Archaeological Excavation of a 'Kettle Hole' (KB5) at Killerby Quarry, North Yorkshire

View of the timber platform during excavation under frost cover (scale = 2m).

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EXECUTIVE SUMMARY

Project Name: Archaeological Excavation of a 'Kettle Hole' at Killerby Quarry, North Yorkshire
Site Code: KIL17
Planning Authority: North Yorkshire County Council
Geology: Devensian till overlying Brotherton formation limestone
NGR: SE 25742 95468
Date of Fieldwork: October-December 2017
Date of Report: June 2018

In October 2017 Archaeological Research Services Ltd was commissioned by Tarmac to undertake an archaeological sample excavation of a kettle hole (KB5) as part of the enabling works for Killerby sand and gravel quarry. In addition, detailed geoarchaeological mapping and palaeoenvironmental study of the kettle hole and its setting was undertaken and is reported upon separately (Parker et al. 2018). The site is located immediately east of the A1M trunk road, North Yorkshire, south of Catterick. The excavation targeted a kettle hole that had previously been identified and mapped by ARS Ltd and labelled 'KB5' by this project (Passmore 2012). It lies beneath the route of the quarry's intended haul road and it was therefore necessary to investigate the feature and its deposit sequence prior to the road's installation. A smaller kettle hole, 'KB15', is located c.17m the north-west of 'KB5'. This feature was also investigated and sampled as part of this phase of archaeological works via a single machine-excavated evaluation trench through its centre.

The site of KB5 is centred at SE 25742 95469 and is situated at 50.54m above Ordnance Datum (aOD) within a field with pronounced undulations varying between 38m and 54m aOD, reflecting its glacial inheritance (Long et al. 2004, Parker et al. 2018 and Waddington and Passmore 2008). The solid geology of the area comprises Carboniferous Millstone Grit and Permian Magnesian Limestone, which is overlain in this area by till which hosts in-filled ice-wastage features including kettle holes and depressions.

Excavation of kettle hole KB5 at Killerby revealed a complex deposit sequence spanning the end of the last major Ice Age (the Devensian) to the modern period. While the geoarchaeological sequence and palaeoenvironmental analysis of the deposits has provided vital insights into past landscape development, land use and climate, the kettle hole revealed a fascinating and rare example of how such features were being utilised and manipulated by humans. The presence of well-preserved in situ archaeological remains dating from the Mesolithic, Neolithic and Bronze Age, including organic remains such as wood and bone, have provided a rare insight into these periods and produced information for filling in certain gaps in the Mesolithic record in particular. As these remains are situated within naturally accumulating organic sediments the archaeological remains can be linked directly to the palaeoenvironmental data which will allow for a rich understanding of human use of the landscape to be built as data from the quarry accumulates.

The remarkable and rare evidence for a Late Mesolithic timber platform built so that it extended into a pond of >1m depth with associated flints and cattle teeth, together

with a huge abundance of microcharcoal present in the pollen diagram is a stunning and unusual discovery. Sites of this age, type and degree of preservation are exceptionally rare. The provisional interpretation of this feature is that it may have been a small pond used for processing and curing wild cattle skins. The tanning of leather requires submergence of skins in a bath of liquid, typically urine-laden water, where they are left for several days to cure. The presence of cattle teeth indicates cattle carcasses were brought to the site, whilst the limited range of chipped lithics indicates specialised taskworking and the presence of scrapers and a coarse stone tool, likely to be a skin softener, are suggestive of skinworking and particularly at the edge of the platform and the pond. Given its landscape position on the top of a ridge where the ever-present wind would blow the pungent smell of such a place away, this evidence, although not definitive, is consistent with such a purpose. The high levels of microcharcoal are consistent with settlement activity nearby, as is the spread of Mesolithic flints, including microliths, from around the kettle hole margin and elswewhere in this and nearby fields.

1. INTRODUCTION

1.1 In October 2017 Archaeological Research Services Ltd was commissioned by Tarmac to undertake an archaeological sample excavation of a kettle hole (KB5) as part of the enabling works for Killerby sand and gravel quarry. In addition, detailed geoarchaeological mapping and palaeoenvironmental study of the kettle hole and its setting was undertaken and is reported upon separately (Parker *et al*. 2018). The site is located immediately east of the A1M trunk road, 3.07km south of Catterick, North Yorkshire (Figure 1). The excavation targeted a kettle hole that had previously been identified and mapped by ARS Ltd and labelled 'KB5' by this project (Passmore 2012). It lies beneath the route of the quarry's intended haul road and it was therefore necessary to investigate the feature and its deposit sequence prior to the road's installation. A smaller kettle hole (KB15) is located to *c*.17m the north-west of KB5. This second feature was also investigated and sampled as part of this phase of archaeological works via a single machine-excavated evaluation trench through its centre. The features investigated by this study have been termed 'kettle holes' as a shorthand for what are small enclosed wet basins having formed during ice wastage/retreat. They should not be confused with solution hollows or sink holes. Throughout much of the Holocene they would have appeared as ponds, some of which were shallow and others of considerable depth. There are up to a dozen or so of these features distributed across the Killerby South area of the quarry. The large and deep ones at the east side of the Killerby South area will not be investigated as this area has been assigned to soil storage with no extraction intended in this area. This has reduced the number of relict wetland 'kettle holes' to be investigated and will facilitate ease of working the site given the wet and unstable nature of this ground. A separate report has been produced that focuses on the geoarchaeological setting of the site and its detailed palaeoenvironmental sequence (Parker *et al*. 2018) and should be read in conjunction with this report.

1.2 In October 2008 ARS Ltd carried out an Historic Environment Assessment for the site which combined baseline data, including Historic Environment Records, with aerial photographic data, map regression analysis and geoarchaeological assessment to assess the potential impact the quarry may have on the historic environment (Waddington and Passmore 2008). The assessment found the potential for archaeological remains to exist within the development area to be medium-high. Subsequently, in 2009, ARS Ltd conducted a rapid geoarchaeological assessment that informed a targeted programme of pre-application archaeological fieldwalking, targeted geophysical survey and a small number of evaluation trenches in order to characterise the nature, importance and likely extent of any surviving archaeological remains (Waddington *et al*. 2009). While the geophysical survey picked up a number of anomalies, none of the evaluation trenches encountered any archaeological features. The fieldwalking was highly informative and produced high densities of chipped stone lithics, the majority of which were of Mesolithic date and were clustered around the relict wetlands (i.e. kettle holes and depressions) and on areas of higher free-draining ground. There was a wide range of tools present including Mesolithic cores, microliths, burins, scrapers and blades, a Neolithic leaf-shaped arrowhead and Bronze Age scrapers. Notably, the majority of the assemblage which comprised Mesolithic material, was made from locally occurring chert rather than flint, indicating that this material

was collected and used locally at this time. Also found were sherds of Roman pottery and a silver penny from the reign of Edward I. Further archaeological evaluation was carried out by ARS Ltd in 2012 to investigate a previously identified peat deposit within a shallow kettle hole in a field immediately next to the A1M, which lies to the immediate west of the Killerby South quarry area and in the field next to the excavation reported here, and which had produced deer bone during an earlier evaluation radiocarbon dated to the Neolithic period (NAA 2005). While no archaeological features were encountered in this shallow wetland, an Early Bronze Age radiocarbon date obtained from a cow tooth from within the peat indicated that activities were taking place around this small wetland locale in both the Neolithic and Early Bronze Age. This field has since been excluded from the development area and no further archaeological work is planned to take place there (Figure 2).

1.3 In 2014 the results of these various interventions were brought together within the Cultural Heritage chapter for an Environmental Statement for the proposed quarry site (Waddington 2014) together with a Written Scheme of Investigation (WSI, see Appendix III) for a programme of mitigation works agreed with the Mineral Planning Authority archaeologist. The pre-application works had shown that the key areas across the site with potential to contain preserved archaeological remains were elements of the earlier prehistoric and Roman landscape particularly from the earliest Mesolithic through to Neolithic times together with some potential for late Iron Age-Roman enclosures/field systems adjacent to Low Street. This work showed the kettle holes had the potential to contain highly informative, well-preserved organic sediments within relict glacial and Holocene valley floor features that not only contained archaeological and faunal remains but which can provide detailed palaeoenvironmental reconstruction informing the character and changing pattern of human land use from earliest prehistory through to historic times, as well as how the landscape and human use of it changed. This will provide unique and new insights not previously available for this region.

2. SITE LOCATION AND GEOLOGY

2.1 The site of KB5 is centred at SE 25742 95469 and is situated at 50.54m above Ordnance Datum (aOD) within a field with pronounced undulations varying between 38m and 54m aOD, reflecting its glacial inheritance (Long *et al*. 2004, Parker *et al*. 2018 and Waddington and Passmore 2008). The solid geology of the area comprises Carboniferous Millstone Grit and Permian Magnesian Limestone, which is overlain in this field by till which hosts in-filled ice-wastage features including kettle holes and depressions (Figure 1).

2.2 Prior to excavation, the ground level in the location of kettle hole KB5 was slightly lower than that of the surrounding field and the crop was noticeably drier. Once the topsoil and subsoil had been removed the upper fill of the kettle hole was found to be much lower than the surrounding ground level, particularly on its north-eastern side. This marked difference in height once the topsoil and subsoil had been removed was due to the material that the farmer had been depositing within the kettle hole's hollow in order to level out the field. The kettle hole was an irregular ovoid shape in plan and measured 50m from north-west to south-east and 20m from north-east to

south-west. It was located on the top of a low glacial ridge from which wide views of the surrounding landscape are available. Kettle hole KB15 was also visible prior to excavation as a slightly lower area of the field where the crop was noticeably drier. Kettle hole KB15 measured 28m from north to south and 15m from east to west and was an irregular ovoid shape in plan. This second kettle hole had also had soil and other waste material deposited within it in order to fill the hollow and level out the field.

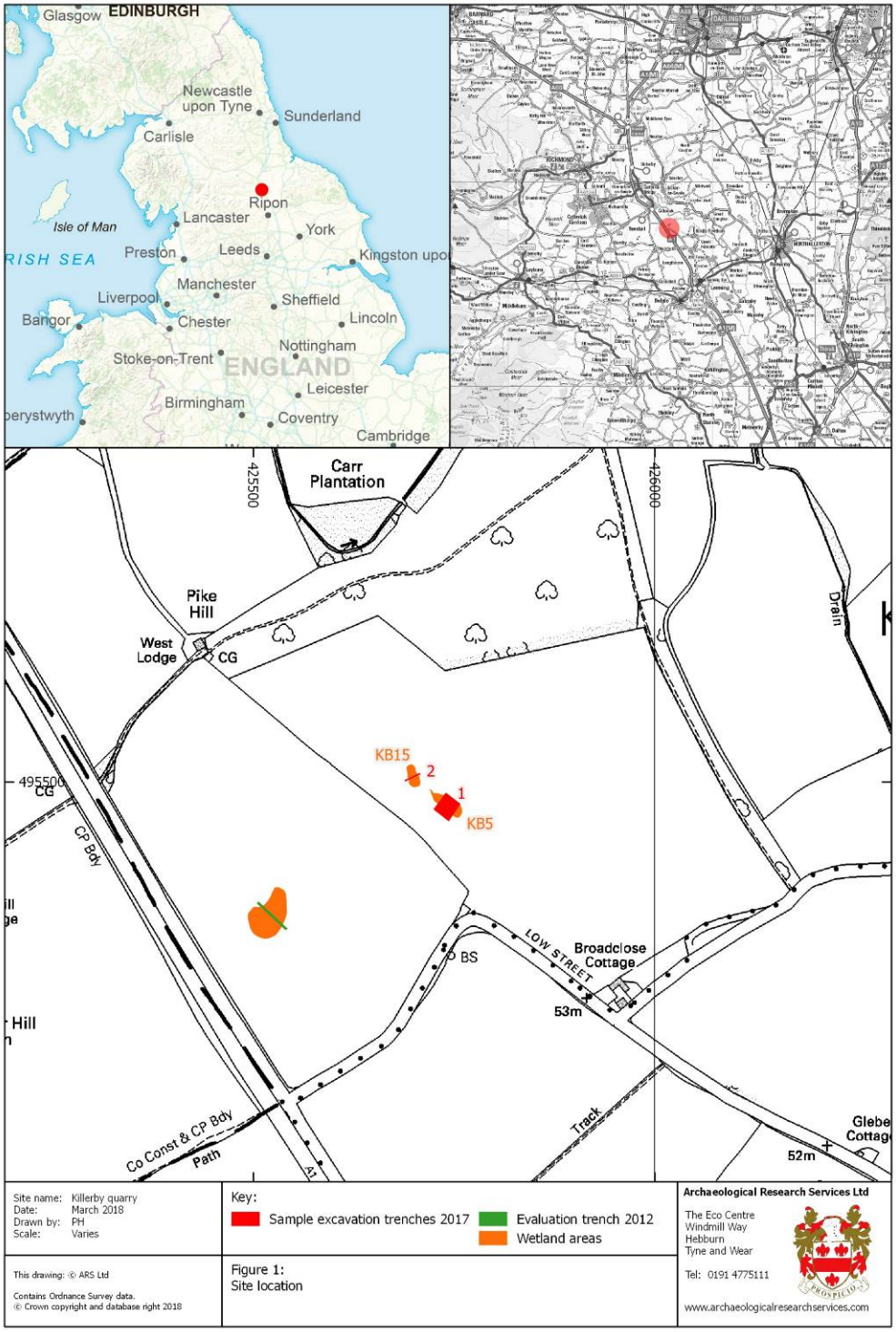


Figure 1. Site location Ordnance Survey data copyright OS, reproduced by permission, Licence no. 100045420. Trenches 1 and 2 described in this report.

3. AIMS AND OBJECTIVES

3.1.1 The aim of this study is to investigate the relict wetland (KB5) via sample excavation in order to understand the character and sequence of prehistoric activity and land use in this area and to relate archaeological remains encountered with the palaeoenvironmental sequence for past landscape and land-use change. In line with National Planning Policy Framework (NPPF) and the Minerals and Archaeology Practice Guide, the excavation will allow for the recording of these important remains prior to their removal and the information produced by these mitigation works will be made publicly available (via the world wide web and other methods) so that there is a public benefit outcome for this and future generations.

7.1.1 The key objectives of this study are to:

- Document and understand the sediment sequence within the kettle hole
- Identify, record and interpret any archaeological remains present within the sediment sequence
- Establish the phasing and chronology of the sediments and the archaeological and palaeoenvironmental information that they contain
- Identify the earliest evidence for human activity/settlement and how this developed and changed over time
- Understand how early human groups were using this wetland and what they were doing in the landscape immediately around it
- Identify the most suitable and efficient method/s for sampling these small wetland basins for applying to other such features on the site in later phases

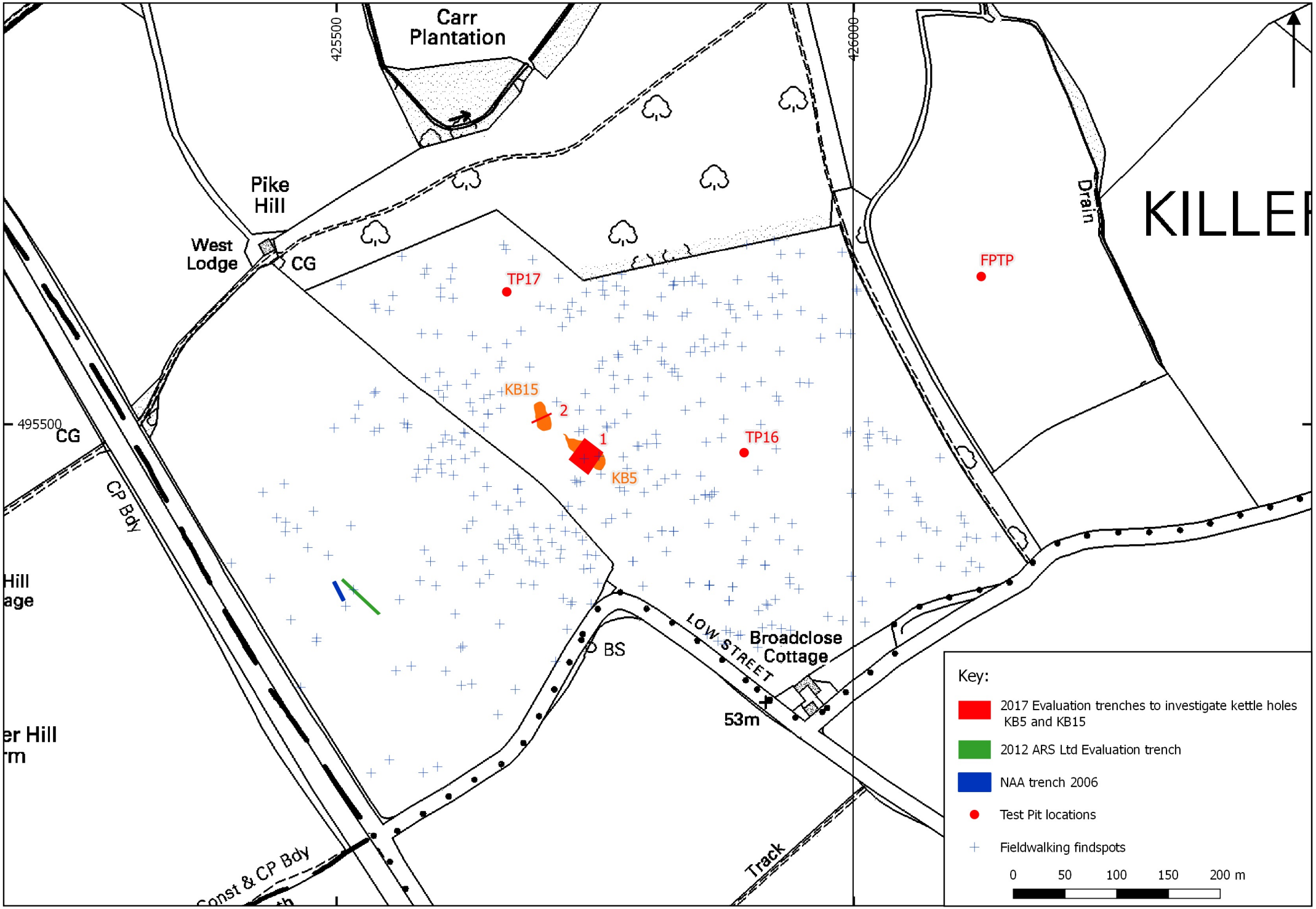
4. METHODOLOGY

4.1 The area of the kettle hole was stripped of topsoil and subsoil using a 360° tracked excavator equipped with a long-reach arm and a ditching bucket. The stripped area was then cleaned by hand to allow the kettle hole's extent to be accurately recorded. The excavation began with a single evaluation trench (Trench 1) measuring 26 x 5m which was excavated through the centre of the kettle hole from north-east to south-west. In order to safely capture the entirety of the kettle hole's profile it became necessary to extend the excavation area to both the north and the south. The resultant trench measured 26 x 24m at its maximum extent.

4.2 A further trench, Trench 2, was excavated through a small second kettle hole (KB15) which was located *c*.17m to the north-west of KB5. This trench measured 21 x 2m and was orientated north-east to south-west through the centre of the kettle hole. Both trenches were carefully excavated in c.0.1m spits using the mechanical ditching bucket under continuous archaeological supervision. When organic layers were encountered with potential for in situ archaeological remains the base of the trench was manually inspected for signs of human activity in the form of features, artefacts and ecofacts. Once the trenches encountered the natural till the sections were recorded by photograph, drawing and written record and monolith and grab samples taken as appropriate. Where archaeological features were encountered in Trnech 1

these were manually cleaned, excavated and recorded before further machining off of the sediments commenced. When the timber platform was encountered in Trench 1 the trench was widened either side of this feature and the fill removed down to this significant layer so that the same phase of archaeological remains could be recorded together in plan. Water ingress was dealt with by regular bucketing out using the machine bucket. The initial section cut down to the till proved useful in creating a sump which helped to drain the otherwise wet sediment either side and above it and this allowed excavation of the archaeologically significant layers to take place.

4.3 Further information on the methodology for the excavation can be found within an appendix to the Environmental Statement Cultural Heritage chapter (Waddington 2014) which has been included at the end of this report.


Carr Plantation
425500
426000
Pike Hill
West Lodge
CG
TP17
FPTP
Drain
KILLE
KB15
2
1
KB5
TP16
495500
CG
CP Bdy
Hill
age
er Hill
rm
BS
LOW STREET
Broadclose Cottage
53m
Const & CP Bdy
Track
Key:
2017 Evaluation trenches to investigate kettle holes KB5 and KB15
2012 ARS Ltd Evaluation trench
NAA trench 2006
Test Pit locations
Fieldwalking findspots
0
50
100
150
200 m

5. RESULTS

5.1 Trench 1 (Please refer to Appendix III: Harris Matrix)

5.1.1 Trench 1 was excavated in level spits until Devensian till (1080) was reached at a maximum depth of 2.87m below the top of the modern topsoil (Figure 3, Figure 4 and Figure 22) (Appendix III: Harris Matrix). The grey, well-sorted clay till extended beyond the limits of the excavation in all directions. Sitting directly above the till and with a maximum thickness of 0.32m was a poorly-sorted, coarse, dark grey silt containing sand and gravel (1022) that became more finely textured towards its base and which characterised the Devensian-Windermere transition on the site. This grey silt had a maximum width of 21m from north-east to south-west across the kettle hole and could be seen in the trench section gradually thinning out towards the margins of the kettle hole (Figure 3, Figure 4 and Figure 22). This deposit represents initial Post Galcial silting within the kettle hole. Palaeoenvironmental analysis of this deposit found it to contain pollen from pioneer species including birch, pine and rowan (for full discussion of the palaeoenvironmental sequence and the geoarchaeological setting see Parker *et al.* 2018). Waterlogged rowan from the lower boundary of deposit (1022) produced a calibrated radiocarbon date of 13335-13026 cal BC (95.4% probability) or probably 13266-13131 cal BC (68.2% probability) (SUERC-79306 (GU79306)).

5.1.2 Overlying deposit (1022) was a 0.24m thick band of medium textured grey/brown organic-rich clay silt (1026) (Figure 3, Figure 4 and Figure 22) (Appendix III: Harris Matrix). This deposit was found to contain abundant microcharcoal which is typically considered evidence for human burning activities, while the discovery of algae pollen, bog bean seeds and bog bean weed pollen within the deposit indicates the presence of standing water at least 1m deep at this time (Parker *et al.* 2018). A waterlogged bog bean seed from the lower boundary of deposit (1026) produced a calibrated radiocarbon date of 11299-11129 cal BC (95.4% probability) or probably 11246-11160 cal BC (68.2% probability) (SUERC-79305 (GU47400)) while a waterlogged bog bean seed from the upper boundary of deposit (1026) produced a calibrated date of 10958-10764 cal BC (95.4% probability) or probably 10873-10794 cal BC (68.2% probability) (SUERC-79304 (GU79304)). Sitting directly above deposit (1026) was a very fibrous and humic dark brown peat measuring 0.16m thick (1025) with numerous bog bean seeds noted within its upper surface and a significant aquatic plant population seen within the pollen record (Parker *et al.* 2018) (Figure 3, Figure 4 and Figure 22). Peat deposit (1025) measured 10m in width across the kettle hole and was only present within the central portion of the kettle hole. A waterlogged bog bean seed from within the upper portion of deposit (1025) produced a calibrated radiocarbon date of 10799-10734 cal BC (95.4% probability) or probably 10783-10747 cal BC (68.2% probability) (SUERC-79300 (GU47398)). Sitting above the peat was a narrow, 0.13m deep band of organic-rich clay (1011) containing significant organic remains and a particularly high concentration of bog bean weed pollen which is indicative of standing water measuring at least 1m deep. Frequent microcharcoal was also noted within deposit (1011), again likely attesting to human activity in the immediate vicinity during this warm spell of the Windermere interstadial (Parker *et al.* 2018).

5.1.3 The beginning of the Loch Lomond Stadial (glacial re-advance) on the site was characterised by the deposition of a band of grey/brown clay silt that had a maximum

thickness of 0.66m and contained occasional angular gravel (1027) (Figure 3, Figure 4 and Figure 22) (Appendix III: Harris Matrix). This deposit indicates an increased level of silt in-wash most probably caused by a destabilisation of the ground surrounding the edges of the kettle hole. A subsequent reduction in in-wash was represented by a graded layer (1010) that graded above (1027), which was finer in texture and had a much higher clay content. This deposit had a maximum thickness of 0.36m and was very dark grey with few inclusions. Palaeoenvironmental analysis of both deposits (1027) and (1010) revealed pollen from various different herbaceous species as well as birch (Parker *et al.* 2018). Until this point the deposits had formed a noticeable hollow within the centre of the kettle hole, however the clay silt (1027) filled this hollow and levelled out the deposit sequence from this point onwards.

5.1.4 Sitting directly above deposit (1010) was an organic peat layer (1008). The lower portion of the sediment, (1008b), was almost indistinguishable from the upper portion, (1008a), aside from a slightly higher clay content within the latter (1008a) which could be observed by eye (Figure 3, Figure 4 and Figure 22) (Appendix III: Harris Matrix). The entire sediment was very dark brown/black in colour and contained significant quantities of organic plant remains as well as very high levels of microcharcoal, indicating human activity. It varied in thickness between 0.1 and 0.3m and had a maximum width of 21m across the kettle hole, and extended from one side of the kettle hole to the other. The total area of the exposed upper surface of the sediment (1008a) measured *c*.420 m^2, although it appears to have extended across the whole kettle whole area, and was encountered across the whole area at a depth of 1.3m below the modern ground surface. Palaeoenvironmental analysis of the lower sediment (1008b) found it to contain evidence for a significant birch population that decreased through time while alder and lime increased. Although deposit (1008) on the whole was seen to be quite shallow during excavation, this was due to significant compression (Parker *et al.* 2018) and the deposit had in fact developed over a significant amount of time. The bulk organic sample taken from the upper portion of sediment (1008a) at the margins of the kettle hole produced a calibrated date of 5741-5641 cal BC (95.4% probability) or probably 5723-5671 cal BC (68.2% probability) (SUERC-79298 (GU47396)) which places this section of the sediment within the Later Mesolithic period. Its lower portion represents the earlier Mesolithic.

5.1.5 At the base of sediment (1008) a significant area of split and laid oak timbers was found forming a platform extending out from the east side of the kettle hole to approximately half way across the kettle hole where a consistent edge was encountered (Figure 26) (Appendix III: Harris Matrix). In the area exposed within the excavation trench the platform measured 10.8 x 10.9m and extended over an area of 90.79m^2 although many of the timbers displayed poor conditions of preservation and had been severely compressed. This indicates that the platform was probably originally much more substantial than it appeared by the time of the excavation (Figure 9, Figure 10, Figure 11 and Figure 12). The platform was several timbers thick in places, however the base of the platform was set in the lowest part of sediment unit (1008b) and rested directly on clay (1010) below. The uppermost of the timbers could be observed at the top of (1008). Only one piece of timber was identified within the south-east of the excavation area and the remainder were concentrated within the north-western area. A total of 34 individual pieces of timber were recorded and removed from within the

sediment at varying levels. Of these 34 pieces, seven were particularly long with timber (1051) measuring *c*.10m in length. Timbers (1032), (1033), (1037), (1038) and (1060) were all aligned roughly north-south in two parallel rows and displayed evidence of having been split in order to create crude planks which had then been laid as a form of 'walkway' or path (Figure 13, Figure 25 and Figure 26) (Appendix III: Harris Matrix). Similarly, timbers (1050), (1051), (1052), (1053), (1054) and (1055) were laid in a roughly east-west direction (Figure 25 and Figure 26). The remaining timbers were mostly much smaller and were concentrated at the southern extent of the sediment at the kettle hole's margin where they had been laid to create a dry platform on what would have otherwise been wet, boggy ground. Timbers (1030), (1062), (1074) and (1075) were found to be tree stumps still rooted into the ground that had potentially been felled on purpose in order to contribute towards the platform (Figure 15 and Figure 16). In addition, timbers (1051) and (1053) appeared to be two halves of a tree trunk that was also still rooted into the ground but had been purposefully split and laid on the ground in opposite directions (Figure 14). Radiocarbon dating of a basal timber of the wooden platform ((1065) SF 176) produced a calibrated date of 5542-5472 cal BC (95.4% probability) or probably 5514-5479 cal BC (68.2% probability) (SUERC-80722 (GU48310)) which places it within the Later Mesolithic period. The uppermost part of the platform, however, dates to the Late Neolithic period (see below for the Neolithic date and further information).

5.1.6 The upper part of sediment (1008a) was found to have a moderate to large number of small limestone cobbles sat upon its surface (Figure 8). The stones did not appear to form any type of structure and there were not enough to create a stable surface, however there is no natural process that can be identified to explain how they came to be there.

5.1.7 During excavation a posthole F1020 was observed within the trench (Figure 7) (Appendix III: Harris Matrix). The posthole contained the remains of a large oak post that had been worked into a point in order to make it easier to insert into the ground. Smaller pieces of hazel and willow had then been wedged down the sides of the post to keep it upright. The cut of the posthole [1021] was tight and irregular with steep sides, while the fill (1020) was medium textured black silt. The posthole had maximum dimensions of 0.98 x 0.55m and a maximum depth of 0.37m from the top of clay (1010). Radiocarbon dating of the short-lived hazel packing for a sharpened, upright oak post produced a calibrated date of 4789-4691 cal BC (95.4% probability) or probably 4771-4710 cal BC (68.2% probability) (SUERC-80723 (GU48311)) indicating it had been inserted through the existing timber platform and into the clay layer (1010) below. This date is several centuries later than the earliest phase of the timber platform and therefore represents a secondary phase of activity associated with the platform and the pond. The uppermost part of the timber platform has been dated to the end of the Neolithic period (see below for further details) indicating at least three phases of activity associated with this feature. Whether this activity was continuous, or punctuated with periods of inactivity, is not clear and it remains possible that many other phases of use throughout this long time bracket could have occurred. This can only be teased out by a further programme of radiocarbon dating timbers associated with the platform.

5.1.8 As sediments (1008b) and (1008a) were removed a number of chipped lithics

were recovered, many of which were found on and within the wooden platform. Seven lithics were recovered from the lower portion of the sediment (1008b) and these included flakes, a blade and a core (see Section 7: Lithic Assessment).The majority of the chipped lithics were recovered from the upper portion of the sediment (1008a), concentrated within the northern corner of the excavation area, and totalled 84 individual pieces including flakes, blades, a core, a scraper and retouched blades. This assemblage is Mesolithic in character and comprises predominantly chert pieces, a material that can be obtained locally. An Early Neolithic leaf-shaped arrowhead and knife were also found close together on the very top of this layer indicating a further phase of activity. These pieces are made from flint which is clearly an import to this area. The stratigraphic location of these pieces provides a *terminus post quem* for the timber platform and its associated artefacts and ecofacts. In addition to the chipped lithics the peat within and around the timber platform (1008) also produced some fragmentary cattle teeth indicating that remains of cattle carcasses had been brought on to the platform.

5.1.9 Sitting above peat (1008a) was an additional organic sediment/peat (1006). This peat had a higher clay content than sediment (1008) and was a dark brown/grey colour and could be differentiated by eye, texture and its stratigraphic position from peat (1008) below (Figure 3) (Parker *et al.* 2018). It had a maximum thickness of 0.09m and a maximum width of 21m across the kettle hole. Sediment (1006) was also found to contain a high level of microcharcoal, indicative of human activity. During excavation 23 lithics were recovered from (1006) including flakes, blades, cores, a scraper and a retouched blade (see Section 7: Lithic Assessment). Also found within sediment (1006) was a coarse stone tool which had possibly been used for the softening of animal hides (see Section 7: Lithic Assessment). The lower portion of the sediment (1006b) produced a calibrated radiocarbon date of 3627-3370 cal BC (95.4% probability) or probably 3518-3376 cal BC (68.2% probability) (SUERC-79297 (GU47395)) while the upper portion (1006a) produced a calibrated radiocarbon date of 1744-1535 cal BC (95.4% probability) or probably 1690-1618 cal BC (68.2% probability) (SUERC-79296 (GU47393)). These results indicate that this sediment unit began to develop during the earlier Neolithic and that this peat continued through to the Middle Bronze Age. At the north-eastern margin of the kettle hole, sediment (1006) and sediment (1008) were separated by grey clay (1007) that had been washed into the kettle hole from its edge before the development of organic sediment (1008). Deposit (1007) had a maximum thickness of 0.2m and a width of 2.6m and was only present within this small area of the excavation. This inwash event would therefore have taken place shorlty prior to 3627-3370 cal BC, but post the use of the timber platform. The presence of this inwash indicates local destabilisation of the sediments around the kettle hole and therefore a proxy for tree/shrub removal and breaking up the land surface. This inwash lens may, therefore, provide a proxy for early agricultural activity around the kettle hole. This would correlate with the stratigraphy and the dating of the sediment units between which it is sandwiched to the beginning of the Neolithic – a period defined by the first farming activity in Britain. This is significant as two independent sets of evidence (the inwash sediment and the presence of diagnostic artefacts) point to Early Neolithic activity in and around the kettle hole and its environs.

5.1.10 Two features displaying evidence of burning were identified within the upper

peat layer (1006) during excavation, both located close to the northern corner of the excavation area. The first of these, F1034, was a small circular patch of very dark brown/black silt containing abundant pieces of charred wood (1034) (Parker *et al.* 2018) (Figure 27 and Figure 28) (Appendix III: Harris Matrix). The deposit did not seem to sit within a cut but was rather sat directly upon the top of the sediment (1006) as a patch of burning and measured 0.38 x 0.35m wide although barely 0.01m depth of the deposit had survived. The second feature (F1035) was located immediately to the east of F1034 and consisted of an elongated patch of charred wood (1035), very similar in composition to (1034), measuring 1.98 x 0.4m and with a depth of *c*.0.02m although there was no discernible cut (Figure 17). A piece of oak charcoal from deposit (1034) was radiocarbon dated and produced a calibrated date of 3325-2923 cal BC (95.4% probability) or probably 3263-2942 cal BC (68.2% probability) (SUERC-79308 (GU47403)) which establishes the feature in the latter half of the Early Neolithic period. This date shows that F1034, and presumably also F1035, pre-date the Bronze Age phase of sediment (1006) which must comprise its uppermost part. The dates of these features add further strength to layer (1006) being considered of Neolithic date whilst (1008) below is Mesolithic. The slightly greater clay content within (1006) which differentiates it from (1008) below has resulted from the in-washing of fine clay particles into the pond during this time and this could be directly associated with the change from Mesoltihic to Neolithic land use and hence why these sediment boundaries appear to correlate with temporal cultural boundaries.

5.1.11 A piece of timber from the uppermost layer of the timber platform returned a calibrated radiocarbon date of 2471-2310 cal BC (95.4% probability) or probably 2466-2349 cal BC (68.2% probability) (SUERC-80721 (GU48309)) which places it at the end of the Late Neolithic period. This date is not consistent with the other date obtained from the base of the platform, however, and therefore shows a much later phase of use of the pond and the platform area. This placed timber provides further evidence of Neolithic activity in and around the kettle hole.

5.1.12 Also noted within sediment (1006) were two patches of heat-affected sediment (1045) and (1046) (Figure 27). The first area of heat-affected sediment (1046) was seen at the north-eastern edge of the kettle hole and measured 0.78 x 1.5m. The second area (1045) was located at the eastern corner of the excavation area, also at the edge of the kettle hole and measured 0.45 x 0.32m. A piece of charcoal from the stony fruits subfamily (e.g. Malus, Crataegus, Sorbus, etc.) extracted from deposit (1045) produced a calibrated radiocarbon date of 1864-1623 cal BC (95.4% probability) or probably 1745-1662 cal BC (68.2% probability) (SUERC-79307 (GU47402)) which places it, and possibly also deposit (1046), within the Early Bronze Age, confirming the upper layers of 1006 as belonging to this period.

5.1.13 Two features also belonging to the Bronze Age phase of activity on the site were identified within the trench however, owing to the dark colour of their fills and how similar they were to the organic sediments within the sequence, they were not recognised until the level of clay (1010) was reached. These features had evidently been cut down into this clay from a higher level (ie. layer (1006)). The first of these features, F1013, was a sub-circular pit with near-vertical sides and a concave base [1012] and a fill consisting of finely textured dark grey/black silt clay containing charred wood fragments (1013). The pit measured 0.32 x 0.36m at its widest and had a

maximum depth of 0.15m from the top of clay (1010) (Figure 21 and Figure 29) (Appendix III: Harris Matrix). A piece of waterlogged oak charcoal from pit F1013 (1013) produced a calibrated radiocarbon date of 1529-1414 cal BC (95.4% probability) or probably 1499-1441 cal BC (68.2% probability) (SUERC-79309 (GU47404)) which places it in the Middle Bronze Age. The other feature was a circular pit, F1016, which measured 0.2m deep from the top of clay (1010). It had a maximum diameter of 1.12m and the cut [1017] had gently sloping sides and a concave base. A number of Carboniferous limestone slabs and cobbles had been intentionally placed in the base of this pit. Limestone does not occur in the drift sediments on the site itself and their rounded and water-smoothed surfaces indicate they are likely to have been brought from the nearby River Swale which lies 1km to the north, and which is a rock-bed river for much of its course in the Catterick-Killerby area. The flat slab, which had been placed horizontally in the pit, has maximum dimensions of 0.31m x 0.31m x 0.54m. The various rounded cobles measured up to 0.20m across. All of the pieces were carefully examined for any trace of having been marked or carved, but no such evidence was visible. Their placement in the hollow suggested their use for a structural purpose, perhaps to provide a firm support and/or packing for a post driven in from one of the layers above (Figure 21, Figure 22 and Figure 27). Pit F1016 also produced a flint flake from its fill (see Section 7: Lithic Assessment). A piece of waterlogged hazel charcoal from pit F1016 (1016) produced a calibrated radiocarbon date of 1109-912 cal BC (95.4% probability) or probably 1031-932 cal BC (68.2% probability) (SUERC-79310 (GU47405)) which places it in the Middle – Late Bronze Age period. This features demonstrates that sediment (1006) continued to develop into the Late Bronze Age.

5.1.14 Above the upper layer of (1006) dated to the Bronze Age, was a thick band of grey, finely textured silty clay containing occasional gravel (1014) (Figure 3, Figure 4 and Figure 22) (Appendix III: Harris Matrix). This deposit had a maximum thickness of 0.52m and a maximum width of 23m within the trench, although it continued beyond the limits of the excavation in all directions. The stone and soil that was evidently introduced to form this deposit is indicative of human influence, although there was a low organic content (Parker *et al.* 2018). Located between clay deposit (1014) and sediment (1006) at the south-western extent of the kettle hole were two further deposits, (1028) and (1029). Deposit (1028) was a grey clay containing frequent pieces of charcoal while deposit (1029) was a black clay containing some organic plant remains. These two contexts have been interpreted as inundation deposits caused by destabilisation of the ground at the edges of the kettle hole. The abundance of charcoal within these deposits indicates human activity and it is therefore quite possible that they were caused by the burning and removal of vegetation for agricultural practices, a process which in turn would have destabilised the ground and caused the ingress of the material. A large deposit of dark grey/brown clay silt (1005) was then seen to have been deposited above clay (1014), extending across the entire width of the kettle hole and beyond the limits of the excavation. This clay silt (1005) had a maximum thickness of 0.24m and was seen for a width of 22m. Similar to deposit (1014), deposit (1005) contained soil and stones that was indicative of human influence. These deposits are considered to represent the deliberate terrestrialisation of the kettle hole (Parker *et al.* 2018), that is, the deliberate levelling up of the kettle hole and infilling it with dry sediment so that farming could take place across its surface.

5.1.15 Cut into deposit (1005) was a Victorian land drain. The drain had been laid within a steeply-sided cut [1019] measuring 0.45m in width and 0.5m in depth from the top of deposit (1005). The fill of the drain (1018) was dark brown coarse silty sand that produced sherds of post-medieval pottery (Figure 22).

5.1.16 Above the land drain the kettle hole's deposits became much narrower towards the upper surface. Deposit (1004) was a grey/blue sandy silt that had a maximum thickness of 0.37m and a maximum width of 14.6m from north-east to south-west. It sat directly upon clay silt (1005) and has been identified as a relatively late period of silting caused by standing water. This was followed by a further deposit of orange/yellow sandy silt (1003) that had a maximum thickness of 0.18m and a maximum width of 10m. Cutting deposit (1003) was the ditch of an old, now removed, field boundary measuring 1m in width and 0.68m in depth from the top of deposit (1003). The cut of the field boundary [1079] was steeply-sided with a flat base and the fill (1078) was brown sandy silt (Figure 24). Modern subsoil (1002) and modern topsoil (1001) overlay the entire kettle hole with a combined depth of 0.3m.

5.1.17 The topsoil and subsoil (1001) and (1002) and the upper fill of the kettle hole (1003) had been disturbed by the dumping of modern farm waste in the feature's southern extent. Discussion with the farmer indicated that the material has been deposited in order to help level out the hollow of the kettle hole and to help dry it out for ploughing.

Feature/ context number	Associated context numbers	Description	Max. dimensions (mm)	Max. depth (mm)	Colour of fill	Composition	Calibrated date range (95.4% probability)
Devensian							
(1080)	-	Till	-	Beyond ex.	Grey	Well-sorted clay	-
Devensian-Windermere transition							
(1022)	-	Post Glacial initial fill of kettle hole	-	320	Dark grey	Silt with sand and gravel	13335-13026 cal BC
Windermere Interstadial							
(1026)	-	Organic-rich deposit	-	240	Grey/brown	Clayey silt	10958-10764 cal BC 11299-11129 cal BC
(1025)	-	Fibrous, humic peat	-	160	Dark brown	Peat	10799-10734 cal BC
(1011)	-	Organic-rich deposit	-	130	Brown	Clay	-
Loch Lomond Stadial							
(1027)	-	Thick band of clay/silt	-	660	Grey/brown	Clay/silt	-
(1010)	-	Graded layer of (1027)	-	360	Very dark grey	Clay	-
Late Mesolithic							
(1009)	-	Inundation deposit	-	20	Grey	Sand	-
(1008b)	-	Organic	-	150	Dark	Silt	-

Feature/ context number	Associated context numbers	Description	Max. dimensions (mm)	Max. depth (mm)	Colour of fill	Composition	Calibrated date range (95.4% probability)
		sediment lower boundary			brown/black		
(1023)	-	Inundation deposit	-	20	Orange/yellow	Sand	-
(1008a)	-	Organic sediment upper boundary	-	150	Dark brown/black	Silt	5741-5641 cal BC
(1030), (1032), (1033), (1038), (1039), (1040), (1041), (1042), (1043), (1044), (1047), (1048), (1049), (1050), (1051), (1052), (1053), (1054), (1055), (1056), (1057), (1058), (1059), (1060), (1061), (1062), (1063), (1064), (1065), (1066), (1067), (1068), (1069), (1070), (1071), (1072), (1073), (1074), (1075), (1076), (1077)	-	Mesolithic wooden platform composed of split oak timbers with accompanying chipped lithics and cattle teeth	10800 x 10900	-	-	-	5542-5472 cal BC
F1020	1020, 1021	Posthole with *in-situ*	980 x 550	370	Black	Silt	4789-4691 cal BC

Feature/ context number	Associated context numbers	Description	Max. dimensions (mm)	Max. depth (mm)	Colour of fill	Composition	Calibrated date range (95.4% probability)
		worked timber post					
Neolithic							
(1007)	-	Inundation deposit	-	200	Grey	Clay	-
(1006b)	-	Organic sediment lower boundary	-	40	Dark brown/grey	Silt	3627-3370 cal BC
F1034	1034	Charred deposit	380 x 350	10	Very dark brown/black	Silt	3325-2923 cal BC
F1035	1035	Charred deposit	1098 x 400	20	Very dark brown/black	Silt	-
(1037)	-	Upper level of timber platform	-	-	-	-	2471-2310 cal BC
Bronze Age							
(1006a)	-	Organic deposit	-	50	Dark brown/grey	Silt	1744-1535 cal BC
(1045)	-	Heat-affected deposit	450 x 320	-	Grey/orange	Silt	1864-1623 cal BC
(1046)	-	Heat-affected deposit	780 x 1500	-	Grey/orange	Silt	-
F1013	1012, 1013	Small pit	320 x 360	150	Dark grey/black	Silty clay	1529-1414 cal BC
F1016	1015, 1016, 1017	Shallow pit with limestone slabs in its base	1120	200	Black	Silt	1109-912 cal BC
Iron Age onwards							
(1028)	-	Inundation deposit	-	320	Grey	Clay	-
(1029)	-	Inundation deposit	-	120	Dark brown	Clay	-
(1014)	-	Terrestrialised deposit	-	520	Grey	Silty clay	-
(1005)	-	Graded layer of (1014)	-	240	Dark grey/brown	Clayey silt	-
Victorian							
F1018	1018, 1019	Victorian field drain	450	500	Dark brown	Silty sand	-
(1004)	-	Upper fill of kettle hole	-	370	Grey/blue	Sandy silt	-
(1003)	-	Upper fill of kettle hole	-	180	Orange/yellow	Sandy silt	-
Modern							
F1078	1078, 1079	Field boundary	1000	680	Brown	Sandy silt	-
(1002)	-	Modern subsoil	-	150	Brown	Sandy silt	-

Feature/ context number	Associated context numbers	Description	Max. dimensions (mm)	Max. depth (mm)	Colour of fill	Composition	Calibrated date range (95.4% probability)
		subsoil					
(1001)	-	Modern topsoil	-	150	Dark brown	Sandy silt	-

Table 1. Feature/context summary table.

Figure 3. Oblique view of the north-west facing section of Trench 1 through kettle hole KB5 showing darker, organic sediments separated by layers of clay after the topsoil and subsoil had been removed (scale = 2m).

Figure 4. The southern section of Trench 1 showing where the deposits met the kettle hole's grey till margin showing monolith tin 6 *in-situ* (scale = 2m).

Figure 5. South-east facing section of Trench 1 showing the deposit sequence and monolith tin 7 *in-situ* (scale = 1m).

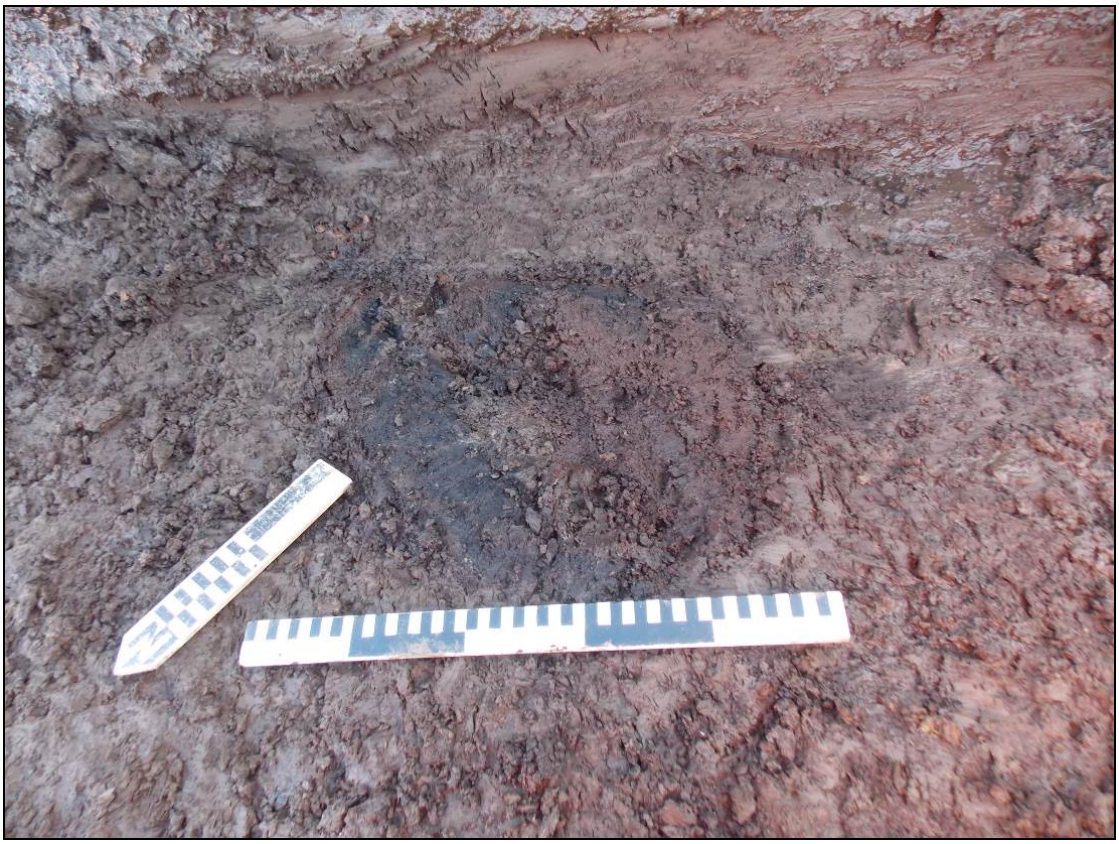


Figure 6. F1020 with oak post still *in-situ* (scale = 0.25m).

Figure 7. Posthole F1020 after removal of the oak post and the remaining fill (scale = 1m).

Figure 8. The excavation area, looking north-east, showing the surface of sediment (1008a) with stones *in-situ* as well as the upper layers of the wooden platform beginning to poke through (scales = 1m+ 2m).

Figure 9. The excavation area, looking east, after the removal of sediment (1008a) showing exposed upper layers of wooden platform with long p[arallel placed timbers visible (scales = 1m + 2m).

Figure 10. The excavation area, looking east, after removal of sediment (1008b) showing the exposed wooden platform after the uppermost long timbers had been removed (scales = 1m + 2m).

Figure 11. The timber platform, looking north-east (scales = 1m + 2m).

Figure 12. Detail of the timber platform, looking north-east (scale = 2m).

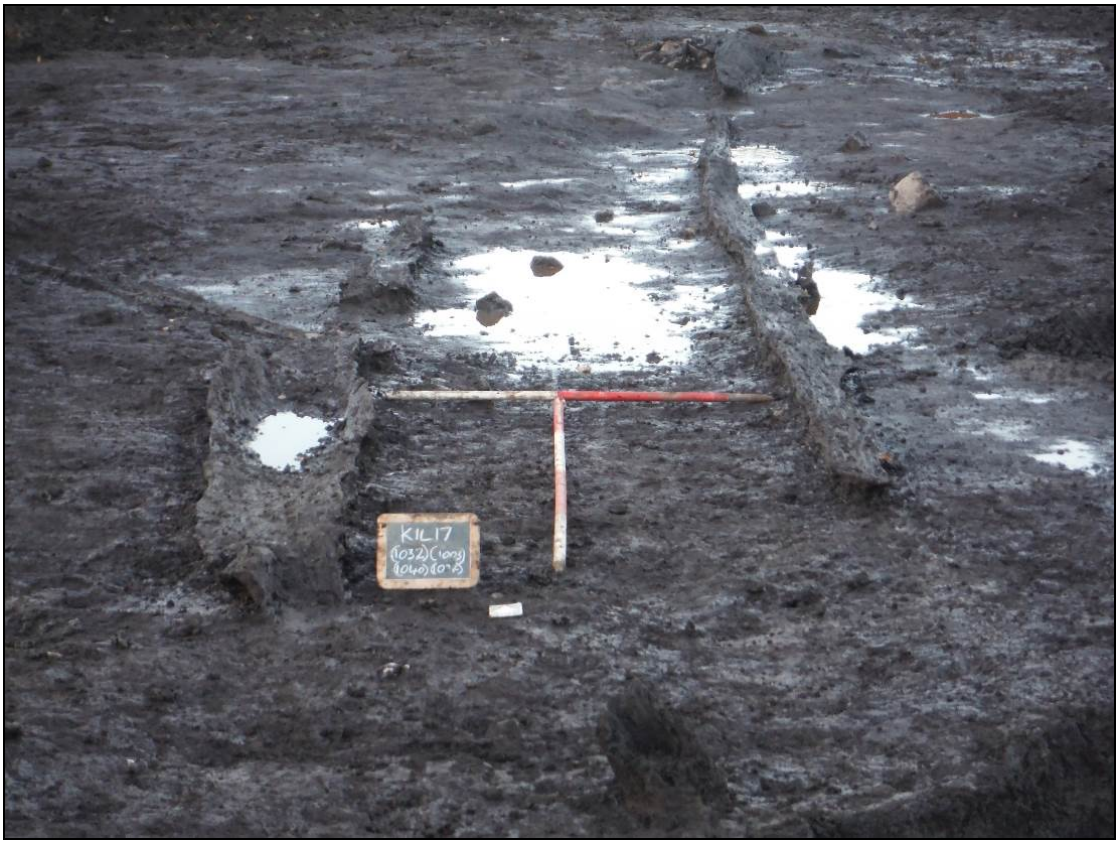


Figure 13. Parallel split timbers (1032) and (1037) after the removal of sediment (1008a), looking north (scales = 1m + 2m).

Figure 14. Split tree trunk (1051) and (1053) still rooted into the ground (scale = 0.2m).

Figure 15. Tree trunk (1030) still rooted into the ground (scale = 1m).

Figure 16. Tree trunk (1062) still rooted into the ground (scale = 0.2m).

Figure 17. Charred patch (feature F1035) prior to excavation (scale = 2m).

Figure 18. Patch of burning at kettle hole's edge (1046) (scale = 1m).

Figure 19. Pit F1013 after half-section excavation, looking south, cut down from above into layer (1010) (scale = 0.25m).

Figure 20. Pit F1013 after full excavation, looking south (scale = 0.25m).

Figure 21. Pit F1016 with in-situ cobbles and limestone slabs in its base cut down from above into layer (1010) (scale = 0.25m).

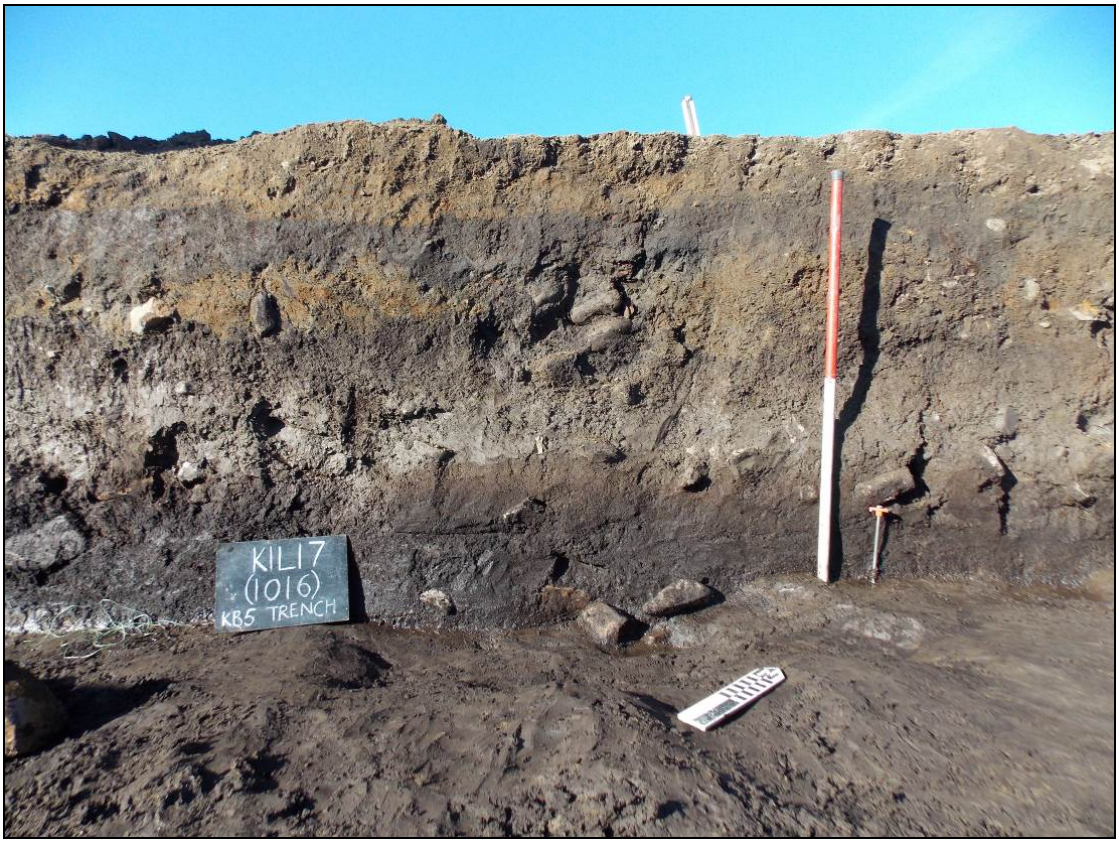
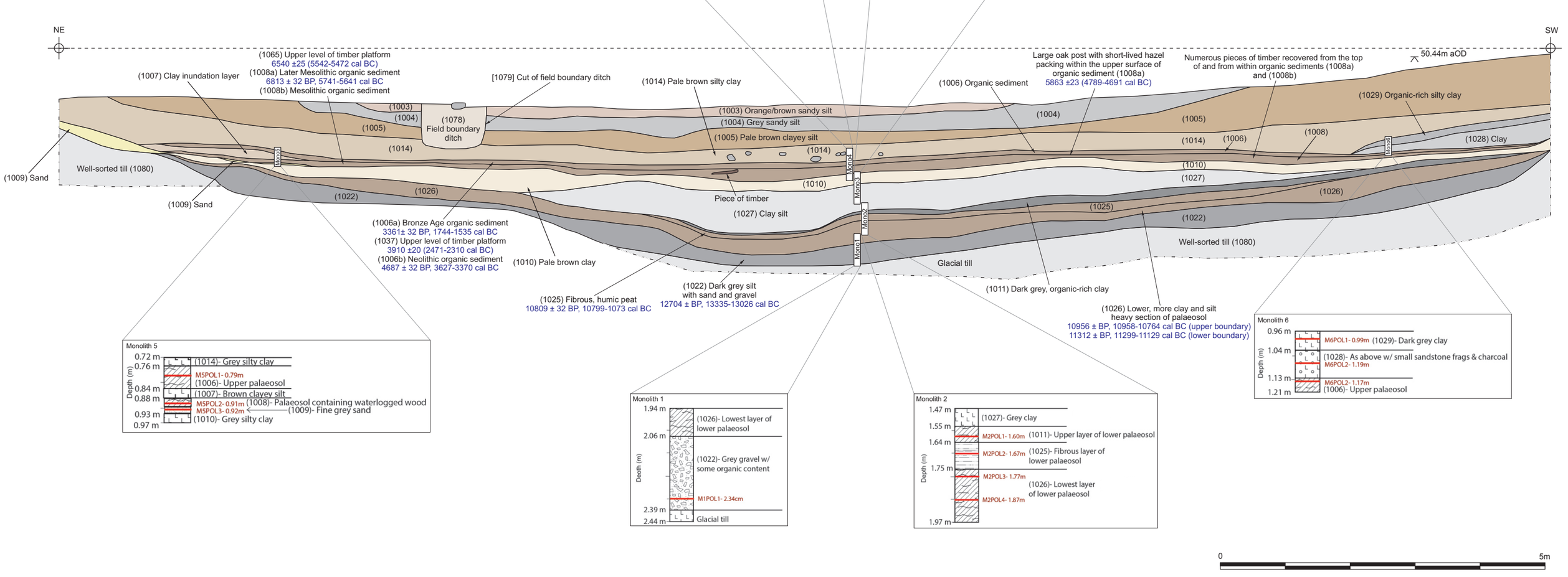


Figure 22. South-east facing section of Trench 1 after excavation of stone-filled pit F1016 showing the deposit sequence (scale = 1m).

North-west facing section of Trench 1 excavated through the centre of kettle hole KB5 including the locations of monolith tin samples.

Oblique view of Trench 1 looking south showing the deposit sequence and the locations of monolith tins 1-6 (scale = 2m).

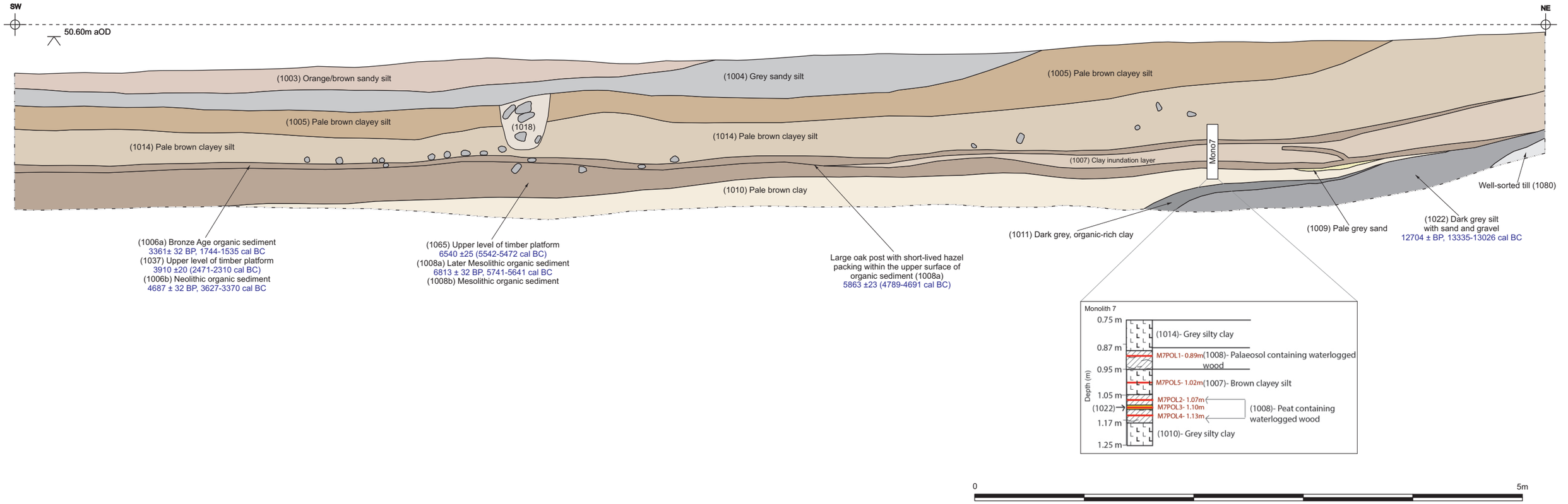
Piece of worked timber, highlighted in red, found within Mesolithic layer (1008b) (scale = 0.25 and 0.5m).



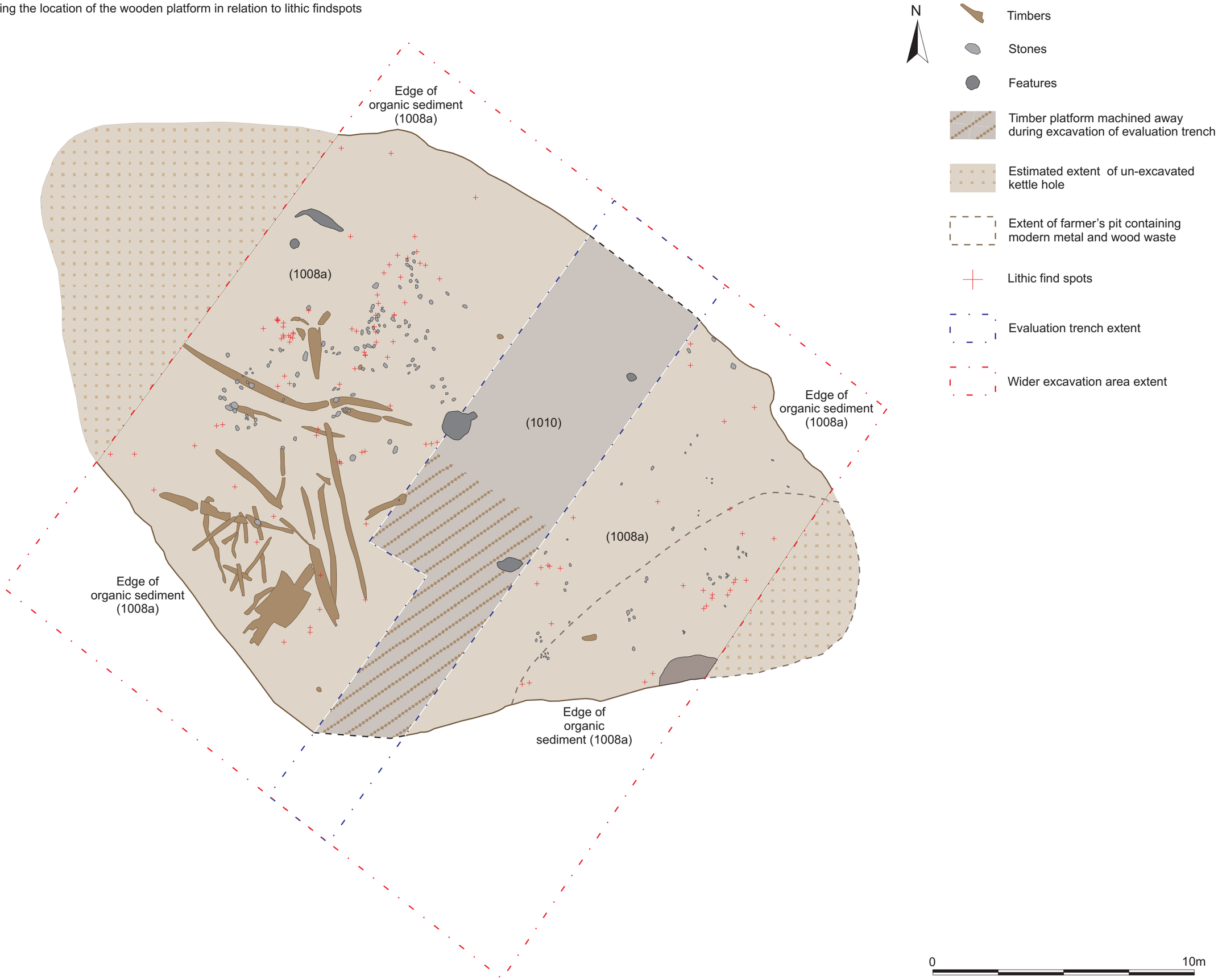
South-east facing section of Trench 1 excavated through the centre of kettle hole KB5

Oblique view of Trench 1 looking west showing the deposit sequence includingNeolithic and Bronze Age organic sediments (scale = 2m).

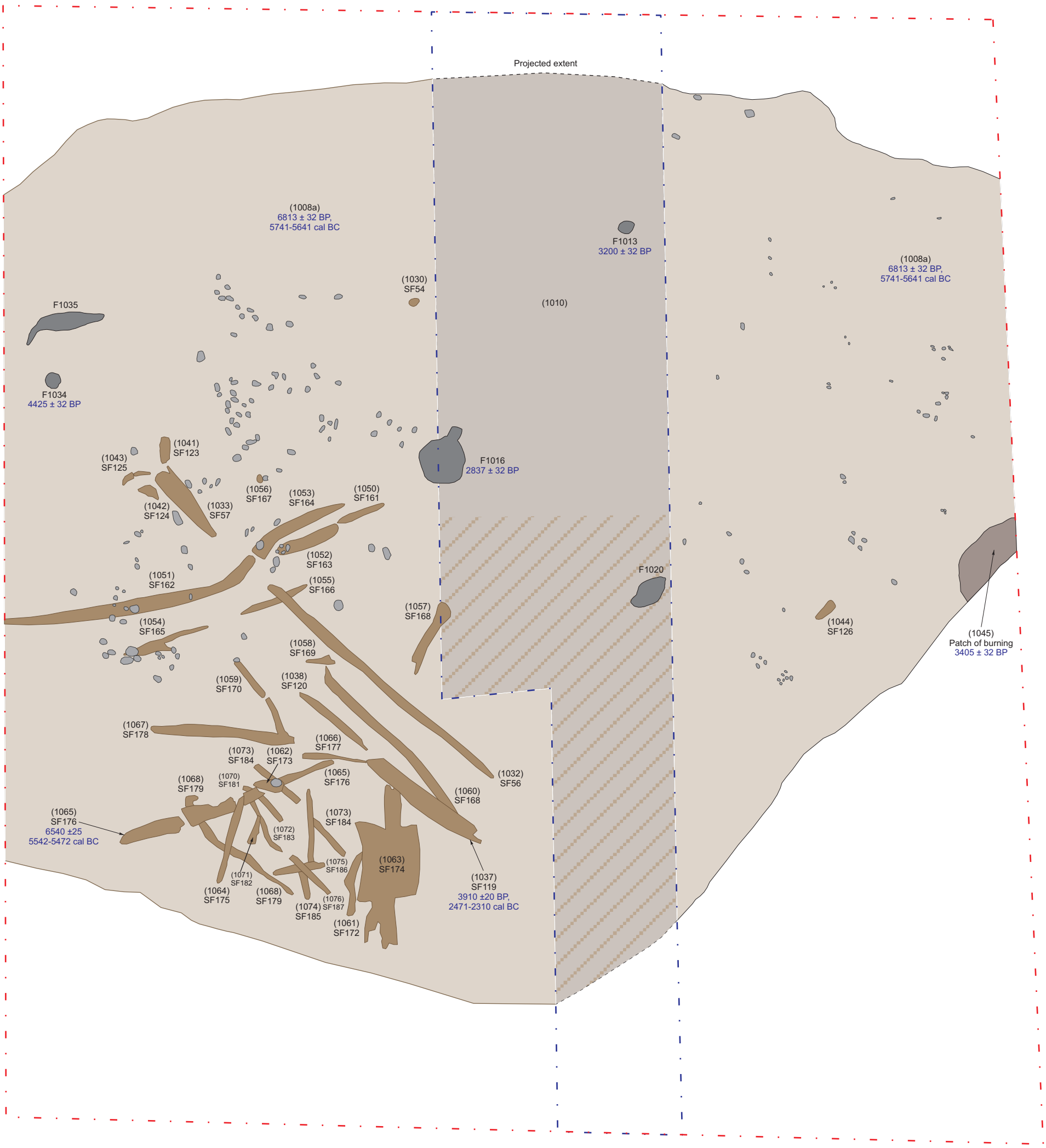
North-east facing section of Trench 1 showing the location of Monolith tin 7 (scale = 1m).



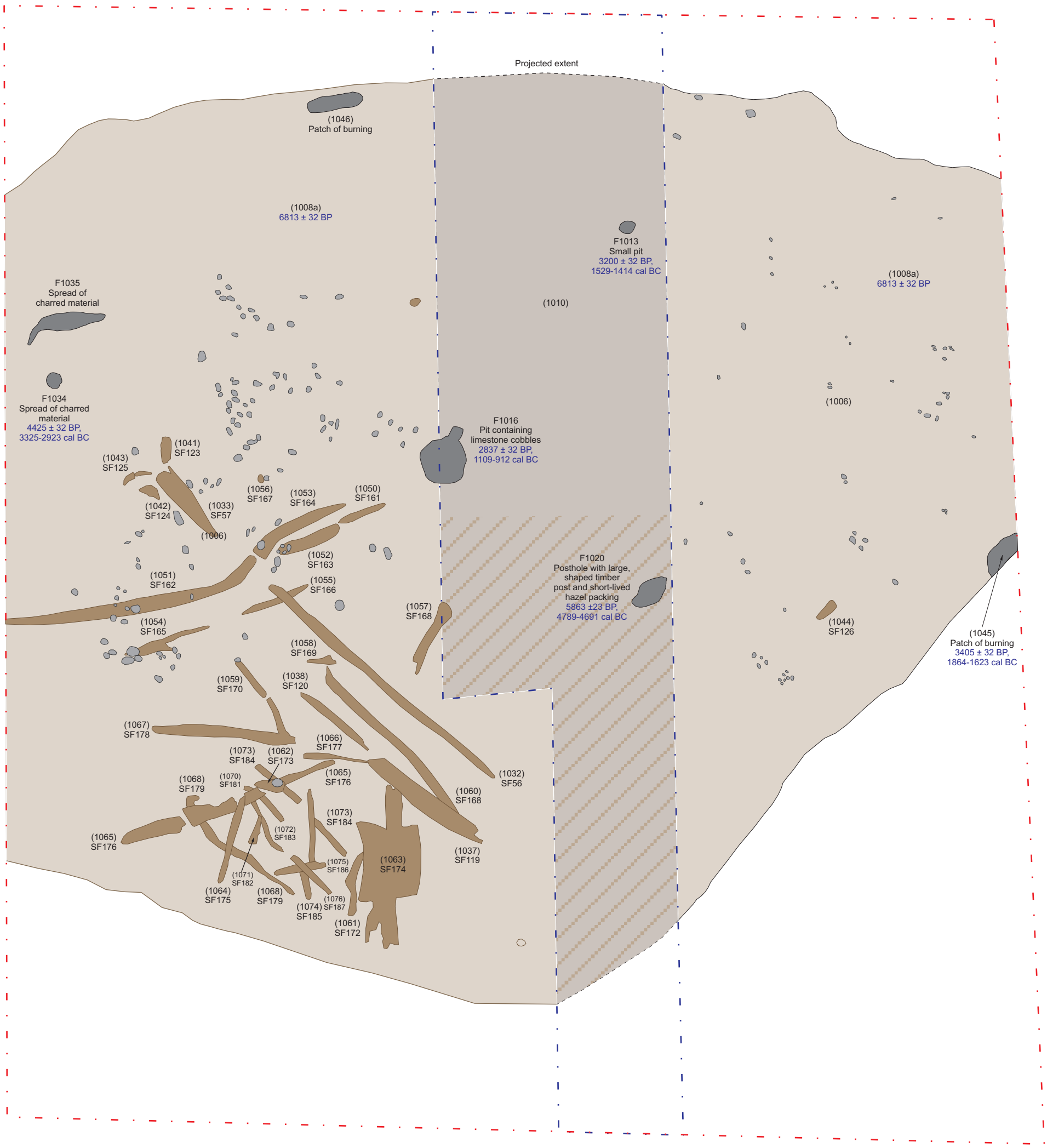
Plan of the excavation area showing the location of the wooden platform in relation to lithic findspots



Detail of the wooden platform at the base of (1006b) and within (1008a), showing context and find numbers



Plan of the excavation area showing features within the top of organic sediment (1006)



Timbers

Stones

Archaeological features

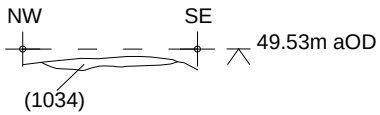
Timber platform machined away during excavation of evaluation trench

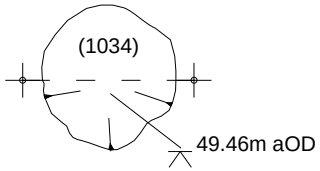
Evaluation trench extent

Wider excavation area extent

0 10m

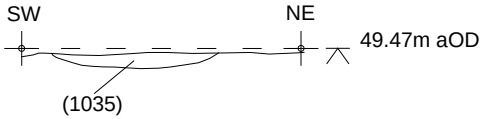
Circular patch of burning (1034)

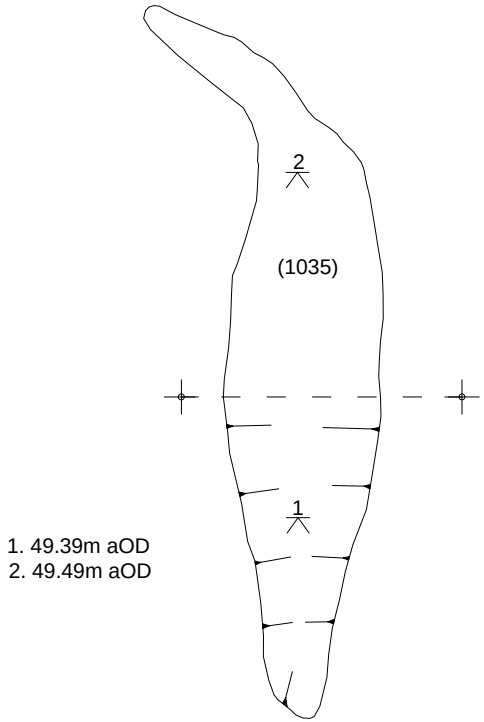




4425 ±32
3325-2923 cal BC

Linear patch of burning (1035)





1. 49.39m aOD
2. 49.49m aOD

Figure 28:

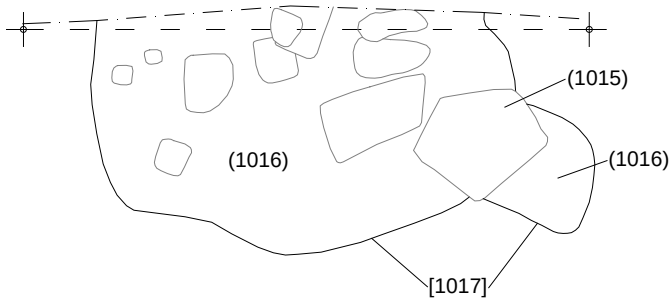
Plans and sections of features F1034 and F1035.

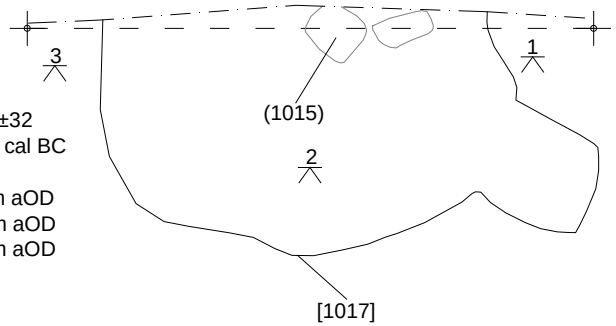
Scale = 1:20 at A4

Key:

N

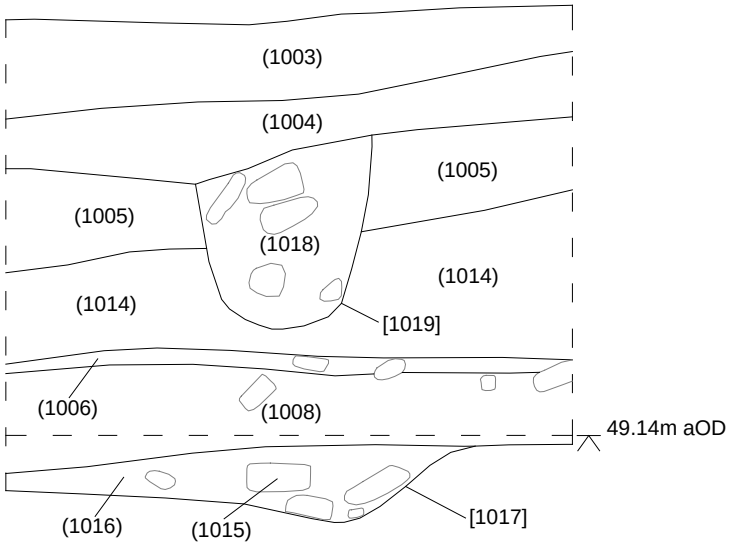
Stone-filled pit F1018



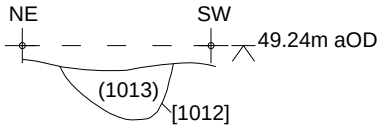


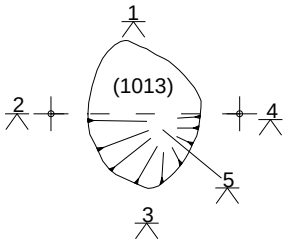
2837 ±32
1109-912 cal BC

1. 49.12m aOD
2. 48.91m aOD
3. 49.05m aOD



Pit F1013

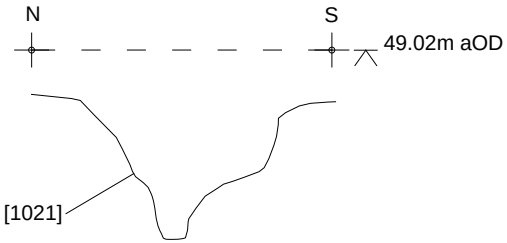


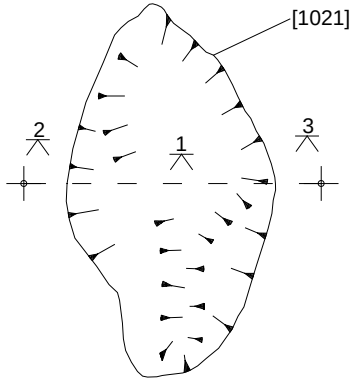


3200 ±32
1529-1414cal BC

1. 49.17m aOD
2. 49.21m aOD
3. 49.19m aOD
4. 49.17m aOD
5. 49.07m aOD

Posthole F1020





5863 ±23
4789-4691 cal BC

1. 48.52m aOD
2. 48.90m aOD
3. 48.88m aOD

Figure 29:

Plans and sections of features F1013, F1016 and F1020.

Scale = 1:20 at A4

Key:

N

5.2 Trench 2

5.2.1 Trench 2 was excavated through the centre of kettle hole KB15 which was located to the north-west of kettle hole KB5. The trench was excavated to a maximum depth of 2.14m where grey clay till (2010) was reached. This deposit continued beyond the limits of the excavation. Above clay (2010) was an organic layer/peat (2009) that had graded into clay (2010) and had a maximum depth of 0.3m. This deposit is believed to have developed during the Windermere Interstadial and can be compared to deposits (1026), (1025) and (1011) within Trench 1.

5.2.2 Above sediment (2009) was clay (2011) which had a maximum depth of 0.15m and is comparable to deposits (1027) and (1010) from Trench 1 and represents the Loch Lomond stadial. A band of sand (2008) was noted within the section of Trench 2 between deposit (2011) and (2007). The sand had a maximum depth of 0.05m and is similar to sand (1009) from Trench 1.

5.2.3 Layer (2007) was an organic-rich peat that had a maximum depth of 0.15m. This deposit (2007) appears to be directly analogous to peat layer (1008) within Trench 1 and likely represents the Holocene fill dating from the Mesolithic through to the Early Bronze Age – as in Trench 1. Sitting above peat (2007) was a thick band of grey clay silt (2006) that had a maximum depth of 0.54m (2006). Above deposit (2006) was a band of yellow/brown silt containing frequent stones. It had a maximum depth of 0.44m and had been overlain within its centre by an in-fill of a grey/brown disturbed deposit. This had presumably been inserted by the farmer in order to level out the hollow that would have been caused by the kettle hole.

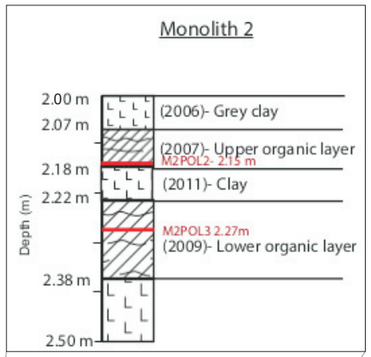
5.2.4 Sealing this layer of disturbed in-fill was a further layer of in-fill (2002) which consisted of black soil containing pottery, glass, timber and other modern waste materials. This has been interpreted as a further attempt to fill the hollow of the kettle hole. The final deposit within the sequence of KB15 was medium brown topsoil (2001) with a depth of 0.48m. A field drain was seen within the section cutting the topsoil (2001) and measuring 1.2m in depth with a maximum width of 1.19m. The field drain also cut deposits (2002, (2003), (2005) and (2006).

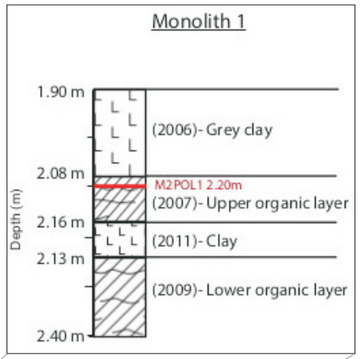
Figure 30. Trench 2 excavated through the centre of kettle hole KB15. Oblique view looking south (scales = 2 x 2m).

Figure 31. Oblique view of north-west facing section of Trench 2 (scale = 2m).

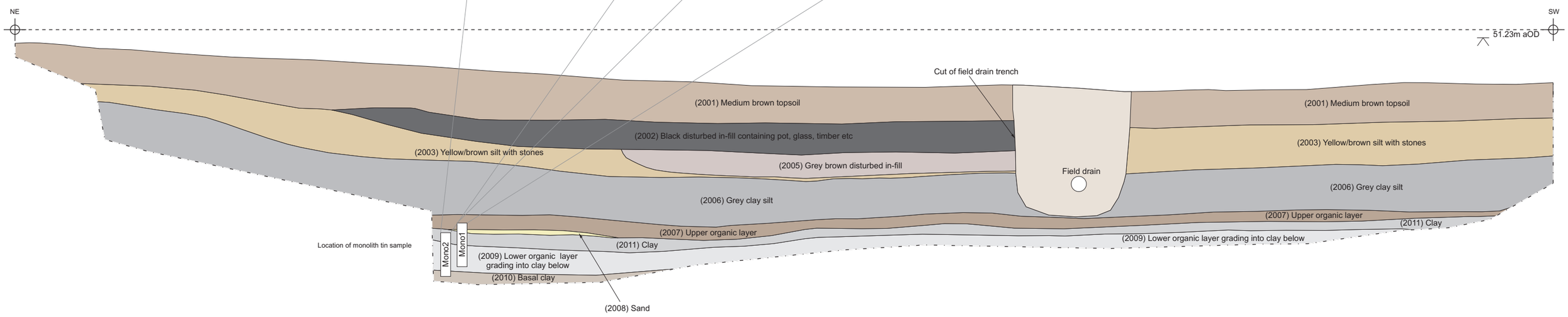
North-west facing section of Trench 2 excavated through the centre of kettle hole KB15

Monolith tin 8 in-situ (scale = 0.25m).






Oblique view of Trench 2 looking south-west showing the deposit sequence within kettlehole KB15 (scale = 2m).



6. RADIOCARBON DATING

6.1 A total of fourteen radiocarbon samples were obtained from archaeological samples from Killerby Quarry. These are summarised in Table 2 below. All radiocarbon dates were measured at the Scottish Universities Environmental Research Centre (SUERC) AMS Facility using the IntCal13 atmospheric calibration curve.

6.2 A sample of waterlogged rowan from the lower boundary of deposit (1022) returned a radiocarbon age of 12704 ±32 (SUERC-79306 (GU47401)). This places the deposit in the Devensian – Windermere transition period after the melting of the glacier that had formed the kettle hole. This date provides a *terminus post quem* for subsequent deposit (1026), below.

6.3 Two samples were obtained from bogbean seeds within organic-rich clayey silt deposit (1026) which places it in the Windermere Interstadial. This deposit contained microcharcoal as evidence of human activity. This date provides a *terminus ante quem* for deposit (1022) and a *terminus post quem* for subsequent deposit (1025), below.

6.4 Waterlogged bogbean from peat deposit (1025) returned a radiocarbon age of 10809 ±32 (SUERC-79300 (GU47398)) which places it in the Windermere Interstadial and provides a *terminus ante quem* for deposit (1026) and a *terminus post quem* for subsequent deposit (1011).

6.5 Material from the upper boundary of organic sediment (1008a) at the kettle hole returned a radiocarbon age of 6813 ±32 (SUERC-79298 (GU47396)) which places the sediment within the Late Mesolithic period when there was a significant presence of microcharcoal. A laid timber platform was found within the base of sediment (1008). A timber from the base of the platform (SF176) returned a radiocarbon age of 6540 ±25 (SUERC-80722 (GU48310)) which places it within the Late Mesolithic period. These dates provide a *terminus ante quem* for deposit (1010) and a *terminus post quem* for subsequent deposit (1006).

6.6 Waterlogged hazel that had been used to pack the large, shaped oak post found within posthole F1020 had a radiocarbon age of 5863 ±23 (SUERC-80723 (GU48311)). This places it within the Late Mesolithic period, although several centuries later than the basal timbers of the platform, and was therefore evidently inserted through the platform as a later addition.

6.7 Organic sediment (1006b) produced a radiocarbon age of 4687 ±32 (SUERC-79297 (GU47395)) which places the sediment within the Neolithic period. A number of Neolithic chipped flint tools were found within the sediment. This date provides a *terminus ante quem* for deposit (1008a) and a *terminus post quem* for subsequent deposit (1006b).

6.8 A piece of oak charcoal from burnt feature F1034 (1034) produced a radiocarbon age of 4425 ±32 (SUERC-79308 (GU47403)) which places the feature within the Neolithic period.

6.9 A piece of waterlogged timber found at the lower boundary of (1006b) (SF119) had a radiocarbon age of 3910 ±20 (SUERC-80721 (GU48309)) which dates it to the end of the Late Neolithic period. While these dates do not overlap, they nevertheless provide important evidence for human activity in and around the kettle hole during the

Neolithic period.

6.10 The upper boundary of organic sediment (1006a) had a radiocarbon age of 3361 ±32 (SUERC-79296 (GU47393)) which places the sediment within the Early Bronze Age period.

6.11 A piece of charcoal from the stony fruits subfamily (e.g. Malus, Crataegus, Sorbus, etc.) from burnt deposit (1045), within deposit (1006a), produced a radiocarbon age of 3405 ±32 BP (SUERC-79307 (GU47402)). This places the feature within the Bronze Age period.

6.12 A piece of waterlogged oak charcoal from the fill of pit F1013 (1013), on the surface of (1006a), produced a radiocarbon age of 3200 ±32 BP (SUERC-79309 (GU47404)) which places the feature within the Bronze Age period.

6.13 A piece of waterlogged oak charcoal from the fill of pit F1016 (1016), also on the surface of (1006a), produced a radiocarbon age of 2837 ±32 BP (SUERC-79310 (GU47405)). This places the feature within the Late Bronze Age and provides a *terminus post quem* for subsequent deposit (1028).

Laboratory no.	Feature and context description	Sample	Radiocarbon Age (BP)	δ13C (0/00)	Calibrated date range (95.4% probability) cal BC	Calibrated date range (68.2% probability) cal BC
Devensian-Windermere transition						
SUERC-79306 (GU47401)	Post Glacial initial fill of kettle hole (lower boundary) (1022)	Waterlogged rowan	12704 ±32	-9.5	13335-13026	13266-13131
Windermere Interstadial						
SUERC-79305 (GU47400)	Organic-rich clayey silt (lower boundary) (1026)	Waterlogged bogbean	11312 ±32	-26.4	11299-11129	11246-11160
SUERC-79304 (GU47399)	Organic-rich clayey silt (upper boundary) (1026)	Waterlogged bogbean	10956 ±32	-26.3	10958-10764	10873-10794
SUERC-79300 (GU47398)	Fibrous, humic peat (upper boundary) (1025)	Waterlogged bogbean	10809 ±32	-25	10799-10734	10783-10747
Late Mesolithic						
SUERC-79298 (GU47396)	Organic sediment (upper boundary) (1008a)	Humic acid	6813 ±32	-28.3	5741-5641	5723-5671
SUERC-80722 (GU48310)	Base of timber platform SF176	Waterlogged oak	6540 ±25	-28.6	5542-5472	5514-5479
SUERC-80723 (GU48311)	Timber packing material for oak post F1020	Short-lived waterlogged hazel branch	5863 ±23	-29.6	4789-4691	4771-4710
Neolithic						
SUERC-79297 (GU47395)	Organic sediment (lower boundary) (1006b)	Humic acid	4687 ±32	-28.6	3627-3370	3518-3376

SUERC-79308 (GU47403)	Charcoal-rich fill of feature F1034 (1034)	Oak charcoal	4425 ±32	-25.7	3325-2923	3263-2942
SUERC-80721 (GU48309)	Timber from uppermost part of platform (1006a) SF119	Waterlogged oak	3910 ±20	-26.5	2471-2310	2466-2349
Bronze Age						
SUERC-79307 (GU47402)	Burnt deposit (1045)	Charcoal: Maloideae	3405 ±32	-26.2	1864-1623	1745-1662
SUERC-79296 (GU47393)	Organic sediment (upper boundary) (1006a)	Humic acid	3361 ±32	-28.6	1744-1535	1690-1618
SUERC-79309 (GU47404)	Fill of circular pit (1013)	Oak charcoal	3200 ±32	-28.8	1529-1414	1499-1441
SUERC-79310 (GU47405)	Fill of pit containing limestone slabs (1016)	Hazel charcoal	2837 ±32	-26.9	1109-912	1031-932

Table 2. Radiocarbon dating results table.

7. LITHIC ASSESSMENT

by Clive Waddington

7.1 Introduction

7.1.1 A total of 118 lithics were retrieved from the fills of kettle hole KB5 . Apart from two chipped lithics from the unstratified topsoil (1001), the lithics were all from stratified layers within the kettle hole of which 23 were retrieved from organic sediment (1006), 84 from organic sediment (1008a), 7 from organic sediment (1008b), one from clay layer (1010) and one from (1016). Although it is possible that one or two of the stratified lithics are either residual or intrusive within the contexts within which they occur, the majority of pieces are considered highly likely to reside in their original context of discard. All finds were located according to the context in which they were found and each find was bagged and given a unique find number. Measurements are given for complete pieces only in accordance with lithic recording conventions (Saville 1980). A full catalogue with details of each individual lithic was produced (see Appendix II: Lithics Catalogue). Table 3 below shows the breakdown of lithic types by context. Although the assemblage of lithic material is small, the assemblage falls into two distinct categories: a Mesolithic component which forms the majority of the assemblage, and a Neolithic assemblage which, although small, is clearly set apart from the Mesolithic material.

7.2 Chronology

7.2.1 Most of the assemblage sits comfortably in a Mesolithic lithic tradition (*c*.11700 - 4000 cal BC), as evidenced by the concern for blade production, many with triangular sections and being small and narrow, the occurrence of irregular retouched microlithic baldelets (ie. microliths made from chert) and a microlith fragment, together with much of this material being patinated, much of it being made from the locally available chert and the presence of other diagnostic pieces such as an abruptly retouched chert end scraper and bladelet platform cores.

7.2.2 The Neolithic material (*c*.4000 – 2400 cal BC) is evidenced by classic diagnostic forms including a fragment from a bifacially chipped leaf-shaped arrowhead, a bifacially retouched knife, various blade tools or fragments thereof, all of which are made on high quality flint imported into the region, a characteristic typical of Neolithic material in northern England (Waddington 2004). The blade tools are of broader form than the Mesolithic blade tools, the latter of which typically have triangular cross-sections whilst this is usually absent from the Neolithic assemblages. None of the Neolithic material is patinated, and all of these pieces are in a remarkably fresh condition.

7.3 Distribution

7.3.1 The single Mesolithic chert core tablet from clay layer (1010) (see Figure 2) is a significant find as it represents the only cultural debris recovered from this layer. The other possibility is that this is intrusive material that has worked its way down from overlying sediment (1008) which is probably the most likely scenario for this artefact's taphonomy.

7.3.2 The majority (ie. 77%) of the chipped lithic material occurs in sediment (1008), the layer which contained the wooden platform, the excpetion being the two clearly Early Neolithic tools which were found on the interface between (1008) and (1006). This peat was clearly longlived and therefore the lithic assemblage present within (1008) could reflect the accumulated debris of past activities in this hollow throughout the Mesolithic, or more probably, the specific phase of Mesolithic activity associated with the timber platform. The mapped distribution of the lithics within this context is of interest as there is a marked cluster running along the northern edge of the timber platform where it intersects with the wetland of the remaining pond (Figure 25). The lack of lithics in the central part of the kettle hole is a direct outcome of this being where the initial evaluation trench was machine-cut and thus all archaeological artefacts were removed during machining of this section. This pattern is clear and implies that the majority of the lithics are associated with the use of the timber platform which has been dated to ? A single chert flake was recovered from the fill (1016) of pit (1017) which has been radiocarbon dated to the Middle – Late Bronze Age.

7.3.3 The other layer to contain more than one chipped stone lithic was the later organic sediment/peat (1006) which contained 20% of the assemblage (see Table 1). The lithics in this sediment generally form a discrete cluster in the central north-east side of the kettle hole suggesting that it is either material washed into this low point or that it formed a foci for processing activities during the Neolithic-Early Bronze Age. The presence of distinctly Mesolithic material in the chipped lithic assemblage from the upper sediment (1006) suggests that this material has moved up into this layer from sediment (1008) due to earthworm, root and other pedogenic processes, or that is has become incorporated into this layer by in-wash of material from immediately around the kettle hole. Given that Mesolithic material was found during the fieldwalking study immediately around the kettle hole the latter option is considered the most likely.

7.4 Raw Material

7.4.1 The lithic raw material is of two types. Artefacts made from flint comprise 62% of the assemblage (73 pieces) and artefacts made from chert comprise 38% of the assemblage (45 pieces). Most of the flint is from unknown provenance, although some

of the pieces indicate a secondary source (e.g. till or fluvioglacial deposits) whilst other pieces indicate a primary, nodular origin (e.g. chalk strata). The nearest sources of till flint can be found in the relatively local superficial till deposits that extend from the Killerby area south and east to the Yorkshire coast south of the North York Moors. The nearest nodular source is the Yorkshire Wolds, although at least one Neolithic piece appears to be made from the high quality 'foorstone' which occurs in East Anglia. Of those for which colours could be ascribed (ie. non-burnt and non-patinated pieces) 15 are brown flint, 7 light grey, 6 medium grey, and 1 white piece. The range of colours is likely to reflect a variety of different sources, although there can be much variation in flint colour, even within a single nodule. Much of the flint was of high purity with very few pieces being speckled. Eight of the flints were patinated white. This suggests that not all of the struck flint was of the same age. None of the diagnostically Neolithic flints had any patination development at all, suggesting this is likely to be a feature of Mesolithic pieces only.

7.4.2 The chert can be found as a naturally occurring rock within the underlying Carboniferous Limestone solid geology which outcrops within the river channel of the nearby Swale where it is a rock bed river. It varies in quality with the light grey material generally being quite rough whilst the medium and dark grey material is finer grained and of higher quality for toolmaking. Within the assemblage 17 pieces are light grey, 12 medium grey and 13 dark grey with another 3 unable to be attributed a colour. Two of the chert pieces are burnt.

7.4.3 Overall there was a high incidence of broken pieces amounting to 64% of the assemblage (ie. 76 pieces of which 56 are flint and 20 are chert). This indicates that most lithics are likely to have been intentionally discarded due to them being broken. This is indicative of processing activities taking place on the site with chipped lithics being broken through a combination of use and curation. The relative paucity of complete pieces indicates that lithic material was valued and that casual loss was avoided, indicating a parsimonious attitude to discard. This implies that good raw material was at a premium and therefore tools were generally kept until such time as they broke and were of no further use.

7.5 Flaking and Manufacture

7.5.1 The assemblage displays evidence for the use of both hard and soft hammer working, with most of the edge-trimming and retouch being unifacial on the material with Mesolithic affinities and with abrupt retouch, whilst some of the Neolithic material displays fine bifacial working, as can be seen for example on the knife and leaf-shaped arrowhead. The manufacturing traditions for both Mesolithic and Neolithic assemblages rely on a blade-based technology that includes slender blades where possible, but also thicker stubby blades when the raw material dictates, as is frequently the case within this assemblage. The smaller and more typically Mesolithic blades have a triangular section and the production and use of microblades is featured within the assemblage. There are, however, several examples of broader and thinner blades that do not have a triangular section and these are likely to be of Neolithic date on the basis of both their diagnostic form and freshness.

7.5.2 A total of 31% of the lithic assemblage was heavily burnt implying that fires were a regular feature of the activities that took place on this sediment and these must

have reached considerable temperatures. The purpose of any such fires is not clear, but the fact that lithics were frequently incorporated into them, either thrown in as discarded material or else laying on the surface where it was decided to lay a fire suggests people were occupying what was then a hollow as the upper peat (1006) started to dry out.

7.6 Types

7.6.1 A range of tool types is present within the lithic assemblage and these are summarised in Table 1 below.

7.6.2 The presence of processing tools, such as the various retouched and utilised pieces and the scrapers, indicate a wide range of processing activities. The number of formal retouched tools in the assemblage amounts to 11 pieces (9% of the assemblage), whilst the quantity of cores and debitage amounts to 107 pieces (91% of the assemblage). This shows that the production and maintenance of tools was common on the site along with a limited range of processing activities. If the Neolithic arrowhead and knife are excluded from consideration then the range of formal tools is very limited which could suggest that the Mesolithic activity at the site was centred around only one or a few specialist tasks. This limited range of tools and evidence for chipping and tool maintenance is consistent with a specialist task site rather than a settlement site, where the latter is more typically characterised by a wide range of processing tools and usually low levels of primary working (Schofield 1991, 1994). The presence of the scrapers might imply that hide working was an important activity.

7.6.3 The few obviously Neolithic tools are quite diverse and suggest that different sorts of activity might have taken place on and around the kettle hole during this time than during the Mesolithic. The broken leaf-shaped arrowhead is suggestive of hunting activities, whilst the knife and other retouched blade tools could be suggestive of butchery. Perhaps this hollow was used to catch animals watering during perennial ponding and then they were butchered on the spot prior to taking back to a settlement, or perhaps cooked and consumed where they were caught as an opportunistic meal.

Type	Unstrat. (1001)	Sediment (1006)	Sediment (1008a)	Sediment (1008b)	Clay layer (1010)	Pit (1016)	Total
Bashed lump				1			1
Chip	1	3	7				11
Flake		13	51	4		1	69
Blade		2	17	1			20
Core		2	1	1	1		5
Utilised blade			1				1
Retouched blade		1	2				3
Edge-trimmed blade			1				1
Edge-trimmed flake			1				1
Scraper		1	1				2
Microlith	1	1					2
Arrowhead			1				1
Knife			1				1
Total	2	23	84	7	1	1	118

Table 3. Summary of lithic types by context.

7.7 Discussion

7.7.1 The kettle hole would have been visible as a small steep-sided depression during the Mesolithic and Neolithic periods with a pond and marshy edge. During the summer the uppermost parts of the peat might have dried somewhat to provide a more stable surface that could be used for other activities. The timber platform implies the use of this soft marshy area when it was wet and watery, possibly during the winter and early spring, when there would have been a need to lay down timbers to produce a stable surface for activities to take place on, and avoid sinking into the soft peat.

7.7.2 The kettle hole hollow (KB5) evidently formed a focus for Mesolithic activity, as evidenced by the Mesolithic material recovered by the excavation, and particularly when peat (1008) was present. The spatial focus of the lithic material is located around the margin of the timber platform suggesting that this is where most of the tool production, maintenance and their use took place; that is on the edge of the open pond which the palaeoenvironmental analysis shows to have been >1m in depth (Parker *et al*. 2018). The restricted range of tool types in the Mesolithic assemblage suggests this was a locale where a specialised activity/ies took place. The nature of the specialised activity is not clear from the lithic assemblage alone. The presence of scraper/softening tools together with a range of edge-retouched flakes and blade tools could suggest a concern for hide-working. Their location on the edge of a platform next to a small wetland or shallow open water suggests the activity involved water or the need for water as part of the process. Burning also took place as evidenced in the Early Bronze Age layer and struck flint and chert pieces were occasionally incorporated or tossed into these open fires.

7.7.3 The Neolithic phase of activity documented within peat layer (1006) and its interface with (1008) below, is represented by just a few flint tools of various kinds including a broken flint arrowhead and a heavily burnt flint knife. The range of Neolithic material is consistent with the opportunistic catching of prey within the hollow, perhaps while any such animals/birds/fowl were watering, and then butchering and maybe even cooking them on the spot, perhaps as an opportunistic meal.

Figure 33. Mesolithic chipped chert pieces from sediment (1008). Left to right: end scraper (find no. 14), platform core (find no. 146) and edge-trimmed broad blade (find no. 112), (scale = cm graduations).

Figure 34. Mesolithic material from sediment (1006) unless otherwise stated. Left to right top row first: chert platform core (find no. 92), micro platform core (find no. 53), edge-retouched blade core (find no. 303 – could also be Neolithic), chert irregular microlith (find no. 4), microlith basal fragment (find no. 51), chert irregular microlith (find no. 304 and from context 1001), chert micro core tablet (find no. 306 – from sediment 1010), (scale = cm graduations).

Figure 35. Chert flake tool from sediment (1006). Abrupt retouch at its broad end indicates this was a softening or scraping tool, akin to bevelled pebble tools found in Mesolithic coastal locales such as Howick, East Barns and Low Hauxley (scale = cm graduations).

Figure 36. Neolithic flint tools recovered from the interface between peats (1008) and (1006). Left to right: broken edge-trimmed broad blade (find no. 132), bifacially retouched knife – heavily burnt (find no. 78), tip end of a bifacial leaf-shaped arrowhead (find no. 148), broad blade tool made on high quality 'floorstone' flint with broken proximal end (find no. 74), and broken utilised blade (117), (scale = cm graduations).

Figure 37. Neolithic flint blade with notched and retouched end and edge-trimmed along its long sides from the interface between peats (1008) and (1006), (find no. 72), (scale = cm graduations).

8. OSTEOLOGICAL ANALYSIS

by Milena Grzybowska

8.1 Material

8.1.1 The material consisted of *c.*72g of hand-collected animal bone derived from Mesolithic layer (1008a) with the material all coming from the peat within the timber platform.

8.2 Methods

8.2.1 The analysis follows *Guidelines for best practice* by English Heritage (Baker and Worley 2013). The bones were identified by species or a broader taxonomic group. All specimens were recorded. The state of surface preservation was scored using a five stage system (poor, bad, moderate, good, and excellent). The presence or absence of butchery marks, root etching, gnawing, burning was noted. Number of Fragments (NF) count treated all bone fragments separately.

8.3 Results

8.3.1 A total assemblage of 24 fragments (NF) of animal bone was analysed. It consisted of permanent and deciduous teeth of *Bos* species, or wild cattle, and one unidentifiable bone fragment of a mammal (Table 4). The total assemblage represents at least one, possibly sub-adult, individual. The preservation and character of the finds precluded collection of metric data that could assist in distinguishing aurochs from domestic cattle.

Context	Find numb.	Weight	Element	Side	Taxon	Age	Sex	NF	Refitted fr.	Colour	Surface pr.	Butchery	Burning	Gnawing	Roots
1008a	144	21.8	uM2	R	*bos* sp	in wear, accessory column not in wear, possibly not erupted yet	-	6	1	dark brown	g	n	n	n	n

1008a	144	8.8	uM1	R	*bos* sp.	accessory column not in wear	-	3	1	dark brown	g	n	n	n	n
1008a	144	16.7	M	-	*bos* sp.	-	-	-	7	dark brown	g	n	n	n	n
1008a	115	10.3	M	R	*bos* sp.	in wear	-	3	1	dark brown	g	n	n	n	n
1008a	114	7.3	M	-	*bos* sp.	accessory column not in wear	-	1	1	dark brown	g	n	n	n	n
1008a	127	3.4	M	-	*bos* sp.	-	-	4	4	dark brown	g	n	n	n	n
1008	109	2.6	M	-	*bos* sp.	-	-	6	1	dark brown	g	n	n	n	n
1008	60	1.1	unk	-	-	-	-	1	1	grey	g	unk	cal?	n	n

Table 4. Inventory of animal remains.
U-maxillary; cal- calcined

9. PALAEOENVIRONMENTAL SUMMARY

by Luke Parker

9.1 (1022) Dark Grey Gravel

9.1.1 The dark grey gravel (1022) was the lowermost sedimentary layer, which immediately overlay the basal glacial till (1080). It was composed of angular gravel clasts contained within a sandy silt matrix, alongside a moderate organic component. This organic content was primarily in the form of occasional ligneous organic matter, alongside infrequent palaeobotanical macrofossils, which were identified as being rowan (*Sorbus aucuparia*) seeds. The angular gravel clasts were identified as being a form of very weakly cemented sandstone. This sedimentary unit represents the initial instance of post-glacial sediment formation.

9.2 (1026) Organic-rich clayey silt

9.2.1 The organic-rich clayey silt (1026) overlay the dark grey gravel (1022) and was the lowermost of a series of three organic-rich sedimentary layers (1022), (1025), and (1011). This sedimentary unit was composed primarily of silt, but with a clay component. There was no observable clastic content. There was a distinctive organic content within this sedimentary unit, within decomposed organic matter as well as recoverable palaeobotanical macrofossils present; primarily in the form of bogbean (*Menyanthes trifoliata*). This sediment has been shown by Parker *et al.* (2018) to be from the earlier stage of the Windermere Interstadial, with the increased organic content being a reflection of the ameliorating conditions following the termination of the Devensian stadial.

9.3 (1025) Fibrous humic peat

9.3.1 The second of the three lower organic-rich sedimentary layers (1022), (1025) and (1011) was composed of discrete layers of compressed organic formation. These layers were formed of well-preserved 'grassy' material interspersed with very frequent bogbean seeds. There was no observable inorganic component of this sedimentary unit and no observable clastic content. This unit represents a continuation the Windermere interstadial, conducive to the formation of organic material (Parker *et al*. 2018).

9.4 (1011) Organic-rich clay

9.4.1 The uppermost of the series of three organic units (1022), (1025) and (1011) contained an increased inorganic component, particularly relative to the fibrous humic peat (1025). This unit, though still containing humified organic matter, as well as palaeobotanical macrofossils, was also composed of a clay component. There was still a lack of clastic content within this sedimentary unit. This unit represents the final instance of sedimentary formation during the Windermere interstadial (Parker *et al.* 2018)

9.5 (1027) Homogenous clay

9.5.1 The sharp lower boundary of (1027) represents the rapid termination of the Windermere interstadial and the onset of the Younger Dryas period (Parker *et al.* 2018). This sedimentary unit was a massive, thick, clay unit entirely without clastic content and entirely inorganic. The highly inorganic nature of the unit reflects the unstable climate of the Younger Dryas which would inhibit organic growth within the kettle hole. The palynological data recovered from this unit was suggestive of the earlier, harsher, part of the Younger Dryas.

9.6 (1010) Silty clay

9.6.1 The homogenous clay (1027) gradually began to contain an increasing silty content, whereupon it was separated into a separate, silty clay unit. Palynological data recovered from this unit again suggests that this inorganic unit represents the unstable climate of the Younger Dryas, though during the later period (Parker *et al.* 2018).

9.7 (1008) Organic sediment containing wooden platform

9.7.1 Overlying the silty clay (1010) was a highly organic sediment, from which numerous archaeological artefacts were recovered, as well as large quantities of waterlogged wood which are described here as a platform. The organic sediment itself was composed of a loam, which contained moderate quantities of sub-rounded clasts of a variety of geologies, though primarily limestone. This sediment was separated into two sub-units (1008a) and (1008b), based on a slight increase in the silt component of the loam towards the upper fraction of the unit. This unit was interpreted as representing the transition from the Younger Dryas into the Holocene, whereby the stabilising climate permits a recommencement of organic material accumulation (Parker *et al.* 2018). It is likely that this sedimentary unit represents the Mesolithic occupation by humans of this landscape.

9.8 (1006) Organic sediment

9.8.1 The organic sediment (1006) represented a continuation in the increasing silt content which was observable through organic sediment (1008). This unit, though still containing a significant organic component, distinctly contained a larger inorganic, silt component than the lower organic sediment (1008), making it more of a silty clay than a loam. Again, moderate quantities of sub-rounded clasts of varied lithologies (though primarily limestone) were present. This increase in silt was interpreted as being the result of increased sediment run-off from the surrounding destabilised landscape caused by forest clearance through anthropogenic activity (Parker *et al.* 2018) during the Neolithic. This unit was separated into two sub-units (1006a) and (1006b) in order

to differentiate between Neolithic and Bronze Age archaeology.

9.9 (1028) and (1029) Sediment influx deposits

9.9.1 Overlying the organic sediment (1006) at the Southwestern margin of the kettle hole were two poorly sorted clayey silt units, which contained frequent visible fragments of charcoal. These units contained frequent, rounded gravels of varied lithologies. This unit was interpreted as being the result of a destabilised landscape created as a result of anthropogenic activity, which created increased surface sediment runoff into the kettle hole. The charcoal contained within these units is interpreted as being in-washed material from the immediate surroundings. The lower of the two influx units, (1028), contained the first conclusive evidence within the pollen profile of KB5 for cultivation occurring within the vicinity of the kettle hole (Parker *et al.* 2018).

10. DISCUSSION

10.1 Excavation of kettle hole KB5 at Killerby revealed a complex deposit sequence spanning the end of the last major Ice Age (the Devensian) to the modern period. While the geoarchaeological sequence and palaeoenvironmental analysis of the deposits has provided vital insights into past landscape development, land use and climate, the kettle hole revealed a fascinating and rare example of how such features were being utilised and manipulated by humans. The presence of well-preserved *in situ* archaeological remains dating from the Mesolithic, Neolithic and Bronze Age, including organic remains such as wood and bone, have provided a rare insight into these periods and produced information for filling in certain gaps in the Mesolithic record in particular. As these remains are situated within naturally accumulating organic sediments the archaeological remains can be linked directly to the palaeoenvironmental data which will allow for a rich understanding of human use of the landscape to be built as data from the quarry accumulates.

10.2 The earliest indication of human influence was seen during the Windermere Interstadial within organic-rich clayey silt (1026) which has been radiocarbon dated to 10958-10764 cal BC (95.4% probability) or probably 10873-10794 cal BC (68.2% probability) (SUERC-79304 (GU79304)). Abundant microcharcoal within this deposit is likely to indicate human activity in the vicinity of the kettle hole. This is some of the earliest evidence for Post Glacial human occupation so far discovered in Britain and corresponds to the occasional rare discovery of Ahrensburgian flints at a handful of sites in the Country. This important palaeoenvironmental proxy for human activity places particular importance on the careful examination of chipped lithic finds from Killerby to see whether corresponding evidence for human activity at this time can be found in the flint record.

10.3 The remarkable and rare evidence for a Late Mesolithic through to Late Neolithic timber platform built so that it extended out into a pond of >1m depth with associated flints and cattle teeth, together with a huge abundance of microcharcoal present in the pollen diagram is a stunning and unusual discovery. Sites of this age, type and degree of preservation are exceptionally rare. The provisional interpretation of this feature is that it may have been a small pond used for processing and curing wild cattle skins. The tanning of leather requires submergence of skins in a bath of liquid, typically

urine-laden water, where they are left for several days to cure. The presence of cattle teeth indicates cattle carcasses were brought to the site, whilst the limited range of chipped lithics indicates specialised taskworking and the presence of scrapers and the coarse stone tool, likely to be a skin softener, are suggestive of skinworking and particularly at the edge of the platform and the pond. Given its landscape position on the top of a ridge where the ever-present wind would blow the pungent smell of such a place away, this evidence, although not definitive, is consistent with such a purpose. The high levels of microcharcoal are consistent with settlement activity nearby, as is the spread of Mesolithic flints, including microliths, from around the kettle hole margin and elswewhere in this and nearby fields. A large oak post that had been packed with smaller pieces of hazel was found at the edge of the platform and although the dates for the post and the platform do not overlap, this may indicate that the platform was a long-lived feature that was improved and maintained, or alternatively experienced periods of abandonment prior to human groups coming back and re-using the pond and platform. The large oak post represents one of these later phases of use. A third and final phase of its use has been identified at the end of the Neolithic period.

10.4 The sediments also indicate when the land around the kettle hole started to be disturbed, probably for agricultural purposes and land use intensification, during the 4th millennium cal BC during the Early Neolithic period. Flints and dated features belonging to this period were found at the interface between layers (1008) and (1006) and in the lowest parts of (1006). Episodes of inwash at the kettle hole margins stratified between (1008) and (1006) have also been dated to the 4th millennium cal BC and provide a proxy for when tree/shrub clearance and the breaking up of the ground was taking place around the kettle hole margin also at this time. The slightly higher clay fraction noted within (1006) is further evidence that this chronostratigraphic unit marks the beginning of the Neolithic period due to the mobilisation and inwash across the whole kettle hole of fine-grained sediment.

10.5 Late Neolithic to Bronze Age activity is well-documented in layer (1006) where burning patches and timbers originated, and pits and the limestone cobble pit were dug. Burning, perhaps small summer camp fires, in the hollow formed by the kettle hole as the pond dried out and the upper peat was exposed would have provided a sheltered place to have a campfire or even for overnight stays. During these visits flints were chipped and tools maintained, although during the process much the flint got burnt.

10.6 While the various archaeological features represent a purposeful and direct use of the kettle hole, evidence from the pollen assemblage documents human activity influencing the wider landscape (see Parker *et al*. 2018). As further work continues at Killerby the rare insights provided by the archaeological work so far will be able to be expanded upon allowing for a detailed insight into the earliest settlement of the region. This will have relevance at both the regional, national and international level given that Britain still formed part of Continental Europe during the Windermere interstadial and much of the Mesolithic period.

11. PUBLICITY, CONFIDENTIALITY AND COPYRIGHT

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13. ACKNOWLEDGEMENTS

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APPENDIX I: CONTEXT SUMMARY TABLE

Context number	Description	Feature number
001	Topsoil and turf across the site	
002	Brash	
003	Andesite bedrock	
004	Cut of palisade slot TR1	1a
005	Fill of palisade slot [004] TR1	1a
006	Upper fill of palisade slot TR3	1a
007	Stone packing within palisade slot TR3	1a
008	Secondary fill of palisade slot [009] TR3	1a
009	Cut of palisade slot TR3	1a
010	Primary fill of palisade slot TR3	1a
011	Stone packing of palisade slot TR1	1a
012	Fill of ring gully within [013] TR2	1d
013	Cut of ring gully filled with (012) TR2	1d
014	Fill of pit [015] TR2	1r
015	Cut of pit filled with (014) TR2	1r
016	Orange silt subsoil across site	
017	Cut of ring gully filled with (018) TR3	1e
018	Fill of ring gully [017] TR3	1e
019	Cut of rock cut pit TR3	1t
020	Primary fill of rock-cut pit [019] TR3	1t
021	Upper fill of rock-cut pit [019] TR3	1t
022	VOID	
023	VOID	
024	Stone packing within ring gully [017] TR3	1e
025	Flagstones in top of pit [037] TR2	1s
026	Material beneath and between (025) TR2	1s
027	Stone tumble amongst mid brown silty loam, overlies palisade slot TR4	1a
028	Pale brown subsoil TR4	
029	Fill of palisade slot [058] TR4	1a
030	Fill of ring gully [031] TR2	1p
031	Cut of ring gully filled with (030) TR2	1p
032	Stones of ring bank TR5	14
033	Stones of cairn TR6	3
034	Soil sealed by stones of cairn (033) TR6	3
035	Cut of scooped platform house N-S TR2	1c
036	Cut of scooped platform house E-W TR2	1h
037	Cut of pit with flagstones (025) in top TR2	1s
038	VOID	
039	Stones of linear bank TR7	6
040	Wall tumble TR7	6
041	Stones of mound in centre of ring cairn TR5	14
042	Buried land surface beneath wall tumble (040) TR7	
043	Cut of ditch running parallel with linear bank/wall (039) TR7	6
044	Stones of cairn TR7	7
045	Cut for pit containing broken pottery vessel TR5	29
046	VOID	
047	Fill within pit containing broken pottery vessel [045] TR5	29
048	Cut for cremation cist TR5	29
049	Dark organic upper fill of cremation cist TR5	29
050	Light yellow/brown primary fill of cremation cist TR5	29

051	Cremated bone within cist	29
052	Sediment beneath ring cairn TR5	14
053	Cut of pit TR1	1q
054	Fill of pit [054]	1q
055	VOID	
056	VOID	
057	VOID	
058	Cut of palisade slot TR4	1a
059	Corbelled stones of cremation cist TR5	29

APPENDIX II: LITHICS CATALOGUE

SF No.	Context	Material	Colour	Provenance	Type: General	Specific	Core RS	Period	L (mm)	W	T	Notes
1	1006	flint			flake	debitage	sec					broken and patinated white
2	1008	chert	medium grey		flake	debitage	sec		40	46	12	
3	1006	flint			flake	debitage	sec					broken and patinated white
3	1008	flint			blade		sec	mes/neo				broken and burnt
4	1006	chert	dark grey		microlith	narrow blade	ter	mes	23.5	9	4.5	
5	1008	flint			flake	debitage	sec					broken and patinated white
6	1008	flint	brown		flake		sec		29	19	4	
7	1008	chert	dark grey		chip	debitage	prim					broken
9	1008	flint			flake	debitage	sec					broken and burnt
10	1008	flint			flake							broken and burnt
11	1008	flint	medium grey		blade			mes?				possible small end scraper - tip broken
12	1008	flint	white		chip	debitage	sec		7.5	5	4	
14	1008	chert	light grey		scraper		ter	mes	36	25	18	
15	1008	flint	brown		blade		sec	mes/neo				broken
16	1008	flint			flake	debitage	sec					broken and burnt
17	1008	chert	medium grey		flake	debitage	sec		29	24	6	
18	1008	flint			flake	debitage	sec					broken and burnt
18	1008	flint	brown		flake	debitage	sec		22	33	8	
20	1008	flint			flake	debitage						broken and burnt
21	1008	flint			flake	debitage	prim					broken and burnt
22	1008	chert	medium grey		blade	debitage	sec		26	9	3	
23	1006	flint			chip	debitage	sec					broken and burnt
25	1008	flint	light grey		chip	debitage	sec					broken
28	1008	flint			flake	debitage	sec					broken and burnt

29	1008	flint	light grey		flake	debitage	sec		10	15	1.5	patinated white
31	1008	flint			flake	debitage						broken and burnt
32	1006	flint			chip	debitage	sec		8	4.5	2	burnt
33	1008	flint			flake	debitage	sec					broken and burnt
34	1008	flint			flake							broken and burnt
35	1008	flint			blade	segement						broken and burnt
36	1008	chert	medium grey		flake	debitage	sec					broken
37	1008	chert	dark grey		chip	debitage						broken
38	1008	chert	light grey		flake	debitage						broken
41	1008	flint			flake	debitage						broken and burnt
42	1008	chert	dark grey		flake	debitage	sec		20	19.5	8	
43	1008	chert	light grey		flake	debitage						broken
44	1008	chert	light grey		blade		sec					broken
45	1008	chert			blade	debitage	sec		19	7	2	
46	1008	chert	dark grey		flake	debitage	sec		29	25	5	
48	1008	flint	light grey		chip	debitage	sec		6	10	3.5	
49	1008	chert	light grey		flake	debitage						broken
51	1006	flint			blade			mes?				possible base of narrow blade microlith, later broken
52	1006	flint	light grey		blade	segement						broken
53	1006	chert	medium grey		core		sec	mes?				tiny core, broken
58	1008	flint	medium grey		blade		sec	mes/neo				broken
59	1008	flint			flake	debitage	sec					broken and burnt
61	1008	flint	medium grey		flake	debitage	sec					broken and patinated white
63	1006	chert	light grey		flake	debitage	prim		25	17	9	
65	1008	flint			flake	debitage						broken and burnt
66	1008	flint			flake	debitage	sec					broken and burnt
67	1006	chert	light grey		flake	debitage	prim					broken
68	1006	flint	light grey	glacial	flake	debitage	sec		21	19	6.5	
69	1006	chert	dark grey		flake	debitage						broken

70	1006	chert	light grey		chip	debitage	sec					broken
71	1008	flint	brown		flake	debitage	sec		24	18	3	
72	1008	flint	brown		retouched blade		ter	mes/neo	30.5	14	4.5	
73	1008	chert	medium grey		flake	debitage	sec					broken
74	1008	flint	brown		blade		sec	neo?				broken
76	1008	chert	light grey		chip	debitage	sec		10.5	5	2	
77	1006	chert	light grey		flake	debitage			14	11	10	
78	1008	flint			knife		ter	neo	66	37	7	bifacially worked, burnt
79	1008	flint			flake	debitage						broken and burnt
85	1008	chert			flake	debitage						broken and burnt
86	1008	flint			blade	bladelet	sec					broken and burnt
89	1008	flint			blade		sec					broken and burnt
89	1008	flint	brown		flake	debitage	sec					broken
90	1006	chert	dark grey		flake	debitage	prim		22	20.5	4	
91	1006	chert	medium grey		flake	debitage	prim					broken
92	1006	chert	medium grey		core	platform	sec	mes?	15	24.5		
94	1008	flint			flake	debitage	prim					broken and burnt
96	1008	flint	brown		flake	debitage	sec		24	19	5	
97	1008	flint			flake							broken and burnt
98	1008	flint			flake	debitage	sec					broken and burnt
99	1008	flint			chip	debitage	sec		14.5	6.5	2	patinated white
100	1008	flint			flake	debitage	sec					broken and patinated white
101	1008	flint			blade		sec					broken and burnt
102	1008	flint			flake	debitage	sec					broken and burnt
104	1008	chert	light grey		blade	debitage	sec					broken
105	1008	flint	light grey		flake	debitage	sec					broken
108	1006	flint	brown		flake	debitage	sec					broken
110	1008	flint			core		sec					broken and burnt
111	1008	flint			blade	debitage	prim		34	11	6	burnt
112	1008	chert	medium grey		edge-trimmed flake		ter	mes	47	34	18	
113	1008	flint	medium grey		flake	debitage	sec		18.5	14	3	

116	1008	flint	brown		retouched blade		ter	mes/neo			but end of broken retouched blade tool
117	1008	flint	brown		utilised blade		ter	mes/neo			broken
128	1008	flint			flake	debitage	sec				broken and burnt
129	1008	flint			blade						broken and burnt
130	1008	flint			blade		sec				broken and burnt
131	1008	flint			flake	debitage	sec				broken and burnt
132	1008	flint	light grey		edge-trimmed blade		ter	mes/neo			broken
133	1008	chert	light grey		flake	debitage	sec				broken
134	1008	chert	light grey		flake	debitage	sec				broken
137	1008	chert	dark grey		flake	debitage	prim		28	26	7.5	
138	1008	chert	medium grey		flake	debitage					broken
139	1008	flint			flake	debitage					broken and patinated white
140	1008	chert	dark grey		flake	debitage	prim		49	41	14	
141	1008	flint			flake	debitage	prim				broken
142	1008	chert	dark grey		blade	debitage	sec		18.5	8	3.5	
143	1008	flint	brown		flake	debitage	prim		21	21	8	
146	1008b	chert	medium grey		core	platform	sec	mes	24	29		
147	1008b	flint	medium grey		flake	debitage	sec		12	10	3	
148	1008	flint	brown		arrowhead	leaf	ter	neo			bifacial working, broken, early neolithic
151	1008	chert	medium grey		flake	debitage	prim		55	49	7	
153	1008b	flint	medium grey		blade		sec	mes?			broken
154	1008b	chert	dark grey		bashed lump		prim		47	53		
155	1006	flint	brown		flake	debitage	sec		25.5	18	3	
156	1008b	flint			flake	debitage					broken and burnt
159	1008b	chert	light grey		flake	debitage	prim		9.5	12	4	
160	1008b	flint			flake	debitage	sec				broken and burnt
301	1006	chert	light grey		flake	debitage	prim				broken
302	1	flint			chip	debitage	sec				broken
303	1006	flint	brown		retouched blade		ter	mes/neo			broken

304	1	chert	dark grey		microlith	retouched bladelet	ter	mes	18	9	6.5	
306	1010	chert	dark grey		core	tablet	sec		9.5	9	3.5	core tablet rejuvenation flake
307	1016	chert	light grey		flake	debitage	sec		11	9	4.5	
308	1006	chert			flake	debitage						broken and burnt
309	1006	chert	light grey		scraper		ter		144	69	26	Large chert blade with what appears to be use at one end indicative of a scraper, possible utilisation down one edge where may have also beeen used as a knife

APPENDIX III: HARRIS MATRIX

Matrix for kettle hole KB5.
Radiocarbon dates are expressed uncalibrated, followed by calibrated at 95.4% probability.
Contexts containing evidence for, or resulting from, human activity are highlighted in pale blue.

			Landscape and vegetation	Climatic conditions
Modern	(1001)	Modern topsoil. Introduced material to make the area of the kettle hole agriculturally productive.	Modern	
	(1002)	Modern subsoil. Introduced material to make the area of the kettle hole agriculturally productive.		
	(1078)	Field boundary		
	[1079]			
Victorian	(1003)	Sandy silt	Modern	
	(1004)	Sandy silt		
	(1018)	Land drain		
	[1019]			
Iron Age onwards	(1005)	Clayey silt, graded layer of (1014). Stone and soil introduced to the sediment by human action with low organic content. Deliberately terrrestrialised.	Abundant arable cultivation present. Landscape relatively open and heavily influenced by human activity.	
	(1014)	Silty clay. Stone and soil introduced to the sediment by human action with low organic content. Deliberately terrrestrialised.		
	(1029)	Organic-rich silty clay at edge of kettle hole		
	(1028)	Clay at edge of kettle hole		
Bronze Age	(1006a)	Bronze Age organic sediment	Arable cultivation present within the latter half of the Bronze Age. Landscape relatively open and heavily influenced by human activity.	Climate relatively unstable, with shifts from relative warmth towards cooler, wetter periods, particularly towards the end of the Bronze Age.
	(1016)	2837 ±32 BP (1109-912 cal BC)		
	3200 ±32 BP (1529-1414 cal BC) (1013)	(1015)		
	[1012] Pit	[1017] Pit with limestone blocks in its base		
	(1046)	(1045) Patches of burning at kettle hole margin		
	3405 ±32 BP (1864-1623 cal BC)			
	(1006a)	Bronze Age organic sediment 3361 ±32 BP (1744-1535 cal BC)		
Neolithic	Features displaying evidence of burning (1034) (1035) (1037)	Upper level of timber platform 3910 ±20 (2471-2310 cal BC)	Decrease in deciduous woodland as a result of human clearance. Replacement by open grassland suitable for grazing.	Climate roughly equivalent to the present day, if not slightly warmer. Humans significantly altering the landscape.
	4425 ±32 BP (3325-2923 cal BC)			
	(1006b)	Neolithic organic sediment 4687 ±32 BP (3627-3370 cal BC)		
	(1007)	Clay inundation layer		
Late Mesolithic	(1020)	Posthole with worked timber post 5863 ±23 (4789-4691 cal BC)	Abundant birch forest gradually succeeded by deciduous woodland as a result of stablilised warmer conditions.	Climatic recovery following the Loch Lomond Stadial/Younger Dryas. Floral transition within (1008) likely a reflection of the warming climate during this period. Humans beginning to alter the nearby landscape.
	[1021]			
	(1008a)	Later Mesolithic upper layer of organic sediment. Decrease in deciduous woodland likely due to human activity evidenced by huge presence of micro-charcoal and replacement by open grassland 6813 ±32 BP (5741-5641 cal BC)		
	Sand (1023)	(1030), (1032), (1033), (1038), (1039), (1040), (1041), (1042), (1043), (1044), (1047), (1048), (1049), (1050), (1051), (1052), (1053), (1054), (1055), (1056), (1057), (1058), (1059), (1060), (1061), (1062), (1063), (1064), (1065), (1066), (1067), (1068), (1069), (1070), (1071), (1072), (1073), (1074), (1075), (1076), (1077) Lower level of timber platform, composed of oak with accompanying chipped lithics and cattle teeth 6540 ±25 (5542-5472 cal BC)		
	(1008b)	Mesolithic organic sediment. Significant birch population decreases as it is replaced by alder and lime. Shallow deposit but represents large amount of compression.		
	(1009)	Sand		
Loch Lomond Stadial/Younger Dryas	(1010)	Clay grading up from (1027), lots of herbacious species and birch present.	Open, steppe-like landscape with numerous grassland herb species and birch.	Sharp, rapid cooling and climatic instability.
	(1027)	Clay/silt. Lots of herbacious species and birch present.		
Windermere Interstadial	(1011)	Organic-rich clay with a particularly high concentration of bog bean weed pollen indicative of standing water at least 1m deep. Frequent micro charcoal evidence of human activity.	Stabilised landscape with developed deciduous woodland and abundant water-based flora within the kettle hole.	Initially fluctuating climate stabilises and warms, enabling rapid organic formation.
	(1025)	Fibrous, humic peat with a high content of bog bean seeds and a significant aquatic population 10809 ±32 BP (10799-10734 cal BC)		
	(1026)	Organic-rich clayey silt. Contained micro charcoal as evidence of human activity. Algae, bog bean seeds and bog bean weed indicative of standing water at least 1m deep 10956 ±32 BP (10958-10764 cal BC) (upper) and 11312 ±32 BP (11299-11129 cal BC) (lower)		
Devensian - Windermere transition	(1022)	Post Glacial initial fill of kettle hole - poorly-sorted silt with sand and gravel. Pollen included pioneer species e.g. birch, pine and rowan 12704 ±32 BP (13335-13026 cal BC)	Very active landscape of melting glaciers and hardy tree species.	Highly unstable, fluctuating.
Devensian	Till (1080)	Well-sorted clay		Cold, arctic, barren landscape.

APPENDIX IV: OASIS FORM

OASIS DATA COLLECTION FORM: England

Printable version

OASIS ID: archaeol5-323604

Project details

Project name	Archaeological Exacavtion of a 'Kettle Hole' at Killerby Quarry, North Yorkshire
Short description of the project	In October 2017 Archaeological Research Services Ltd was commissioned by Tarmac to undertake an archaeological sample excavation of a kettle hole (KB5) as part of the enabling works for Killerby sand and gravel quarry. The site is located immediately east of the A1M trunk road, North Yorkshire, south of Catterick. The excavation targeted a kettle hole that had previously been identified and mapped by ARS Ltd and labelled 'KB5' by this project (Passmore 2012). It lies beneath the route of the quarry's intended haul road and it was therefore necessary to investigate the feature and its deposit sequence prior to the road's installation. A smaller kettle hole, 'KB15', is located c.17m the north-west of 'KB5'. This feature was also investigated and sampled as part of this phase of archaeological works via a single machine-excavated evaluation trench through its centre. Excavation of kettle hole KB5 at Killerby revealed a complex deposit sequence spanning the end of the last major Ice Age (the Devensian) to the modern period. While the geoarchaeological sequence and palaeoenvironmental analysis of the deposits has provided vital insights into past landscape development, land use and climate, the kettle hole revealed a fascinating and rare example of how such features were being utilised and manipulated by humans. The presence of well-preserved in situ archaeological remains dating from the Mesolithic, Neolithic and Bronze Age, including organic remains such as wood and bone, have provided a rare insight into these periods and produced information for filling in certain gaps in the Mesolithic record in particular.
Project dates	Start: 23-10-2017 End: 14-12-2017
Previous/future work	Yes / Yes
Type of project	Field evaluation
Monument type	TIMBER PLATFORM Late Mesolithic
Monument type	PITS Bronze Age
Significant Finds	LITHICS Early Neolithic
Significant Finds	LITHICS Late Mesolithic
Methods & techniques	"Sample Trenches","Test Pits","Visual Inspection"
Development type	Mineral extraction (e.g. sand, gravel, stone, coal, ore, etc.)
Prompt	National Planning Policy Framework - NPPF
Position in the planning process	After full determination (eg. As a condition)

Project location

Country	England
Site location	NORTH YORKSHIRE HAMBLETON KIRKBY FLEETHAM WITH FENCOTE Killerby Quarry

Study area	800 Square metres
Site coordinates	SE 25742 95468 54.353946850071 -1.603882632811 54 21 14 N 001 36 13 W Point

Project creators

Name of Organisation	Archaeological Research Services Ltd
Project brief originator	North Yorkshire County Council
Project design originator	Archaeological Research Services Ltd
Project director/manager	Clive Waddington
Project supervisor	Philippa Hunter

Project archives

Physical Archive recipient	Yorkshire Museums Trust
Physical Contents	"Animal Bones","Wood","Worked stone/lithics"
Digital Archive recipient	Yorkshire Museums Trust
Digital Contents	"none"
Digital Media available	"GIS","Survey"
Paper Archive recipient	Yorkshire Museums Trust
Paper Contents	"none"
Paper Media available	"Context sheet","Drawing","Map","Photograph","Plan","Report","Survey "

Entered by	Philippa Hunter (philippa@archaeologicalresearchservices.com)
Entered on	25 July 2018

OASIS:

Please e-mail Historic England for OASIS help and advice

Cite only: http://www.oasis.ac.uk/form/print.cfm for this page

APPENDIX V: WRITTEN SCHEME OF INVESTIGATION

KILLERBY QUARRY

ARCHAEOLOGICAL WRITTEN SCHEME OF INVESTIGATION

1. Introduction

1.1 This Written Scheme of investigation has been prepared by Archaeological Research Services Ltd on behalf of Tarmac Ltd. It has been developed in line with the 'National Planning Policy Framework' (DCLG 2012), the 'Planning Practice Guidance' (DCLG 2014), English Heritage's document '(Consultation draft 11 July 2014) Historic Environment Good Practice Advice in Planning. Note 2: Decision-Taking in the Historic Environment' and the Mineral and Historic Environment Forum's 'Mineral Extraction and Archaeology: A Practice Guide' (MHEF 2008) to which the English Heritage document defers. This WSI relates to archaeological recording works at the Killerby Quarry site in North Yorkshire. The site is located in North Yorkshire and is situated to the south-east of Catterick Village (NGR centrepoint: SE 263 958). To the west of the site is the modern A1 road and to the north the River Swale. The study area consists of the four proposed extraction areas identified in Figure 7.1. The extraction areas occupy *c.*153ha of farmland currently used primarily for cereal cultivation.

1.2 With the exception of the proposed Phase 3 extraction area which is relatively level, the rest of the land is hummocky with broken vistas, sloping ground and localised high points. The elevation across the site varies between 38m and 54m AOD. The solid geology of the area comprises Carboniferous Millstone Grit and Permian Magnesian Limestone, which is variously overlain by glacial sands and gravels which have the potential to contain peat-filled ice-wastage features such as kettle holes, river gravels and alluvium, with the latter having the potential to contain buried land surfaces and relict channel belts (palaeochannels).

2. Policy Background and guidance

2.1 This scheme relates to the mitigation of potential impacts on the historic environment on the site by the development. The scheme has been prepared in line with National Planning Policy Framework (DCLG 2012) and follows the guidance set out in 'Mineral Extraction and Archaeology: A Practice Guide' (MHEF 2008) and the Institute for Archaeologists Standard and Guidance for Excavation (IfA 2008) and Code of Conduct (IfA 2013).

3. Background

3.1 A desk based assessment was undertaken by Archaeological Research Services Ltd of the site in 2008 (Waddington 2008). Prior to this no archaeological assessment or intervention had taken place on the site apart from a small evaluation close to the A1 which is outside the current development area (Speed 2007). The desk based assessment revealed no certain buried archaeological remains surviving within the proposed development areas (chipped stone tools were shown to survive in quantity within the plough soil across the site and the palaeoenvironmental deposits within the kettle hole fills and Holocene channel belts have good preservation of ancient sediments and have the potential to host waterlogged archaeological remains), although the areas to the north-west and north of the site have been found to be rich in archaeological remains dating from all periods from the Mesolithic through to the modern era. Following the submission of the desk based assessment an archaeological evaluation

programme was agreed with North Yorkshire County Council which included the following:

- A fieldwalking programme across the development area identified pottery from the Roman and later periods together with lithic remains dating principally from the Mesolithic period.
- Peat filled kettleholes, enclosed basins and palaeochannels on the site were cored and radiocarbon dated to the Late Upper Paleolithic, Mesolithic, Bronze Age, Iron Age and early medieval periods, the earlier of which correspond with the lithic assemblage collected from the fieldwalking programme. These kettleholes have been shown to have the potential to contain faunal remains dating from the Mesolithic – Bronze Age period as well as providing an excellent resource for palaeoenvironmental reconstruction and human impacts on the environment (Appendix 7.1; 7.6; Speed 2007).
- A detailed gradiometer survey was undertaken across 8.2 hectares of pasture which revealed numerous potential archaeological features.
- Evaluation trenches were excavated to test the anomalies identified by the geophysical survey and aerial photograph assessment but no archaeological features were identified as a result of this evaluation.

4. Methodology

4.1 An overarching methodology is set out for the scheme of archaeological mitigation for the site which comprises an integrated programme of work consisting of:

- A scalable archaeological watching brief - strip, map and sample methodology appropriate to the scale and nature of any archaeological remains encountered
- Targeted sample excavation of the kettle holes and Holocene channel fills
- Detailed palaeoenvironmental analysis of the peat sediments from selected kettle hole fills and Holocene alluvial channel fills

4.2 The watching brief will be undertaken on all groundworks where archaeological features may survive. This includes areas of 1a, 1b, 1c, 1d and 2a landforms (Fig. 7.4). The archaeological watching brief will aim to ensure that surviving archaeological remains are adequately dealt with prior to destruction. This will be achieved by establishing the presence or absence of archaeological remains, their quality, depth and preservation. The overall aim of the watching brief will be:

• To establish the presence/absence, nature, depth and character of any archaeological features.
• To record any archaeological features.

4.3 The process of archaeological recording will be an iterative one. If numerous and significant archaeological remains are encountered on the site, following consultation with LafargeTarmac, the Development Control Archaeologist for North Yorkshire County Council and Archaeological Research Services Ltd, the watching brief may be altered, in the areas where deemed necessary, to a strip, map and sample methodology.

4.4 The kettle hole and channel peat deposits will be sample excavated in order to recover any surviving archaeological remains (which are likely to be very well

preserved due to the anaerobic waterlogged conditions) and to obtain sediment columns for palaeoenvironmental analysis of pollen and botanical macrofossils and the recovery of dating samples. The palaeoenvironmental analysis will allow for the reconstruction of the landscape at different periods in the past and the identification of what the land was used for and what crops were grown at different times.

4.5 Coring of other key palaeoenvironmental deposits (e.g. selected palaeochannel fills) for analysis will also be undertaken.

4.6 The delivery of public benefit will form a key part of the archaeological works. Opportunities will be provided for participation in the fieldwork for the local community and schools. Running parallel with the archaeological works will be a programme of public engagement and dissemination which will include making information available on web pages, in magazines and via the local media, where appropriate, by the provision of public talks as well as a comprehensive academic publication and conference contributions.

5. Project Management and Standards

5.1 The project will be carried out in compliance with the Code of Conduct of the Institute for Archaeologists (IfA) (2013) and the IfA Standard and Guidance for Excavations (2008).

5.2 All staff employed on the project will be suitably qualified and experienced for their respective project roles and have practical experience of archaeological excavation and recording. All staff will be made aware of the archaeological importance of the area surrounding the site and will be fully briefed on the work required by this specification. Each member of staff will be fully conversant with the aims and methodologies and will be given a copy of this written scheme of investigation to read. All members of staff employed by Archaeological Research Services Ltd are fully qualified and experienced archaeologists which will ensure that appropriate decisions regarding environmental and dating sampling will be made in the field.

6. Watching Brief Methodology

6.1. Unstratified modern material and topsoil will be removed by a machine using a wide, toothless ditching bucket, under continuous archaeological supervision.

6.2 All archaeological features and deposits will be recorded on a pre-excavation plan before excavation, sampling and recording.

6.3 All features exposed will be excavated by hand. Sampling will typically comprise 50% of discrete features; 25% of linear/curvilinear features with non-uniform fill and 10% of linear features with a uniform fill, although this may be varied subject to agreement with the local authority if, for example, a particular set of features is providing no further information gain.

6.4 In the event of human burials being discovered, they will be left *in-situ,* covered and protected. If removal is essential, a Ministry of Justice license will be obtained and recording work will comply with Ministry of Justice regulations. If burials are removed they will be lifted in their entirety and fully recorded.

6.5 Appropriate procedures under the relevant legislation will be followed in the event of the discovery of artefacts covered by the provisions of the Treasures Act 1996.

6.6 Deposits that have the potential for providing environmental or dating evidence will be assessed while the work is in progress. An environmental sampling strategy has been agreed with the English Heritage Scientific advisor for North-East England, Jacqui Huntley. The sampling strategy comprises the following:

- Archaeological contexts with potential for containing environmental evidence will be sampled based on a question-led approach. Sampling percentages of certain features types or clusters will be agreed on site with greater sampling of rare and most significant deposits and lower sampling of less significant features. Deposits with poor taphonomic integrity will generally be avoided. For those features selected for sampling small pit features will normally be 100% sampled while bulk samples of 80 litres will be taken from larger feature contexts, such as primary linear ditch fills.

- Any samples recovered will be floated on site in graduated sieves with the smallest being 300μm and the flots and residues collected.

6.7 During and after the excavation, all recovered artefacts and environmental samples will be stored in appropriate materials and storage conditions to ensure minimal deterioration and loss of information (this will include controlled storage, correct packaging, regular monitoring of conditions and immediate selection for conservation of valuable material).

7. Strip, map and sample

7.1 This methodology will only be employed following consultation with the parties discussed above.

7.2 Topsoil and unstratified modern material will be removed mechanically by a machine using a wide toothless ditching bucket, under continuous archaeological supervision.

7.3 The topsoil or recent overburden will be removed down to the first significant archaeological horizon in successive level spits.

7.4 No machinery will track over areas that have previously been stripped until the area has been signed off by Archaeological Research Services Ltd.

7.5 The areas will be appropriately cleaned using hand tools in order to expose the full nature and extent of archaeological features and deposits.

7.6 All spoil removed during groundworks will be scanned visually to recover small finds. Any finds so recovered will be recorded and their location noted on a site plan at a relevant scale. The finds will be retained and recorded.

7.7 Areas containing archaeological features and deposits will be recorded on a pre-excavation plan.

7.8 Following the strip, map and sample process consultation will take place with representatives of Tarmac Ltd, North Yorkshire County Council and Archaeological Research Services Ltd and a suitable sampling strategy will be agreed.

8. Peat Deposits

8.1 Targeted excavation will be undertaken of enclosed water basins and/or kettle-hole fill sediments, providing this does not become impractical due to water ingress and/or any health and safety concerns. The locations of the areas to be investigated can be seen in Figure 7.3.

8.2 The aim of these excavations will be to identify whether they contain faunal remains dating from prehistory and obtain paleoenvironmental radiocarbon dating evidence.

8.2 The peat within these kettleholes will, initially, be machine excavated using a machine with a toothless bucket under direct and careful archaeological supervision. The archaeologist will halt the excavations if any archaeological remains are identified and remains will be cleaned and three dimensionally recorded before excavation proceeds. If further remains are encountered or anticipated then excavation will proceed by hand. The peat will be removed in level spits of a depth of 100 mm in order to 'section' the kettleholes of *c.*20m or less in diameter, which will provide an accurate profile of the feature and allow for water to be pumped out. Any archaeological remains identified will be carefully excavated by hand. If significant archaeological remains are identified extending into unexcavated areas then a contingency of a further 50 square metres (ie. up to 10m by 5m area) can be invoked. The remaining half of the deposit will be excavated. If no significant archaeological remains are identified, only the 'half section' will be excavated. For those kettle hole/water basin fills larger than 20m in diameter an area of 400 square metres will be sample excavated from these deposits with a contingency of a further 100 square metres (ie. up to 10m by 10m area) using the same methodology. Should archaeological remains be encountered then these will be hand excavated and recorded as set out above. Should shoring be needed then this will be utilized to allow excavation to proceed.

9. Sediment Coring

9.1 Sedimentary sequences KB2, KB3, KB4, KB5, KB8, KB10, KB11 and KB14 (Fig. 7.2) will be re-cored using closed chamber coring equipment, or environmental sampling tins for peats within excavated kettle hole deposits, and full palaeoecological analysis and radiocarbon dating will be undertaken of these targeted sedimentary units.

9.2 The purpose of the sediment coring is to establish:

- The date of selected surviving organic sediment samples
- The nature of environmental remains within the various sediment units sampled to facilitate a reconstruction of the sedimentary and palaeoenvironmental sequence in each.

9.3 Samples will be double bagged in sealed plastic bags and labelled accordingly. The palaeoenvironmental samples will be fully analysed (pollen, botanical macrofossils, and insect remains) by a suitably qualified and experienced specialist.

9.4 All coring points will be surveyed in using a total station and an accurate plan of the location of the cores produced as part of the report.

9.5 A text report summarising the data from the sediment logs, together with digital photographs and an accurate plan will be produced.

9.6 The coring work will be undertaken in the field by suitably experienced Archaeological Research Services Ltd staff under the guide of Drs Clive Waddington and David Passmore, both of whom are experienced geoarchaeologists.

10. Geomorphological mapping and topographic survey

10.1 Geomorphological mapping and topographic survey will be undertaken of selected areas of the Phase 1, 2 and 3 extraction areas in order to resolve:

- The basin morphology and spatial extent of former wetland habitats in the area of KB2, KB3, KB7 and KB8 (Fig. 7.2).
- The Holocene river terrace and palaeochannel morphostratigraphy in the phase 3 extraction area to clarify the age sequencing of dated and undated palaeochannel fragments on the alluvial surfaces.

11. Recording

11.1 The site will be accurately tied into the National Grid and located on a 1:2500 or 1:1250 map of the area.

11.2 A full and proper record (written, graphic and photographic as appropriate) will be made for all work, using pro-forma record sheets and text descriptions appropriate to the work. Accurate scale plans and section drawings will be drawn at 1:50, 1:20 and 1:10 scales as appropriate.

11.3 The stratigraphy of the site will be recorded even where no archaeological deposits have been identified.

11.4 All archaeological deposits and features will be recorded with above ordnance datum (AOD) levels.

11.5 A photographic record of all contexts will be taken with a digital camera of minimum 500 megapixel resolution and will include a clearly visible, graduated metric scale. A register of all photographs will be kept.

11.6 Where stratified deposits are encountered, a 'Harris' matrix will be compiled.

12. Access

12.1 Archaeological Research Services Ltd will give the Development Control Archaeologist 10 working days (or less if so agreed) notice of the commencement of fieldwork.

12.2 Archaeological Research Services Ltd will afford access to the Development Control Archaeologist or their representative at all times, for the purposes of monitoring the archaeological mitigation.

12.3 Archaeological Research Services Ltd will maintain regular communication with the Development Control Archaeologist to ensure that the project aims and objectives are met.

13. Finds Processing and Storage

13.1. All finds processing, conservation work and storage of finds will be carried out in compliance with the IFA guidelines for Finds Work (2001) and those set out by UKIC (1990).

13.2 Artefact collection and discard policies will be appropriate for the defined purpose.

13.3 Bulk finds which are not discarded will be washed and, with the exception of animal bone, marked. Marking and labelling will be indelible and irremovable by abrasion. Bulk finds will be appropriately bagged, boxed and recorded. This process will be carried out no later than two months after the end of the excavation.

13.4 All small finds will be recorded as individual items and appropriately packaged (e.g. lithics in self-sealing plastic bags and ceramic in acid-free tissue paper). Vulnerable objects will be specially packaged and textile, painted glass and coins stored in appropriate specialist systems. This process will be carried out within two days of the small find being excavated. Prehistoric pottery will not be cleaned or be subject to any abrasion or loss of adhering residues.

13.5 During and after the excavation all objects will be stored in appropriate materials and storage conditions to ensure minimal deterioration and loss of information (including controlled storage, correct packaging, and regular monitoring, immediate selection for conservation of vulnerable material). All storage will have appropriate security provision.

13.6 The deposition and disposal of artefacts will be agreed with the legal owner and the appropriate repository museum prior to the work taking place. All finds except treasure trove are the property of the landowner.

13.7 All retained artefacts and ecofacts will be cleaned and packaged in accordance with the requirements of the recipient museum.

14. Site archive

14.1 The archive will be compiled in an orderly fashion in accordance with the Guidelines for the Preparation of Excavation Archives for Long Term Storage (UKIC 1990). The archive will be deposited with the appropriate Museum within 6 months of the fieldwork once all post-excavation work is completed and the final report produced.

15. Report

15.1 An archive report will be produced for each discrete phase of archaeological mitigation work. On completion of the project a final synthetic report will be produced. One copy of the report will be submitted to the client, and one bound hard copy and a digital copy in word or pdf format will be submitted to the North Yorkshire HER within fourteen working days of the completion of the report. Each report will be bound with each page and paragraph numbered and will include as a minimum the following:

- executive summary
- a site location plan to at least 1:10,000 scale with 10 figure central grid reference
- contractor's details including date work carried out
- nature and extent of the proposed development, including developer/client details
- description of the site location and geology
- trench plans to a suitable scale and tied into the national grid so that features can be correctly orientated
- discussion of the results of field work
- context & feature descriptions
- features, number and class of artefacts, spot dating & scientific dating of significant finds presented in tabular format
- plans and section drawings of the features drawn at a suitable scale
- additional plans/map extracts to display noted and recorded archaeological features as appropriate
- recommendations regarding the need for, and scope of, any further archaeological work, including publication
- bibliography

16. OASIS

16.1 Archaeological Research Services Ltd will complete an on-line OASIS form for this fieldwork. Archaeological Research Services Ltd is a registered contractor on the OASIS system and has uploaded archaeological reports before.

17. Formal Publication

17.1. A publication report will be prepared for the entire project in line with the guidelines set out by English Heritage in 'Management of Research Projects in the Historic Environment' (English Heritage 2006). Copies of the report will be submitted to Tarmac and the HER upon completion. This will take the form of an academic article or monograph which will be submitted for publication either in hard copy or on-line within 18 months of completion of the project.

17.3 Project results will be regularly reported on the ARS Ltd and/or LafargeTarmac web site targeted towards the general reader but with links to further and more in-depth reports for those who would like to find out more.

18. Delivering Public Benefit

18.1 The NPPF paragraph 141 states that developers are required "to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible." Killerby

Quarry is a substantial quarry site and it provides an opportunity to generate significant public benefits that will mitigate the loss of any heritage assets due to removal of soil and sediments. The programme of works to provide public benefits will include:

- Making available local school visits to the site to be shown archaeological remains, should they be discovered, and to take part in a hands-on activity such as fieldwalking or test pitting
- Arranging a site open day to for the public where they can find out more about the archaeology of the site
- Provide some participation opportunities of local volunteers (e.g. the chance to assist with certain aspects of the fieldwork, health and safety permitting)
- Once there are results to report produce articles for local magazines and newsletters, for popular archaeology magazines and minerals magazines and provide news releases to the media as appropriate
- Produce regularly updated web pages on the archaeology of the site as fieldwork progresses. Reports can be made available to download from these sites and the web site details can be published and advertised in site publicity
- Talks will be given to local heritage meetings, history groups and similar as well as to academic conferences as appropriate

The timetable for these deliverables will vary depending on what is found and when but the programme of outputs will be regularly reviewed to ensure advantage is taken of opportunities as they arise.

The restoration of the site includes scope for interpreting historic environment remains as well as the form of the ancient landscape and its vegetation to residents and visitors to the site using public rights of way. This will contribute to the sustainable development of the site from a historic environment perspective and will help to off set the loss of heritage assets that may take place due to mineral extraction.

19. Monitoring

19.1 Reasonable access to the site will be allowed to the Development Control Archaeologist or their nominee for the purpose of monitoring the archaeological scheme. Prior notification of a site visit is required and LafargeTarmac Ltd and Archaeological Research Services Ltd should be notified accordingly.

20. References

DCLG 2012 *National Planning Policy Framework*. London.

DCLG 2014. *Planning Practice Guidance*. London.

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