and (308); some bone and flint were found well into the mineral sediment (308), in some places to a depth of over 0.1 m. Both lithics and bone can move within soil profiles due to bioturbation, but in some cases groupings of animal bone were found together well below the top of the mineral sediment. This suggests that animal bones either became worked into the soil or in some cases may have been placed in pits which were not visible during excavation due to the subsequent gleying process.

A series of features were recorded cutting into the basal mineral deposit (308). The first of these were recorded in 2008 during the excavation of trench SC23 and consisted of a shallow, irregular hollow [148], with two fills (149 and 125) surrounded by a series of smaller stake or postholes. None of these features were visible in the overlying deposit. The features are thought to form a structural arrangement (the eastern structure) focused on the large, central hollow (Chapter 5).

A larger concentration of 58 features was recorded just to the west of these during the 2014 excavations of trench SC34. These included a second structure (the central structure), again made up of a deliberately cut hollow [330] with two fills (331 and 325) as well as several other arrangements of features that could have potentially served a structural function (Chapter 5). A relatively large pit/posthole [336]/(337) was located to the southwest of the structure and contained an unusual collection of flint (Chapter 8) and burnt bone (Chapter 7) and a slightly larger pit/posthole [451], filled by (452) and (461) was excavated to the southwest of the central occupation area, situated on the edge of the lake (Figure 20.4). These features were associated with a spread of darker material, mostly a friable sandy silt, which has been interpreted as a buried soil of occupation deposit (Figure 20.4). This was assigned two context numbers, (326) and (440), but was essentially the same deposit. Across this area was a spread of soft, fine sand (311), which was encountered below the desicated upper peat (301). A third scatter of cut features was recorded to the east of trench SC34, forming a further structural arrangement (the western structure) (Chapter 5).

The features were all slightly ephemeral when observed in plan, and whilst it was possible to identify them as they were exposed, their edges remained indistinct and difficult to distinguish from the surrounding sediment. This is probably due to a combination of the gleying process described above, and bioturbation, where root and worm action has mixed the fills of the features with the deposits that they were cut into.

Conclusions

With the exception of the basal mineral sediments in both the wetland and dryland areas, most of the deposits present at Star Carr are the result of natural processes that occurred throughout the time the site was occupied. The lower sequence of peat deposits (the detrital mud, reed peat and wood peat) accumulated at the edge of the lake and reflect the gradual transition from shallow water reedswamp to terrestrial fen and carr that resulted through a process of hydroseral succession (see Chapter 19). Archaeological material was present throughout these deposits, reflecting tasks carried out within the wetlands or the deposition of material into this area.

Broadly contemporary with these on the adjacent dryland was the layer of grey/brown clay (302), which represents the remains of the Early Mesolithic ground surface. The interface between (302) and (308) was disturbed and the sediments have since changed due to gleying processes. Context (308) contained the majority of the archaeological material and had been cut through by a series of deliberately cut hollows, stake and postholes, and pits.

The one type of feature that is notable by its absence is the hearth; either as a formalised arrangement of stones or staining on the Mesolithic ground surface. This is unlikely to be the result of later truncation, as the subsequent formation of peat towards the end of the Early Mesolithic (and the later deposition of upcast from the River Hertford) have undoubtedly protected the Mesolithic horizon, reducing the impact of ploughing and other activities. As such the absence of hearths would appear to be real. However, this does not mean that people were not lighting fires, or that hearths were not present on the site. As Sergant et al. (2006) note, stone-lined hearths are generally quite rare on Mesolithic sites, whilst taphonomic processes (notably bioturbation) can remove traces of burning from the original land surface (Sergant et al 2006, 999), and as noted above, there is evidence of both bioturbation and gleying at Star Carr. What is more, hearths are clearly represented in the large quantities of burnt flint, often in discrete clusters, that have been recorded at Star Carr (see Chapter 8),

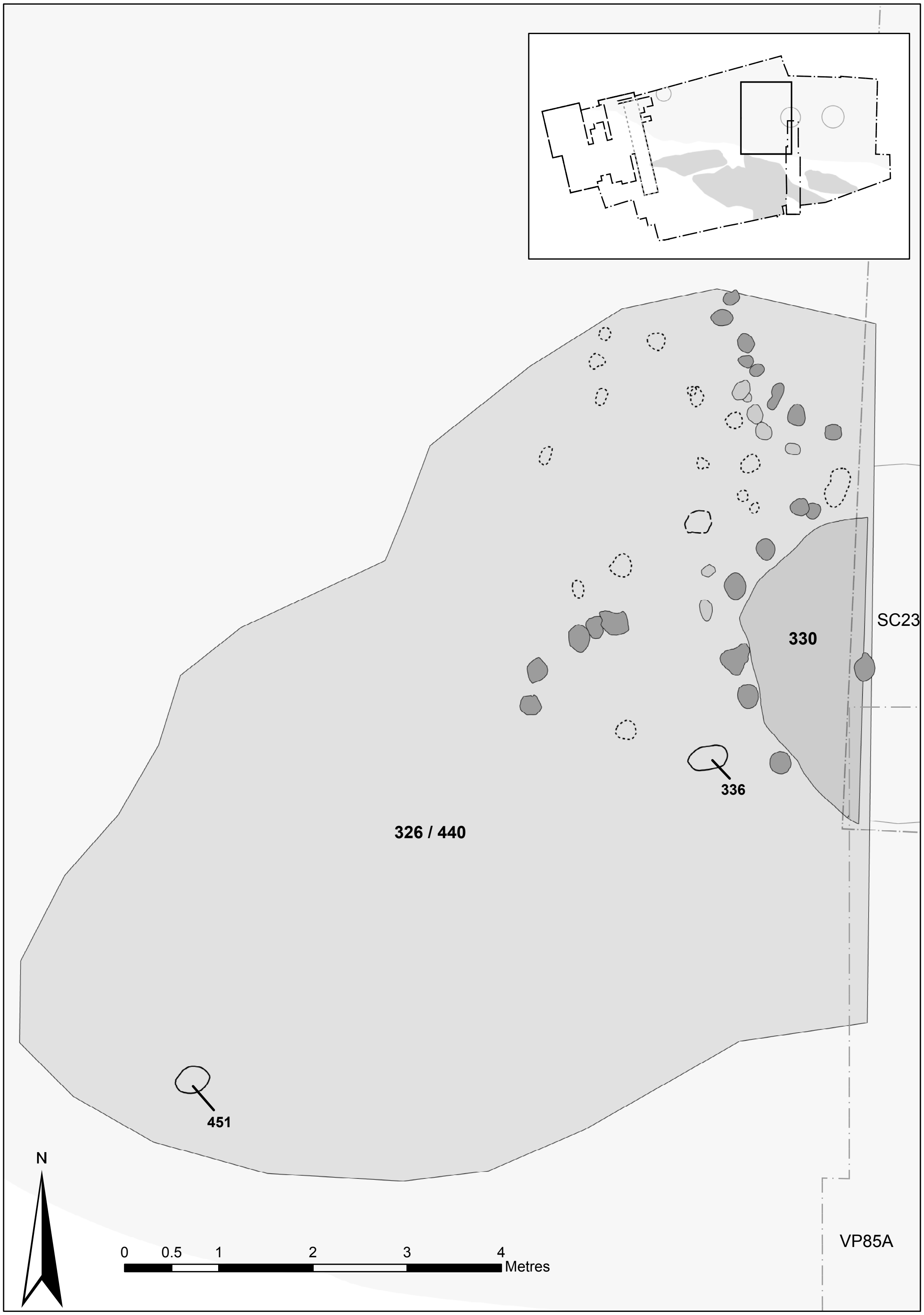

Figure 20.4: Plan of the features in the central area (Copyright Star Carr Project, CC BY-NC 4.0).

and charcoal records, both as micro-charcoal found within the eastern structure and discrete patches of charcoal found at the lake edge (Chapter 32). Taken together, the evidence points to the setting of hearths on the Early Mesolithic ground surface, without either pits or arrangements of stones around them.

The upper part of the sedimentary sequence in both the wetland and dryland areas is largely the result of the later development of the wetlands, with peat-forming environments encroaching above the lake shore and over what had previously been the Mesolithic terrestrial land surface (see Chapter 4). The cause of this development is currently poorly understood. However, the gleying of the mineral deposits indicates a rising water table, which may have been sufficient to trigger peat formation on the low-lying parts of the terrestrial landscape. These later peat deposits, both on the dryland and wetland parts of the site, are highly humified and very badly preserved, reflecting the subsequent drainage of this landscape.