ARCHAEOLOGICAL SERVICES
DURHAM UNIVERSITY

on behalf of
Altogether Archaeology

NORTH PENNINES
Area of Outstanding Natural Beauty
GLOBAL GEOPARKS NETWORK

Long Meg and Her Daughters
Little Salkeld
Cumbria

post-excavation full analysis

report 4043
April 2016

Durham University

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1. Summary

The project

1.1 This report presents the full analysis results of an archaeological excavation conducted as part of the 'Altogether Archaeology' community project at the site of Long Meg and Her Daughters stone circle and adjacent enclosure near Penrith, Cumbria. The excavation comprised three trenches, with significant post-excavation analysis undertaken on pottery, lithics and palaeoenvironmental remains. The works were commissioned by the North Pennines AONB, and supervised by Archaeological Services Durham University.

1.2 The enclosure ditch was sample excavated in all three trenches. The ditch was initially filled with sand similar to the underlying natural subsoil. Two radiocarbon dates were returned from material within the ditch fill: one was Early Neolithic, the other Late Mesolithic. South of the enclosure was a posthole; material from this was radiocarbon dated to the Early Neolithic. The ditch was later recut, and partially filled in with sand similar to the natural subsoil. Material from this fill was radiocarbon dated to the later Early Neolithic.

1.3 South of the enclosure was a larger pit, possibly used for storage. A radiocarbon date from this was Middle Neolithic. A shallow pit, of similar date, was recorded between the enclosure ditch and the stone circle. This pit may be the socket for a former standing stone: the date may therefore relate to the construction of the stone circle.

1.4 Radiocarbon dating indicated that a pit dug through the backfilled enclosure ditch was early medieval. A large quantity of burnt oak in the pit suggested a deliberate fire. A loam subsoil accumulated over this.

1.5 Later, a spread of rounded stones was embedded into the subsoil between two of the standing stones, probably to form a surface. Two stake holes were also recorded to the north of here, outside the circle.

1.6 A flat-based sherd from a hand-built vessel of possible Grooved Ware type, broadly later Neolithic in date, was recovered. A further sherd of prehistoric pottery was also recovered, but was not large enough to permit detailed comparative analysis. A coarseware base sherd from a flat-based Roman vessel, probably a jar, was also identified.

1.7 The lithic assemblage included 32 artefacts, including flakes, fragments and a single tool. The artefacts were predominantly made on flint, with some flakes and fragments in quartz and Cumbrian tuff. A component of Arran Pitchstone is also present. This is of considerable importance due to its rarity. Polished greenstone tuff flakes and pitchstone indicate an Early Neolithic date.

1.8 Palaeoenvironmental analysis identified low numbers of charred hazelnuts in the majority of the samples, while evidence of cultivated crops was absent, not unusual on sites of earlier prehistoric origin. Much of the charcoal from the Neolithic deposits was either of small stemwood or branchwood, indicating the presence of easily collectable material. The deliberate selection of small calibre hazel branchwood in the fills of a pit suggests this material was collected for a certain purpose, and is probably the remnants of a wicker-lining for storage.

2. Project background

Location (Figure 1)

2.1 The site is located at Little Salkeld, Hunsonby, approximately 9km north-east of Penrith, Cumbria (NGR: NY 57110 37210).

2.2 The stone circle and enclosure to the north are part of a Scheduled Monument: 'Long Meg and Her Daughters stone circle, associated cursus and prehistoric enclosure' (List Entry no. 1007866; Monument no. 23663; Cumbria HER no. 6154).

Objectives

2.3 The principal objectives of the project were as follows:

- to provide an opportunity for members of the North Pennines AONB 'Altogether Archaeology' project to receive excavation training and to engage in local heritage research
- to recover information relating to the chronology, form and function of the monument.
- to assess the nature and condition of buried archaeological deposits, at specific locations , to aid future management of the site and enable informed decisions to be made regarding potential future investigation.

2.4 Specific research aims of the excavation were:

- to examine the relationship between the stone circle and the enclosure, including whether a passage existed.
- to determine if the stones were set within a bank and to ascertain if this was in association with the enclosure ditch.
- to record the nature of the enclosure ditch and obtain dating evidence.
- to assess the surviving nature of the Neolithic ground surface within the stone circle and the enclosure and the impact post-neolithic agriculture has had on it.
- to investigate potential features within the enclosure interior, identified in the geophysical survey.

2.5 The wider aims of the Altogether Archaeology project at Long Meg are to further our understanding of the monument within the context of cross-Pennine transport and communications during the Neolithic and to contribute to a broader understanding of the Neolithic throughout the North Pennines.

2.6 The project aims compliment the regional research agenda (Chitty & Brennand 2007). Relevant to this project, this framework highlights radiocarbon dating (2.8), environmental sampling (2.15-16), Mesolithic – Neolithic transition (2.27), collaborative projects (2.33) and characterisation and clarification of sequences of monument sites (2.35).

Project design

2.7 The works have been undertaken in accordance with a Project Design prepared by Paul Frodsham of the North Pennines AONB Partnership (Frodsham 2015).

2.8 Scheduled Monument Consent was granted by English Heritage prior to the work.

Dates

2.9 Fieldwork was undertaken between 21st and 29th March 2015. This report was prepared for April 2016.

Personnel

2.10 Fieldwork was conducted by volunteers from the North Pennines AONB 'Altogether Archaeology' project.

2.11 Volunteers were trained and supervised by Matthew Claydon and Jonathan Dye, with direction of project fieldwork by Peter Carne. This report was written by Matthew Claydon with illustrations by David Graham and editing by Peter Carne. Specialist reporting was conducted by Dr Rob Young (prehistoric pottery), Dr Carrie Armstrong (animal bone), Dr Helen Drinkall (lithics), Jennifer Jones (other artefacts), Lorne Elliott (palaeoenvironmental) and Kamal Badreshany (SEM-EDS analysis).

2.12 Overall project management and coordination was provided by Paul Frodsham, the Altogether Archaeology Project Officer for the North Pennines AONB Partnership. The academic director for the project was Professor Chris Scarre.

Archive/OASIS

2.13 The site code is **AAL15**, for **A**ltogether **A**rchaeology **L**ong Meg 20**15**. The archive is currently held by Archaeological Services Durham University and will be transferred to Penrith Museum in due course. Archaeological Services Durham University is registered with the **O**nline **A**cces**S** to the **I**ndex of archaeological investigation**S** project (**OASIS**). The OASIS ID number for this project is **archaeol3-246541**.

Acknowledgements

2.14 The project team is grateful to the landowners Mr & Mrs Rowley of Glassonby Lodge, Glassonby, the tenants Mr & Mrs Morton of Long Meg Farm and to English Heritage for facilitating this research. Dr Helen Drinkall is grateful for the assistance of Torbin Ballin in preparing the report on the pitchstone.

3. Landuse, topography and geology

3.1 Both the stone circle field and adjacent field to the north are pasture; a single-track road cuts through the fields.

3.2 The stone circle occupies a very gentle north-east-facing slope at the head of a small valley that heads north-west to join the River Eden near Lacy's Caves. The ditched enclosure immediately north of the circle encloses the head of this valley. The northern field is predominantly level in the east but steepens in the west, down to the springs and the farm buildings

3.3 The underlying solid geology of the area comprises Early Triassic sandstone of the St Bees Sandstone Formation. Devensian till covers the sandstone to the east of the road that cuts through the site.

4. Historical and archaeological background

4.1 The following information is edited from the Project Design prepared by Paul Frodsham (2015).

4.2 The huge stone circle, the third largest in England and fifth largest in the British Isles, measures *c.*110 by 93 metres. The original number of stones is not known, and it is hard to be sure about the current number given that some are broken and partly buried, but recent analysis suggests a total of 68 surviving stones in the circle, of which 26 are still standing, plus Long Meg herself standing some 20 metres outside the circle's possible south-west entrance. The entrance is framed by two outlying 'portal stones'. Long Meg is of local red sandstone, presumably quarried from the nearby river cliffs.

4.3 Within the circle, some of the extremely large stones may mark significant points around the circumference, for example perhaps in relation to sunrise at particular times of year. The largest stone is a huge block in the south-south-west, about 3.3 metres wide and weighing some 28 tons; it has been estimated that it would have taken 120 people to set it up. Two similarly sized massive boulders are located at opposite each other in the circle's east and west arcs.

4.4 In some places, notably on the western side, it appears that the stones are set within a low bank. If original, this is an interesting architectural feature that may suggest links with henge monuments elsewhere, but it may be a result of ploughing in more recent times.

4.5 Long Meg stands 3.8 metres above the turf, and weighs *c.*9 tonnes. It has incised spirals and concentric circles on the east face; it may have been quarried from an already decorated river cliff. Other motifs have been recorded on some of the circle stones, but given the rough, eroded nature of the volcanic rock surface, it is not known for certain whether these are artificial or natural.

4.6 The stones of the circle appear to be rhyolite (a form of granite) and are usually assumed to have been deposited in the general area when the glaciers melted at the end of the Ice Age. There appears to be some variation in the geological structure of the boulders, for example some contain much more quartz than others. Those with large amounts of quartz may be located at significant places around the circle.

4.7 The great enclosure, of which there appears virtually no sign on the ground, lies immediately north of the circle and measures 210 metres north-south by 200 metres east-west. Much of the interior is now taken up by Long Meg Farm, and no ancient features are visible within it. The enclosure appears to be earlier than (or, at the latest, contemporary with) the stone circle. There appears to be an entrance between the two in the north-west of the circle/south-west of the enclosure.

4.8 A possible cursus has been recorded from air photographs running 600 metres from the entrance of the stone circle westwards towards the cliffs above the east bank of the Eden. Whether this is a feature contemporary with the stone circle, or later field boundaries, is not known.

4.9 The whole complex sits on a wide sandstone terrace above the east bank of the Eden. The general location is probably of significance, and may have been so before the monument was constructed. Some of this significance may relate to the nearby red sandstone river cliffs and rapids, possibly marking the highest navigable point on the Eden. The possible local exploitation of gypsum (apparently used to great effect within the great henges at Thornborough in North Yorkshire) may also be significant.

4.10 Topographic and geophysical surveys (Archaeological Services 2013) recorded features of potential significance, including confirmation of presence of the enclosure ditch which appears better preserved in some places than in others. Unsurprisingly, the survey was not able to establish the relationship between the stone circle and enclosure.

4.11 The topographic and resistance surveys support the observation that the stones of the circle may have been set within a bank; if so then this is a feature with a range of implications regarding the original design and links with other sites elsewhere.

4.12 The geophysical surveys have suggested the possible presence of features within the stone circle and enclosure, and elsewhere within the complex, but the nature, condition and chronology of these cannot be determined without excavation. A key question remains the extent to which the Neolithic ground surface remains undisturbed throughout the complex; this has major implications for future site management, including possible future research.

5. The excavation

Introduction (Figures 3 and 4)

5.1 Three trenches were planned for this excavation and were positioned over the stone circle and enclosure in accordance with the project aims (above, 2.4). Natural subsoil, a pink sand [131=217=309], was reached at a depth of 0.4-0.5m.

Early Neolithic (4000-*c.*3400)

Enclosure (Figures 6-8)

5.2 A section was excavated through the enclosure ditch in each of the three trenches, providing a relatively consistent profile and stratigraphic sequence of deposits. In Trench 1 in the south-west [F109] and Trench 3 in the north-east [F303] the enclosure ditch was 5m-6.5m wide and 1.2-1.5m deep. It was significantly narrower, and shallower in Trench 2 at the south-east [F208: 3.1m wide, 0.7m deep], the point at which it was closest to the stone circle. In all three sections the primary ditch fill comprised variations of stony pink sand [128; 215; 307], similar to the natural subsoil through which the ditch had been dug. This may indicate that the bank/s were formed by the up-cast from the ditch returned to the ditch, either from slumping caused by significant erosion, or by deliberate in-filling. This process may have occurred relatively soon after the ditch was dug, as no other identifiable deposits had accumulated at its base prior to the re-deposition. Hazel charcoal from fill 307 has been radiocarbon dated to 3950-3790 cal BC, suggesting the ditch was backfilled at the beginning of the Early Neolithic period. Oak charcoal from the same fill however, has provided a radiocarbon date of 5290-5050 cal BC suggesting a late Mesolithic date, and the presence of residual material.

5.3 The re-deposited natural fill 128; 215; 307 was recut as a narrower ditch [F133=F220=F310: 1.8m-3.9m wide, 0.45m deep], evident in all three sections. This was filled by pink silty sand [117=214=306: 0.15-0.35m thick]. Hazel charcoal from context 214 has been radiocarbon dated to 3630-3370 cal BC. The pink sand in the fill suggests the up-cast bank had again returned to the ditch. In the south-west and south-east sections the deposits were consistent: a thin deposit of grey silty sand with charcoal flecks [116=216: 0.05-0.01m thick], overlain by yellow/orangey grey silty sand [115=213: 0.1-0.15m thick], with light yellowish grey silty sand

[108=207=211: 0.1m thick] above. In the south-east, along the northern edge of the ditch imbedded into [108] and [128], was an intermittent spread of small rounded stones [107: 3m+ by 0.5m, 0.15 thick].

5.4 In the north-east the ditch was much wider near the top, indicating a possible recut [F311]. Here fill 306 was overlain by yellowish grey sand [304: 0.2m thick], which corresponds to context 115=213. This was overlain by grey sand [305: 0.1m thick], which corresponds to 108=207=211. Above this was brown silty sand [302: 0.15m deep].

5.5 A possible stakehole [F130: 0.1m diameter, 0.15m deep] filled with brownish pink sand [129] similar to the lower ditch fills was recorded on the northern edge of the ditch in the south-west.

Structure

5.6 In Trench 1, 5m south of the ditch, was a large, well-defined posthole [F121: 0.45m diameter, 0.5m deep] with near vertical edges and a flat base (Figure 9). It was filled with yellowish brown sandy silt [120: 0.5m thick]. It contained five large packing stones [119]. A charred hazelnut shell from the fill of the posthole has been radiocarbon dated to 3950-3720 cal BC, an Early Neolithic date corresponding closely to the primary fill of the enclosure ditch.

Middle Neolithic (*c*.3400-3000 BC)

Structure

5.7 South of the posthole in Trench 1 was a larger pit [F124: 0.8m diameter, 0.7m deep]. It had near vertical edges and a flat base (Figure 10) suggesting it may also have been a posthole. Six large stones [123] were present within the cut, which may be post-packing. The primary fill was a pinkish brown silty sand [125: 0.3m thick], sealed by a secondary fill of yellowish brown sandy silt [122: 0.4m thick]. Hazel charcoal from fill 125 has been radiocarbon dated to 3360-3100 cal BC.

Stone socket

5.8 To the north of standing stone 17 was a possible socket [F105: 1.6m by 1.2m, 0.3 deep; Figure 11] for a former standing stone. The cut was relatively shallow and was lined along its southern edge with rounded stones 0.2-0.3m in size [127]. Similar clusters of stones were recorded around the base of Stone 17 and Stones 25 and 26 in Trench 2. The primary fill was orangey brown sandy silt [113: 0.3m thick], above which was a greyish brown sandy silt [112: 0.1m thick]. Above the feature was a spread of angular red sandstone fragments [126: 0.2m thick]. Hazel charcoal from fill 113 has been radiocarbon dated to 3340-3100 cal BC, corresponding closely to the primary fill of posthole F124.

5.9 A shallow cut [F104: 1.5m by 1.2m, 0.2m deep] was recorded to the south of standing stone 17. It was filled with orangey brown sandy silt [103] overlain by another deposit of angular sandstone fragments [102: 0.15m thick]. This feature was difficult to define and its purpose remains uncertain, although it is conceivable that it once held another stone.

5.10 The north end of stone 25 appeared to have been shaped or flaked to create a rough point. If the stone had fallen over from the north side, its original position would have been set into the backfilled ditch. Two circular indentations were identified on

the stone, one on the upper face at its worked end (Figure 12) and one on the lower face towards the south end (Figure 13). Both were quite large, around 0.1m in diameter, with a depth of *c.*0.05m. One or both of these may be deliberate cup marks. The upper mark was the more defined, with a sharper cut; the lower mark was rather smooth. The upper mark would have been below ground level if the north end of the stone was imbedded in the ground when it was erect.

Early medieval (5th century AD-1066)

Pit

5.11 At the eastern edge of Trench 1 the ditch was cut by a probable pit [F111: 1m+ by 0.7m, 0.2m deep; Figure 14]. Its primary fill was a dense layer of charcoal [118: 0.1m deep], suggesting burning *in situ;* this was sealed by greyish brown sandy silt with occasional charcoal flecks [110: 0.15m deep]. The feature extended beyond the edge of the trench so it could possibly be a ditch or gully terminus. The charcoal from this deposit predominantly comprised oak heartwood and may reflect the remains of a burnt structure or a large fire. This charcoal has been radiocarbon dated to 430-610 cal AD, indicating early medieval activity on the site.

?Medieval - ?modern (1066 onwards)

5.12 Subsoil, brownish orange clayey sand with frequent inclusions of small stone [106=202=308: 0.2-0.3m thick], was present in all three trenches, and had accumulated over the above features. A cluster of cobble stones [132] were set in to this around the base of stone 17. Similar clusters of stones were present around the base of stone 26 [218] and stone 25 [219].

Cobbled surface

5.13 At the northern end of Trench 2 a cobbled surface [F210: 3m+ by 1m+, 0.1m thick] was set into the subsoil, extending over the south part of the trench (Figure 15). Its northern limit corresponded closely with the north edge of the enclosure ditch, and also the outer edge of the stone circle. There was no evidence for the surface extending east or west as it was not encountered in the excavations at the bases of standing stones 25 or 26.

5.14 In the extreme south-east corner of the trench the cobbled surface was overlain by a thin spread of dark brown sandy silt [212: 0.05m thick]. This may be a buried topsoil, but as so little of the deposit was exposed this is uncertain. A spread of occasional large stones [209] was also recorded over the cobbled surface.

Postholes

5.15 Cut into the subsoil [202] were two postholes, [F204: 0.12m by 0.12m, 0.22m deep] and [F206: 0.12m by 0.12m, 0.22m deep] (Figure 16). Both were filled with soft orange brown sandy silt, [F203] and [F205] respectively. The form and fill of these features suggest they may have been for fairly modern fence posts.

5.16 The subsoil and features were overlain by a grey brown sandy silt topsoil [101=201=301: 0.25-0.4m deep].

6. The artefacts

Prehistoric pottery analysis

Results

6.1 Three sherds were submitted for analysis:

6.2 1) AAL15 [116] SF15: Flat based sherd from a hand-built vessel of possible Grooved Ware type. Mottled grey/black/dark brown fabric with some large calcite gritting present on base and inner surfaces. Max. grit size visible: *c.*13mm x 5mm. Min. grit size visible: *c.*4mm x 2mm and possibly smaller. Outer surface smoothed and decorated with three parallel incised/impressed lines running around the circumference of the vessel. The basal line appears to be impressed with a single strand of twisted cord but the upper two have clearly been incised with a round pointed implement as can be seen in the visible profiles. Six further incised, parallel, lines run at *c.*45 degrees across the main incised decoration. The three parallel lines are *c.*2mm wide and *c.*2mm deep and spaced *c.*3-4mm apart. The angled incised lines are *c.*1-1.5mm wide and spaced *c.*3-5mm apart. These latter incisions have been made by a sharp edged object, possibly a flint blade, and are *c.*1-1.5mm deep. Some smearing is present on the outer surface. The inner surface of the vessel has clearly been broken to reveal the coarse nature of the fabric and inner gritting. Max. sherd dimensions: 38mm x 21mm. Base thickness: *c.*13mm. Max. surviving wall thickness: 8mm (Figure 5. a).

6.3 2) AAL15 [201]: A coarseware base sherd from a flat-based, Roman vessel, probably a jar form. Hard-fired, sandy, fabric with some very small micaceous/sand grits visible on inner surface. Light orange outer surface, darker black/grey inner surface, suggests that the vessel was fired in an inverted position. Max. dimensions: 35mm x 42mm. Wall thickness: *c.*9mm. Base thickness: *c.*10mm. Throwing rings visible on inner surface, outer surface smoothed/worn (Figure 5. b).

6.4 3) AAL15 [215] SF14: Undiagnostic , prehistoric, body sherd from a hand-built, plain, coarse-ware vessel. Dark grey/black fabric with heavy, white/grey? calcite gritting and some smaller micaceous inclusions present. External face smoothed with very few inclusions showing. Inner face indicates heavy extent of gritting within the fabric. Max grit size: 5mm x 3mm. Min grit size: *c.*1mm x 1mm and possibly smaller. Max sherd dimensions: 32mm x 27mm. Max wall thickness: *c.*8mm (Figure 5. c).

Discussion

6.5 This small assemblage is very difficult to date. The sherd from context Trench 1 [116] could be of Grooved Ware type and hence broadly later Neolithic in date. Parallels for the vessel form and decoration have been impossible to find among published comparanda.

6.6 The two sherds from Trench 2 are equally enigmatic. Evidence for Roman activity at a site like Long Meg might not be unexpected, as evidenced by the sherd from [201]. The small undecorated body sherd (SF14) is likely to be broadly prehistoric. Given its location in the basal fill of the enclosure ditch it might be of Neolithic origin, but again the sherd is not large enough to permit detailed comparative analysis.

Later Pottery analysis

Results

6.7 Eleven sherds (110g wt) were hand-recovered from three topsoil contexts.

6.8 Context [101] had four small sherds of plain glazed ware of 19th/20th-century date.

6.9 Context [201] had three further sherds of glazed ware, probably from the same vessel as two of those from [101]. This context also produced a body sherd from a 19th-century green stoneware vessel and a sherd (not full thickness) of 18th century late blackware.

6.10 Context [301] had the base of a 19th century grey-bodied stoneware bottle or jar with patches of brown glaze and a small base sherd from a 19th-century coarseware vessel.

Animal bone analysis

Results

6.11 The hand-recovered assemblage comprises four small bone fragments. No diagnostic features were present to determine either element or species. Three of the bone fragments were recovered from topsoil context [201]. One of these fragments is calcined, the other two appear unheated and refit together. These may potentially have originally been one fragment as the break appears recent. A calcined bone fragment was also recovered from context [101]. This is of a size to potentially derive from a medium-sized mammal (sheep/goat-sized), although the tiny nature of the fragment and the inability to identify it to element means this interpretation is tentative.

Discussion

6.12 This assemblage is extremely small and provides little information. The presence of calcined bone indicates the exposure of bone to relatively high temperatures (Ubelaker 1978), above *c*.600 degrees Celsius (McCutcheon 1992). The condition of the bone fragment is relatively good, and the recovery of the items does demonstrate the potential for further material to be recovered from the site.

Clay pipe analysis

Results

6.13 Context [101] had a small piece of pipe bowl with no stamps or decoration. The heel is broken, but the surviving bowl shape suggests a 19th-century date.

Lithics analysis

Summary

6.14 The lithic assemblage consists of 36 objects, although four of these are of natural origin. The worked component comprises flakes, fragments and a single tool. Whilst the artefacts are predominantly made on flint, there are limited numbers of flakes and fragments in quartz and Cumbrian tuff. In addition a small component of Arran Pitchstone is also present. This is of considerable importance due to its rarity. The majority of the pieces were recovered from the topsoil of the three trenches and can only be assigned broadly to the prehistoric period. However, the polished greenstone tuff flakes and pitchstone serve to narrow the date slightly, linking these finds to the Early Neolithic phase of occupation.

Results

6.15 The assemblage totals 36 pieces with the typological breakdown shown in Table 1 and the raw material in Table 2. Technological aspects of the artefacts have been recorded, and these are listed in Appendix 1, Table A1.2. Four pieces which were

recovered from the samples have been added to the previously assessed assemblage.

6.16 Four types of raw material are represented (flint, greenstone tuff, pitchstone and quartz), and will be discussed separately below. Three natural chert fragments were also recovered, one from [101] and two from [201], which showed no signs of human working, and are not included in the tables below.

Flint

6.17 This is the largest group in the assemblage (n=17, 47%), with more than twice the number of the other raw material groups represented. The topsoil [101] of Trench 1 produced five artefacts. The first (SF4) is a distal flake on partially patinated light grey flint with white banding. Breaks are present at the proximal and right dorsal sides. The dorsal surface appears glossy and battered with striations indicating some post-depositional movement.

6.18 SF5 is a flake fragment of lightly patinated light grey flint with a break at the proximal end and deliberate removal at the distal. A tiny fragment of thin cortex remains on the dorsal surface, which looks similar to that from SF6 [101]. The flake is chunky and battered, with edge damage to all sides.

6.19 The only sizeable flake from the assemblage (SF6) is much more patinated than the rest, perhaps representing occupation in an earlier phase. The small fragment of cortex remaining is thin and suggests manufacture from a secondary raw material source such as river cobbles. There is slight damage to the left dorsal edge and a small break at the distal end of the right edge. There is evidence of platform preparation, which also gives weight to an Early Neolithic date.

6.20 SF10 [101] is a small, finely made flake on grey flint with a small break at the proximal end. The final flint artefact is a distal flake fragment (SF13) on dark grey flint, broken at the proximal end. Thin, worn cortex covers 25-50% of the dorsal surface, again displaying similarities with the cortex type from SF6, suggesting a similar material source.

6.21 The only definitely worked artefact from a secure context in Trench 1 is SF12, a distal flint flake fragment on dark grey flint from the fill [113] of a possible stone socket [F105]. The cortex covers 25-50% of the dorsal surface and, though worn, looks fresh, suggesting a different raw material source to the rest of the assemblage (e.g. SF6). Unfortunately the form of this piece is not diagnostic. However, hazel charcoal from this context [113] has been radiocarbon dated to 3340-3100 cal BC, giving a Middle Neolithic date.

6.22 A chip on light grey flint [122] <16> was not included in the original analysis but came from pit/ posthole [F124]. Hazel charcoal from the fill below this layer gave a radiocarbon date of 3360-3100 cal BC, providing a comparable date to [113].

6.23 Only one flint artefact came from Trench 2, a fire-cracked flake from ditch fill [207]. The ventral surface has been badly damaged due to overheating of the material, demonstrated by fractures lines and crazing (Schmidt 2014). The dorsal displays deep white mottled blue patination. The small amount of cortex on the dorsal is thin and worn, again suggesting a comparable raw material source to SF6 and SF13.

6.24 Six flints were produced from the topsoil [301] of Trench 3. The first is a fragment with two removals. Thin cortex covers 25-50% of the surface. The second is a heated flake, completely white in colour, with fine lines spreading across the surface as a result of heating the material. Another burnt piece was also recovered, a fragment with extensive cracking and damage to the internal structure which precluded further identification. Extensive damage was also present on another fragment of grey flint with white inclusions, again making it impossible to tell if the piece was worked or not. The fifth piece is another working fragment this time on dark grey flint. The final piece is a flake with a break at the proximal end, which a removal was struck off. The cortex is again thin and comparable to the majority of pieces in the assemblage.

6.25 The final piece from Trench 3, which was not included in the original assessment, came from ditch fill [302] <4>. This is a flint chip on grey flint. Another two flake fragments came from unstratified contexts [u/s]. The first is on dark grey flint with a natural fracture obscuring part of the ventral surface. The small amount of cortex visible is thicker, suggesting perhaps a slightly different raw material source to the rest. The second is non-cortical, on lighter grey flint displaying breaks on all sides.

Greenstone tuff

6.26 Seven pieces of Cumbrian greenstone tuff were also recovered, comprising 19% of the assemblage. Only one piece originated from Trench 1, a fragment of greenstone, from topsoil [101], which is almost circular in shape. Only one section of the original surface is left, and this indicates that the original implement was smoothed but not polished. All other surfaces are rough and it is likely this is an internal fragment of a stone axe.

6.27 Two flakes came from the topsoil [201] of Trench 2 (SFs 1 and 3). Both have polished dorsal surfaces indicating origin from Neolithic Group VI Langdale axes. Interestingly, the surface of SF3 is much smoother and a higher quality polish than that of SF1 and overall seems in much better (mint) condition, despite a break to the distal end, compared to SF1 which is more battered.

6.28 Two pieces of greenstone also came from cobbled surface [210]. SF11 is a thin flake with a finely polished dorsal surface, again originating from a polished Neolithic stone axe. The other artefact is worked, with a smoothed top surface and curved edge. The material is the same colour and type as that from [101] and [210]. The surfaces are not polished and the form does not suggest origin from an axe, but from some other implement. Two small fragments were also recovered from unstratified contexts [u/s].

Arran Pitchstone assemblage

6.29 The five pitchstone artefacts, representing 14% of the assemblage, came from topsoil deposits [101] [201] [301] in each of the three trenches.

6.30 Two came from [101], the first of which (SF8) is a thick curved flake with a plunged overshoot termination. The proximal end is missing and the piece has six removals on the dorsal surface (Figure 17). The second (SF2) is a distal flake fragment with very fine retouch forming a notch on the left dorsal side, a removal and fine retouch creating a point at the distal end, similar in form to a piercer (Figure 18).

6.31 Trench 2 [201] also contained two pieces of pitchstone found together (SF7). The first is a thick curved flake with four dorsal scars, a marginal butt and plunged overshoot termination (Figure 19). The second is a distal flake fragment with a step termination. The size of the original flake would have made it the biggest pitchstone artefact from the site. There is damage present to the dorsal surface at the distal end, and three dorsal scars (Figure 20). Due to the fracture mechanics of pitchstone, flakes with exaggerated curvature and a tendency to produce plunged overshoot terminations are characteristic of pitchstone assemblages (Ballin 2006, 2008b).

6.32 The final pitchstone flake, from [301], is very small, with a curving thick profile and feather termination. Slight damage at the proximal end has removed the platform, and there is a small break at the distal end. The piece has three dorsal scars (Figure 21).

Quartz assemblage

6.33 Two pieces of quartz were recovered from Trench 1 [122] <16>. One is natural in origin and not worked, and as such has not been included in the tables below. The other shows signs indicative of potential working and may be the distal end of a flake, although quartz is a difficult material to assess (Ballin 2008a; Driscoll and Warren 2007). They come from pit/posthole [F124) the lower fill of which produced a Middle Neolithic radiocarbon date.

6.34 Two possible quartz flakes were recovered from topsoil deposits [201] and [301]. Although these pieces are small, they do give some indication that they are likely to have been worked, namely the form of the ventral surface and signs of a striking platform. This cannot be said with certainty given the general difficulties of identifying worked quartz (Ballin 2008a; Driscoll and Warren 2007).

Chert

6.35 Three pieces of chert were also recovered, although these are all natural in origin and are not humanly worked. These are not included in the tables below.

Discussion

6.36 Unfortunately for such an important site, the flint assemblage for the main part consists of small flakes and debitage fragments, providing little information about the type of activity undertaken on site. There is only one flake of sizeable dimensions ([101] SF6) and this could potentially derive from an earlier occupation, due to differences in the depth of patination of the flint surface compared to the rest of the assemblage. The piece is not Mesolithic in form so could belong to the Early Neolithic phase of occupation. This is also suggested by the prepared platform on this piece. Interestingly, the chip from [302] <4> is also well-patinated and comes from a ditch fill linked to the Early Neolithic phase of the site.

6.37 The small size of the pieces might result from the fact that the local raw material is pebble flint, derived from secondary sources in river gravels (Evans 2008; Cherry and Cherry 1987). However, some of the assemblage is on imported grey Yorkshire flint ([122], [101] SF5 and SF6, [u/s], [301]), which is linked to the exchange networks distributing the Cumbrian axes (Cherry and Cherry 1987). It has been suggested that in the eastern area of Cumbria, chert is more common in earlier assemblages (e.g. Mesolithic/Early Neolithic) (Evans 2008). Although Cherry (2009) argues the dominance of chert is more a Mesolithic characteristic, with Yorkshire flint dominant

in the Neolithic. Here chert only occurs as naturally derived pieces, suggesting the assemblage is more likely to be Neolithic in date.

6.38 Regarding the quartz component, it is a difficult material to assess given its coarse-grained nature and different fracture mechanics (Ballin 2008a; Driscoll and Warren 2007). However the flakes do display signs which are reasonably indicative of being humanly worked.

6.39 There are a number of pieces of greenstone tuff present, most likely originating from the Langdale Group VI axe factories in Cumbria. Three of these are flakes exhibiting polished dorsal surfaces, deriving from Neolithic stone axes. These polished flakes tend to appear more frequently in the eastern uplands of Cumbria, compared to the west (Cherry 2009).

6.40 The real significance of the assemblage lies with the five pieces of pitchstone, the archaeological source of which is Arran on the west coast of Scotland (Williams-Thorpe and Thorpe 1984). Pitchstone is a volcanic rock similar in composition to obsidian and evidence suggests trading networks extended up to 400km, as far away as Orkney (Ballin 2009, 2015a). It is rare south of the Scottish border (Ballin 2008b) and this dearth in artefacts, especially for Cumbria, has been highlighted as a future research agenda (Ballin 2009).

6.41 Although the pitchstone assemblage at Long Meg seems small, the general frequency of pitchstone artefacts outside the main areas in Scotland is so low that this assemblage is an important discovery. The average frequency of artefacts in what Ballin has termed 'Zone IV' is between two and four per assemblage, with the highest number within a 10km by 10km area being seven (2009). Pitchstone usually constitutes a tiny fraction of the overall assemblage with the majority of pieces being flakes and debitage with very few tools (pers. comm., Annie Hamilton-Gibney). Here it represents 14%, a comparatively high percentage, with one of the five retouched into a tool.

6.42 This is further highlighted by the results of a large field walking project in the area, which was conducted by Penrith Museum, and only recovered three pitchstone artefacts (pers. comm., Annie Hamilton-Gibney). Consequently, the fact that five pieces have been found together constitutes an important addition to the English record.

6.43 Unfortunately the artefacts were all recovered from topsoil deposits [101] [201] [301] and cannot be securely dated. The narrow form of the pieces, and fact they are manufactured on aphyric pitchstone, which is of high quality and contains little or no phenocrysts, does indicate an Early Neolithic affinity (Ballin 2009). Furthermore, dating work suggests the exchange of pitchstone on the Scottish mainland is an Early Neolithic phenomenon and there is a common association with pottery of the Carinated Bowl Tradition in Scotland (Ballin 2015a).

6.44 The presence of pitchstone assemblages also frequently coincides with the occurrence of Cumbrian tuff. This is commonly in the form of flakes, from the Langdale greenstone axe factories, and suggests they could have been part of the same exchange network (Ballin and Ward 2008). Examples include Carzield in Dumfries and Galloway, where they were also in association with Early Neolithic

pottery (Maynard 1993). At Biggar, South Lanarkshire pitchstone and Cumbrian tuff were found together in large quantities (Ballin 2009). A similar occurrence at Loudoun Hill Quarry (Atkinson et al. 2000) further confirms links between pottery of Early Neolithic date and pitchstone artefacts.

6.45 The majority of dates indicate an Early Neolithic date for the movement and spread of pitchstone. However, there is now evidence for a Late Neolithic phase, mostly along the western coast of Scotland (Ballin 2015b). So, whilst it cannot be said with certainty, it is more likely, given the strong evidence for the exchange of pitchstone as an Early Neolithic phenomenon, coupled with the presence of Cumbrian tuff at the site, that the pitchstone component at Long Meg is associated with the earlier phase of use at the site.

6.46 In 2009, very few examples of pitchstone existed in English contexts, and none were known from Cumbria (Ballin 2009). Given the extensive trade conducted in the Cumbria Group VI axes and the Scottish associations, this lack gave rise to a range of questions (Ballin 2008b). Now it seems more likely this was a function of the record. Pitchstone has been recovered from Northumberland, for example in Coquetdale (Pederson, unpublished). In Cumbria, pitchstone has been identified in the coastal areas (pers. comm., Torben Ballin), and in the Eden Valley (pers. comm., Annie Hamilton-Gibney). Recently, a large assemblage was excavated by Oxford Archaeology North at Stainton West, Carlisle. This site is only 27km to the north-west of Long Meg and produced 263 pieces of pitchstone (OA North 2011). Although, as with many pitchstone assemblages, the context is not secure, containing diagnostic flint artefacts of both Mesolithic and Neolithic types (Ballin 2015b; OA North 2011).

6.47 To conclude, whilst the flint component is in general non-diagnostic, a number of features of the assemblage, such as the technological attributes of SF6, the pitchstone and Cumbrian tuff indicates that although there may be a later Neolithic component, the evidence suggests an Early Neolithic date.

Context	Flint		Greenstone		Quartz		Pitchstone		Total
	Fl	Frag	Fl	Frag	Fl	Frag	Fl	Tool	
[101]	5			1			1	1	9
[113]	1								1
[201]			2		1		2		7
[122]		1				1			2
[207]	1								1
[210]			1	1					2
[301]	2	4			1		1		8
[u/s]	2			2					4
[302]		1							1
Totals	**11**	**4**	**3**	**4**	**2**	**1**	**4**	**1**	**32**

Table 1: Typological composition of the assemblage by context and raw material type. Key: Fl – flake, Frag – Fragment

Context	Flint	Greenstone	Quartz	Pitchstone
[101]	5	1		2
[103]				
[113]	1			
[122]	1			
[201]		2	2	2
[207]	1			
[210]		2		
[301]	6		1	1
[302]	1			
[u/s]	2	2		
Totals	**17**	**7**	**3**	**5**

Table 2: Quantities of artefacts by raw material type

Stone analysis

Results

6.48 Two pink/white quartz pebbles were retained, one u/s from Trench 1 and the other (SF9) from pit fill context [103]. Neither is considered to be a hammerstone. The smaller example (u/s) is oval 64mm long with one broken end, and the other (SF9) is sub-circular 98mm diam. The stones show no battering damage and their crystalline interiors – visible in pits over the surface - would have made them unsuitable for use as hammerstones. It is possible that they were curated, however, and that SF9 was deliberately placed in the pit, but this cannot be determined with any certainty.

6.49 A quantity (315g wt) of other small (50mm long max) irregularly shaped white quartz pebbles were found in topsoil context [201]. While the stones show no evidence of working or deliberate use/placement, it is known that white quartz stones and pebbles are often found at prehistoric (and later) sites, deliberately brought in and probably used for marking or decorating monuments and other important places (Darvill 2002, 73-108).

Iron objects analysis

Results

6.50 Eight objects came from two topsoil contexts. Context [101] had parts of five hand-wrought nails of varying size, all highly corroded. Not easily dated, but they are possibly pre-industrial. A length (148mm) of corroded chain, made up of five oval links, also came from [101]. Both ends are broken. Probably associated with animal tethering. Undateable.

6.51 Context [301] had part of an undateable nail shank and a 19th/early 20th century heel plate.

Industrial residues analysis

Results

6.52 Topsoil context [101] had a small piece of cinder, incorporating fragments of burnt, shaley coal. This context also had a small piece (20g wt) of undiagnostic ironworking residue. The piece is dark and relatively dense, but has a vesicular and slightly corroded interior, suggesting a fairly high iron content.

6.53 Context [201] (also topsoil) had a further small piece of cinder along with a fragment of unburnt coal.

7. Palaeoenvironmental analysis

Methods

7.1 Palaeoenvironmental analysis was carried out on 20 bulk samples, taken from the enclosure ditch, a stakehole, pits, postholes and a possible socket associated with the stone circle. The samples were manually floated and sieved through a 500μm mesh. The residues were examined for shells, fruitstones, nutshells, charcoal, small bones, flint, pottery, glass and industrial residues, and were scanned using a magnet for ferrous fragments. The flots were examined at up to x60 magnification using a Leica MZ7.5 stereomicroscope for waterlogged and charred botanical remains. Identification of these was undertaken by comparison with modern reference material held in the Palaeoenvironmental Laboratory at Archaeological Services Durham University. Plant nomenclature follows Stace (1997). Habitat classification follows Preston *et al.* (2002).

7.2 Charcoal samples were 100% assessed and a selection of fragments from each context was analysed in order to give an overall representation of the material. Identifications were made on fragments >4mm following Boardman (1995). The <4mm sieve fraction was scanned for any additional taxa present. The transverse, radial, and tangential sections were examined at up to x600 magnifications using a Leica DM/LM microscope. Analysis was undertaken following Marguerie & Hunot (2007) and included examination of the number of tree rings, tree ring curvature, and when present the diameter of roundwood was measured. The occurrence of bark, pith, tyloses, insect degradation, reaction wood and alteration by fusion or radial cracks were also recorded. Identifications were assisted by the descriptions of Gale & Cutler (2000), Hather (2000) and Schweingruber (1990), and modern reference material held in the Environmental Laboratory at Archaeological Services Durham University.

7.3 The works were undertaken in accordance with the palaeoenvironmental research aims and objectives outlined in the regional archaeological research framework and resource agendas (Hodgson & Brennand 2007; Hall & Huntley 2007; Huntley 2010).

Results

General comments

7.4 Finds from the samples were sparse, comprising a few quartz chips and a tiny fragment of flint from deposit [122] and a small fragment of fired clay from [216]. Varying quantities of charcoal remains were present in all of the samples and were abundant in fill [118]. At least ten tree/shrub taxa were identified from the samples, although poor condition, extensive mineral inclusions and the friable nature of the material often prevented detailed analysis. Sparse charred plant macrofossil remains consisted entirely of hazel nutshells. Fragments of charred nutshells occurred in 12 deposits from the site (Trenches 1-3), with the largest quantity in posthole fill [121]. Charred cultivated crop remains were absent. Soil samples from fills [304] and [305] were much paler in colour compared to other samples. No obvious reason for this difference was noted. These were selected for SEM-EDS analysis (below).

Trench 1

7.5 Deposits associated with a possible stone socket [112, 113] comprised small quantities of very fragmented charcoal. Six species of tree/shrub were identified from this material including hazel, oak, alder, ash, birch and cherries (blackthorn, wild or bird cherry), with evidence for stemwood and branchwood. Similar material,

but larger in quantity, was recorded nearby in enclosure ditch fill [107]. These fills were the only sampled deposits from the site containing any evidence of ash tree. Hazel branchwood charcoal from [113] was radiocarbon dated to 3340-3020 cal BC.

7.6 Pit deposit [103] contained a small quantity of fragmented charcoal predominantly consisting of oak heartwood/stemwood and cherry family branchwood. The cherry family charcoal comprised evidence of vitrification and radial cracks, possibly indicating the burning of green/damp wood. Rare occurrences of heather and Maloideae (apple/hawthorn) charcoal were recorded.

7.7 Posthole fill [120] comprised small quantities of fragmented charcoal, identified as oak sapwood and hazel branchwood, with rare occurrences of alder stemwood and Maloideae. A concentration of fragmented hazel nutshells (the largest from the site) was recovered from this deposit. A charred hazel nutshell from this deposit provided a radiocarbon date of 3950-3710 cal BC. The comminuted nature of the charcoal may be the result of exposure to repeated burnings and is typical of domestic hearth waste, possibly indicating the presence of a hearth close by.

7.8 Large quantities of charcoal were present in the upper [122] and lower [125] fills of a possible pit [F124]. This charred material was almost entirely composed of small calibre hazel branchwood and stemwood. Small hazel roundwood noted in [125] provided measurements of between 5 and 18mm in diameter. Single occurrences of oak sapwood and blackthorn branchwood in the upper fill are probably intrusive material due to later disturbance. Occasional radial cracks were recorded in the hazel charcoal and evidence of insect degradation (woodworm tunnels) occurred in approximately 10% of the charcoal from [122] and 20% of the charcoal from [125]. Low numbers of charred hazel nutshells were recovered from these deposits. Hazel branchwood charcoal from [125] provided a radiocarbon date of 3360-3100 cal BC.

7.9 Stakehole fill [129] comprised small quantities of very fragmented oak and alder charcoal in equal proportions.

7.10 Charcoal was abundant in deposit [118], consisting of approximately ten litres of material. The condition of this charcoal was relatively good compared to other deposits from the site. Virtually all of the charred material was identified as oak heartwood (timber), due to the common presence of tyloses, weak to moderate growth ring curvature and distinctive fracturing along the ray and ring boundaries. Small quantities of bark, birch branchwood, oak branchwood with eccentric growth and a few fragments of rowan were recorded. Rowan was distinguished from the Maloideae subfamily by several anatomical features including vessels clustering more in the earlywood, abundant fine spiral thickenings and predominant biseriate rays with narrow cells.

7.11 A large element of the oak charcoal from [118] was recorded in the >10mm sieve fraction. The largest fragment was measured as 49mm. Low levels of vitrification, distortion and abundant radial cracks within the oak charcoal provide evidence of high temperatures (Schweingruber 1990), and the 'blocky' angular nature of the material indicates *in situ* burning. The presence of small burnt (magnetised) stones provides further evidence of *in situ* burning at high temperatures. Oak branchwood from this deposit provided a radiocarbon date of 430-610 cal AD.

Trench 2

7.12 Enclosure ditch fill [214] comprised a modest amount of subrounded to subangular charcoal, predominantly identified as alder and hazel with strong or moderate growth ring curvature. Much of the material from this deposit was soft and friable and in poor condition with abundant mineral inclusions, although occasional fragments of Maloideae charcoal comprised a solid composition. Small charred hazel nutshell fragments were present. Hazel branchwood charcoal from this fill provided a radiocarbon date of 3630-3370 cal BC.

7.13 Charcoal remains were common in enclosure ditch deposit [216]. A large element of the material was small calibre hazel branchwood and twigs containing occasional radial cracks. Stemwood of alder, Maloideae and birch comprising moderate growth ring curvature occurred in smaller quantities. A small proportion of the charcoal fragments occurred in the >10mm sieve fraction (1 of only 2 deposits from the site). The charcoal from this deposit, although greater in quantity, was very similar in composition to [214], apart from less evidence of alder. A charred hazel nutshell fragment was recovered from this deposit.

7.14 Posthole deposits [203] and [205] comprised small quantities of charcoal identified as oak sapwood and Maloideae branchwood. Both fills contained low numbers of charred hazel nutshells. This could be residual material if the origin of the postholes is thought to be fairly recent. The possible buried soil deposit [212] contained traces of oak and hazel charcoal, and a charred grass-type rhizome.

Trench 3

7.15 Five deposits sampled from enclosure ditch [F303] comprised comparable material, consisting of small quantities of fragmented charcoal and low numbers of charred hazel nutshell fragments. Identified remains comprised oak stemwood, hazel branchwood and traces of birch stemwood. Charcoal of hazel branchwood and oak sapwood with long latewood growth provided radiocarbon dates of 3960-3790 cal BC and 5290-5040 cal BC respectively. The latter appears to be residual material and provides evidence of Mesolithic activity at the site. This highlights the potential for intrusive material due to disturbance from various phases of activity at the site or taphonomic processes such as bioturbation and water percolation. A summary of radiocarbon dating is provided in Table A1.4. The results are presented in Table A1.3.

Discussion

7.16 The majority of the samples comprised low numbers of charred hazelnuts, while evidence of cultivated crops was absent. Deposits of this nature commonly occur on sites of earlier prehistoric origin (Greig 1991). Low numbers of botanical remains are typical of earlier prehistoric monument sites which tend not to have the significant accumulations of ethnobotanical remains associated with domestic occupation sites (Hall &Huntley 2007). Frequent evidence for the use of hazelnuts indicates the importance of this food source during the Neolithic period and probably represents the remains of communal feasting events at the site.

7.17 Evidence from the analysed charcoal indicated that much of the material from the Neolithic deposits was either of small stemwood or branchwood indicating the presence of easily collectable material. Hazel and oak were the most frequently recorded species in charcoal deposits of Neolithic origin. The deliberate selection of

small calibre hazel branchwood in the both the upper [122] and lower [125] fills of possible pit [F124] suggest this material was collected for a certain purpose. These remains probably represent a wicker-lined pit for storage, possibly for hazelnuts, to be used at a time other than in the autumn. The presence of beetle infestation may explain why this material was set alight. Wicker-lined storage pits have been recorded at Iron Age sites in Britain (Cunliffe 1991), although comparable evidence from elsewhere during the Neolithic period is uncertain.

7.18 The abundance of oak heartwood charcoal from early medieval deposit [118] was notable compared to the Neolithic assemblages. The larger fragment size of this material (up to 5cm) is not characteristic of hearth waste material, where the hot ash charcoals are regularly scattered, and probably reflects an ephemeral nature or single event. The make-up of the material is not typical for charcoal production and the presence of birch branchwood and bark probably represents kindling or 'starter' wood for a fire installation rather than the remains of a structure. The deliberate selection of oak logs suggests either high temperatures (500°C +) were required or visual impact was necessary. Evidence for high temperatures was present, but the absence of calcined bone, food waste or metalwork waste indicates an alternative source for such a sizeable fire. A plausible explanation may be a fire beacon. These features have been recorded close to prehistoric sites on well-placed summits.

SEM-EDS analysis

7.19 The analysis of 3 samples was undertaken by SEM-EDS with the aim of checking for the presence of gypsum. The 3 samples were collected from two different contexts. Sample 1 was composed of soil from context [305] <20>. Sample 2 was composed of soil from context [304] <3>. Sample 3 was composed of 11 rocks and also came from context [304] <3>. Gypsum is a soft sulfate mineral composed of calcium sulfate dihydrate, with the chemical formula $CaSO_4 \cdot 2H_2O$. To determine whether gypsum occurred in the samples, scanning electron microscopy combined with energy dispersive X-ray spectroscopy (SEM-EDS) was utilised as a first analytical step. If the samples contained appreciable amounts of gypsum, bulk X-ray analysis using SEM-EDS would show relatively high levels of both Calcium (Ca) and Sulphur (S). Conversely, the lack of Ca and S, would be a sure indicator of the absence of gypsum from the soils. The presence of Ca and S alone, however, would not signify that gypsum was surely present in the samples as both elements are common components of many types of soils, rocks, and minerals. The discovery of these elements in the samples, thus, would necessitate further testing, potentially using X-ray Diffraction (XRD), to positively identify the presence of gypsum.

7.20 The samples selected for SEM-EDS analysis varied from approximately 15 to 20 grams. The soil samples arrived homogenised and required no further processing before analysis. The rock samples were analysed whole. All three samples were then examined using a Hitachi TM3000 SEM fitted with a SwiftED3000 EDS. The accelerating voltage was set to 15 kV and the probe current was set to 700 pA. The bulk compositional analysis was generated by the SwiftED software using standardless matrix corrections and is semi-quantitative. About 1 gram of sample was used in each analysis. Appreciable amounts of Calcium (less than .2 % by weight) or Sulphur (less than .06% by weight) were not recorded in any of the samples. The lack of gypsum in any of the samples was confirmed without the need for further testing using other analytical methods. Samples 1 (Appendix A1.5) and 2 (Appendix A1.6), both soils, seem to be mostly composed of quartz, feldspar, and clay minerals.

Sample 3 (Appendix A1.7), was a mixture of two different types of rocks, sandstone and what appears to be highly weathered granite, possibly rhyolite. The circle stones at Long Meg are mostly made of rhyolite, and are glacial erratics. The Long Meg monolith is made of red sandstone. It is very likely the rocks of sample 3 are composed of the same materials as the Long Meg monolith (red sandstone) and the circle stones (rhyolite).

8. Radiocarbon dating

8.1 AMS radiocarbon dating and calibration were carried out by the Scottish Universities Environmental Research Centre (SUERC), East Kilbride, Scotland using OxCal4 software and IntCal13 atmospheric curve. The charred plant macrofossil material selected for seven individual dates provided adequate carbon for accurate measurement in each case, and analyses proceeded normally. A summary of radiocarbon dating is provided in Table A1.4.

9. Conclusions

Mesolithic (*c.*10000-4000 BC)

9.1 The primary fill of the enclosure ditch provided two AMS radiocarbon dates. The earliest date was 5290-5050 cal BC, a Mesolithic date, much earlier than any other date from the site. The similarities between the primary ditch fill and the underlying natural subsoil suggest that the up-cast from the original excavation of the ditch initially provided an associated bank, but that this material very quickly found its way back into the ditch, either being washed in or through deliberate backfilling. The early date may be residual material from the topsoil, or possibly from an earlier feature that was removed by the ditch, being redeposited at the base of the ditch. The date can be taken to indicate probable late Mesolithic activity on the site.

9.2 Mesolithic activity has been documented at many other Neolithic sites, including stone circles. At Stonehenge several Mesolithic pits were recorded, three of which may have held large pine posts (Vatcher & Vatcher 2003). At Avebury many Mesolithic flints were found in the vicinity, including a concentration indicative of a possible flint-working site which might be evidence for a temporary camp near the site. It has been suggested that a large posthole near the south entrance might be Mesolithic. Although the posthole has not been dated, its position was considered out of place with the rest of the monument (Pollard and Gillings 2004, 23-25). A similar scenario has been suggested at Hambledon Hill, a Neolithic enclosure in Dorset (ibid., 25). Bann flakes, Mesolithic leaf-shaped flint tools, were also found in early deposits at Newgrange (Stout 2004, 19). Mesolithic flint tools have also been found around the Thornborough Henges, and a nearby double pit alignment at Nosterfield has been dated to the Mesolithic (Dickson & Hopkinson 2011). A Mesolithic knapping floor comprising over 1100 chert flakes was recorded at Marne Barracks, Catterick, beneath a large Neolithic palisaded enclosure (Hale 2009).

Early Neolithic (4000-*c.*3400 BC)

9.3 The later radiocarbon date was 3950-3790 cal BC. Although as a consequence of the earlier date both must be viewed with caution, this date suggests the ditch was backfilled after this time. A narrow and shallow recut was made through the centre of the basal fill of the ditch. This was particularly evident in Trenches 2 and 3. The fill

of the recut was radiocarbon dated to 3630-3370 cal BC in Trench 2. This may suggest that the ditches were probably maintained for a very considerable period.

9.4 The primary fill of the recut ditch again included a significant amount of pink sand potentially derived from redeposited natural subsoil. Although this could be a consequence of deliberate backfilling, this layer was relatively shallow, perhaps indicating the sand had eroded back in. Subsequent fills of the ditch were distinct from each other, and included a late deposit of grey sand. This was initially considered to potentially be gypsum, available locally and considered to be used at the Thornborough Henges. Samples submitted for SEM-EDS analysis confirmed that it was not gypsum, and that it is very likely that one of the samples was composed of the same materials as the Long Meg monolith (red sandstone) and the circle stones (rhyolite). It is conceivable that this material could have been used to maintain a boundary around the site after the ditch was filled.

9.5 The non-intrusive surveys of the site have suggested the possibility of causewayed entrances into the enclosure. Infra-red photography appears to show a causewayed entrance through the ditch immediately north of a possible entrance to the stone circle, between stones 17-19. However, this was not evident in the resistance survey; although the anomaly was weak it does appear to continue unbroken at this point. The resistance survey did, however, suggest a possible narrow causeway may be present just to the east, north of stones 21-22 (Archaeological Services 2013, 13). No evidence of a causeway was identified in Trench 1, which was located over the west terminus proposed by the infra-red photography. No features identified as potentially Neolithic were recorded within the enclosure in any of the trenches.

9.6 The second radiocarbon date from the primary fill of the ditch corresponded very closely to posthole F121 (3950-3720 cal BC), suggesting they were contemporary. This posthole was very well defined, with steep sides, a flat base and packing stones. As the area of excavation was relatively small, it was not possible to determine whether the post was an isolated feature or had been part of a larger structure.

Middle Neolithic (*c*.3400-3000 BC)

9.7 Adjacent to posthole F121 was a larger pit F124. This also had steep sides with a flat base, and several possible packing stones, so was initially considered to be a much larger posthole. The palaeoenvironmental analysis has identified evidence of a possible burnt wicker lining constructed from hazel wood, suggesting this was used as a storage pit, perhaps for preserving hazel nutshells. The wood had evidence of woodworm, which was probably the reason it was burnt. The pit was radiocarbon dated to 3360-3100 cal BC.

9.8 In Trench 1 a shallow pit, potentially a socket for a former standing stone, was excavated. The socket was positioned roughly where it might be expected to be in order to form an entrance with Stone 19. The pit is relatively shallow, cut only 0.3m into the natural subsoil. The cut for the pit was ill-defined, but some degree of disturbance as a consequence of the removal of the stone would be expected. A concentration of stones around the edge of the pit may have been packed around the standing stone; such concentrations were recorded at the base of Stone 17, and potentially around the base of Stone 25 and Stone 26, although as these are no longer standing their precise original location is uncertain. A second pit [F104] south

of Stone 17 might also mark the place of a stone, but this pit was too shallow and poorly defined for any conclusions to be drawn.

9.9 William Stukeley visited Long Meg *c.*1725 and recorded that the circle was being damaged, with stones being carted away, broken up with gunpowder and sawn up for millstones (Frodsham 2015).

Later features

9.10 A fragment of Roman pottery was recovered from the topsoil, indicating activity on the site at this time.

Early Medieval (5th century AD-1066)

9.11 The upper fill of the enclosure ditch was cut by a probable pit. Its primary fill comprised oak heartwood and may reflect the remains of a burnt structure or a particularly large fire potentially burnt *in situ.* The wood predominantly comprised oak heartwood, which burns to a high temperature. The absence of calcined bone, food waste or metalwork waste suggests the fire was itself the purpose of its construction, possibly as a beacon. The charcoal has been radiocarbon dated to 430-610 cal AD, indicating early medieval activity on the site. Significant early medieval activity has been established on many prehistoric sites, often in the form of burial, perpetuating the impression of spiritual significance. Williams (1997, 7) recognises 27 such occurrences, including the reuse of barrows.

?Medieval - ?modern (1066 onwards)

9.12 A clayey sand subsoil overlay the natural subsoil and the aforementioned features. A cobbled surface was set into this between Stones 25 and 26. This surface continued beyond the south extent of the trench, but stopped at the edge of the stone circle, coinciding closely with the north edge of the backfilled ditch. There was no evidence for the surface extending east or west as it was not encountered at the bases of Stones 25 or 26. Since this surface was cut in to the subsoil, which the burnt pit in Trench 1 was beneath, the assumption is that this surface must be early medieval or later. There was no evidence in the geophysical surveys that this surface was part of a defined path through the circle, although there is an appreciable contrast in the resistance survey that suggests the interior of the monument was generally stony than the surrounding area.

9.13 Two small postholes cut through the subsoil in Trench 2 are characteristic of fence stakes driven into the ground, widely used in agricultural fencing. Regular visitors to the site were in agreement that the circle has not been fenced off in the last 50 years, but the posts could relate to fencing of an earlier date.

10. Sources

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Appendix 1: Data tables

Table A1.1: Context data

The • symbols in the columns at the right indicate the presence of artefacts of the following types: P pottery, B bone, M metals, F flint, I industrial residues, G glass, C ceramic building material, S Stone.

No	Area	Description	P	B	M	F	I	S
101	1	Topsoil	•	•	•	•	•	•
102	1	Stone fill of F104						
103	1	Fill of F104						•
F104	1	Shallow pit						
F105	1	Stone socket						
106	1	Subsoil						
107	1	Stone deposit in F109						
108	1	Fill of F109						
F109	1	Ditch cut						
110	1	Fill of F111						
F111	1	Ditch/pit cut						
112	1	Fill of F105						•
113	1	Fill of F105				•		
114	1	VOID						
115	1	Fill of F109				•		
116	1	Fill of F109	•					
117	1	Fill of F109						
118	1	Charcoal deposit in F111						
119	1	Packing stones in F121						
120	1	Fill of F121						
F121	1	Posthole						
122	1	Fill of F124						
123	1	Stones in F124						
F124	1	Pit/posthole						
125	1	Fill of F124						
126	1	Stone deposit in F105						
127	1	Packing stones in F105						
128	1	Fill of F109						
129	1	Fill of F130						
F130	1	Stakehole						
131	1	Natural subsoil						
132	1	Stones around base of Stone 17						
F133	1	Recut of ditch F109						
201	2	Topsoil	•	•		•		•
202	2	Subsoil						
203	2	Fill of F204						
F204	2	Posthole						
205	2	Fill of F206						
F206	2	Posthole						
207	2	Fill of F208				•		
F208	2	Ditch						
209	2	Stone deposit						
210	2	Cobbled surface						•
211	2	Fill of F208						
212	2	Buried topsoil						
213	2	Fill of F208						
214	2	Fill of F208						
215	2	Fill of F208	•					
216	2	Fill of F208						
217	2	Natural subsoil						
218	2	Packing stones						
219	2	Packing stones	•		•	•		
F220	2	Recut of ditch F208						
301	3	Topsoil						•
302	3	Fill of F303						

No	Area	Description	P	B	M	F	I	S
F303	3	Ditch						
304	3	Fill of F303						
305	3	Fill of F303						
306	3	Fill of F303						
307	3	Fill of F303						
308	3	Subsoil						
309	3	Natural subsoil						
F310	3	Recut of ditch F303						
F311	3	Recut of F310						

Table A1.2: Catalogue of the lithic assemblage

Context	Raw material	Description	Length (mm)	Width (mm)	Thickness (mm)	Cortex	Termination	Butt	Patination	Condition
101 (SF2)	pitchstone	piercer	8.78	6.69	1.43	n/a	feather	removed	n/a	fresh
101 (SF4)	flint	flake	14.45	20.9	7.4	none	feather	removed	slight	rolled
101 (SF5)	flint	flake	22.19	17.47	6.96	<25%	n/a	n/a	slight	rolled
101 (SF6)	flint	flake	46.2	29.34	6.76	<25%	feather	plain	fully	fresh
101 (SF8)	pitchstone	flake	16.46	10.79	5.45	n/a	plunged overshoot	removed	n/a	fresh
101 (SF10)	flint	flake	13.24	9.01	1.43	None	feather	removed	none	mint
101 (SF13)	flint	flake	15.38	30.62	4.93	25-50%	plunged overshoot	removed	slight	fresh
101	greenstone	fragment	52.53	42.15	13.82	n/a	n/a	n/a	n/a	fresh
113 (SF12)	flint	flake	11.31	15.35	2.15	25-50%	hinge	removed	none	fresh
122 <16>	flint	chip	6.44	6.35	1.98	none	feather	removed	slight	rolled
122 <16>	quartz	fragment	11.89	7.85	3.84	n	n/a	n/a	n/a	n/a
201 (SF1)	greenstone	flake	47.24	31.55	7.95	n/a	feather	plain	n/a	rolled
201 (SF3)	greenstone	flake	28.51	26.06	4.99	n/a	removed	dihedral	n/a	mint
201 (SF7)	pitchstone	flake	14.29	9.54	4.13	n/a	plunged overshoot	marginal	n/a	fresh
201 (SF7)	pitchstone	flake	14.02	16.49	4.71	n/a	step	removed	n/a	fresh
201	quartz	flake	10.52	5.51	2.28	n/a	n/a	n/a	n/a	n/a
207	flint	flake	18.91	18.59	3.66	<25%	n/a	n/a	fully	fresh
210 (SF11)	greenstone	flake	25.82	18.11	2.47	n/a	removed	plain	n/a	fresh
210	greenstone	fragment	48.11	35.5	13.63	n/a	n/a	n/a	n/a	rolled
301	flint	fragment	24.17	15.53	18.38	25-50%	n/a	n/a	slight	rolled
301	flint	fragment	17.18	14.46	8.65	none	n/a	n/a	partial	rolled
301	flint	flake	13.76	13.26	2.34	none	removed	removed	fully	fresh
301	flint	fragment	11.5	6.84	6.06	none	n/a	n/a	partial	fresh

Context	Raw material	Description	Length (mm)	Width (mm)	Thickness (mm)	Cortex	Termination	Butt	Patination	Condition
301	flint	fragment	17.31	10.82	7.04	none	n/a	n/a	slight	fresh
301	flint	flake	18.38	17.87	6.77	25-50%	step	removed	partial	fresh
301	pitchstone	flake	11.9	8.05	2.73	n/a	feather	marginal	n/a	fresh
301	quartz	flake	9.52	5.72	3	none	n/a	n/a	none	n/a
302 <4>	flint	chip	4.72	6.67	0.46	none	removed	removed	mostly	fresh
u/s	flint	flake	12.72	9.06	2.19	none	hinge	removed	slight	fresh
u/s	flint	flake	11.31	13.54	4.56	<25%	n/a	n/a	none	fresh
u/s	greenstone	flake	19.67	21.34	7.26	n/a	n/a	n/a	n/a	fresh
u/s	greenstone	flake	14.66	20.54	5.39	n/a	n/a	n/a	n/a	fresh

Table A1.3: Data from palaeoenvironmental assessment

Trench	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**1**	**2**	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**3**	**3**
Sample	**5**	**10**	**8**	**11**	**19**	**12**	**15**	**16**	**17**	**18**	**1**	**2**	**6**	**7**	**14**	**4**	**3**	**20**	**9**	**13**
Context	**103**	**107**	**112**	**113**	**113**	**118**	**120**	**122**	**125**	**129**	**203**	**205**	**212**	**214**	**216**	**302**	**304**	**305**	**306**	**307**
Feature number	**104**	**109**	**105**	**105**	**105**	**111**	**121**	**124**	**124**	**130**	**204**	**206**	**-**	**208**	**208**	**303**	**303**	**303**	**303**	**303**
Feature	**P**	**ED**	**SS**	**SS**	**SS**	**P/D**	**PH**	**P/PH**	**P/PH**	**SH**	**PH**	**PH**	**BT**	**ED**	**ED**	**ED**	**ED**	**ED**	**ED**	**ED**
Material available for radiocarbon dating	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	-	✓	✓	(✓)	✓	✓	✓	✓
Volume processed (l)	18	15	14	10	5	33	19	20	16	1	2	2	5	8	7	18	15	14	18	19
Volume of flot (ml)	200	60	150	100	25	9900	60	200	250	15	50	40	50	150	400	100	40	100	30	30
Residue contents																				
Burnt stones magnetised	-	-	-	-	-	++	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Charcoal	-	-	-	-	-	++	-	-	-	-	-	-	-	+	+	-	+	+	-	-
Fired clay / Pot (number of fragments)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-	-	-	-
Flint (number of fragments)	-	-	-	-	-	-	-	1	-	-	-	-	-	-	-	1	-	-	-	-
Quartz (number of fragments)	-	-	-	-	-	-	-	2	-	-	-	-	-	-	-	-	-	-	-	-
Flot matrix																				
Charcoal	++	++	++	++	+	++++	++	+++	+++	++	++	++	+	+++	+++	+	++	+	++	++
Monocot stem (charred)	-	-	-	-	(+)	-	-	-	-	-	-	-	-	-	(+)	-	-	-	-	-
Rhizomes (charred)	-	-	-	-	-	-	-	-	-	-	-	-	+	(+)	-	-	-	-	-	-
Roots (modern)	+++	++	+++	++	+	-	++	++	+	+	++	++	++	+	-	++	++	++	++	+
Uncharred seeds	(+)	-	(+)	(+)	(+)	-	-	-	-	-	(+)	-	(+)	-	-	(+)	(+)	-	-	-
Charred remains (total count)																				
(t) *Corylus avellana* (Hazel) nutshell frag.	-	2	-	-	-	-	28	1	3	-	3	1	-	3	1	1	1	1	4	-
Identified charcoal																				
Alnus glutinosa (Alder)	-	++	+	(+)	(+)	-	+	-	-	++	-	-	-	++	+	-	-	-	-	-
Betula sp (Birches)	-	-	(+)	-	-	++	-	-	-	-	-	-	-	-	+	-	-	(+)	(+)	(+)
Calluna vulgaris (Heather)	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Corylus avellana (Hazel)	-	+	++	+	+	-	++	+++	+++	-	-	+	(+)	++	+++	+	++	+	++	+
Fraxinus excelsior (Ash)	-	+	-	+	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Maloideae (Hawthorn, apple)	+	-	-	-	-	-	+	-	-	-	+	+	-	+	++	-	+	-	-	-
Quercus sp (Oaks)	++	++	+	+	+	++++	++	(+)	-	++	++	+	+	+	(+)	+	+	+	+	++
Prunus spinosa (Blackthorn)	-	-	-	-	-	-	-	(+)	-	-	-	-	-	-	-	-	-	-	-	-
Prunus sp (Blackthorn, wild and bird cherry)	++	-	-	(+)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salicaceae (Willow, poplar)	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sorbus aucuparia (Rowan)	-	-	-	-	-	+	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Weight of charcoal >10mm (g)	-	-	-	-	-	247	-	-	-	-	-	-	-	-	5	-	-	-	-	-
Weight of charcoal 4-10mm (g)	-	-	-	-	-	592	-	5	16	-	-	-	-	29	59	-	2	<1	<1	-
Total weight of charcoal (g)	8	15	4	4	2	2542	5	14	46	1	<1	<1	<1	70	156	<1	5	<1	3	3

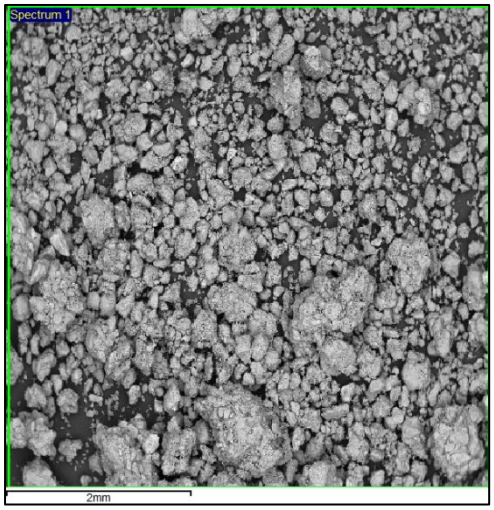
[t-tree/shrub. BT-Buried Topsoil; ED-Enclosure Ditch; P-Pit; PH-Posthole; SH-Stakehole; SS-Stone Socket; (+): trace; +: rare; ++: occasional; +++: common; ++++: abundant (✓) may be unsuitable for dating due to size or species]

Table A1.4: Summary of radiocarbon dating

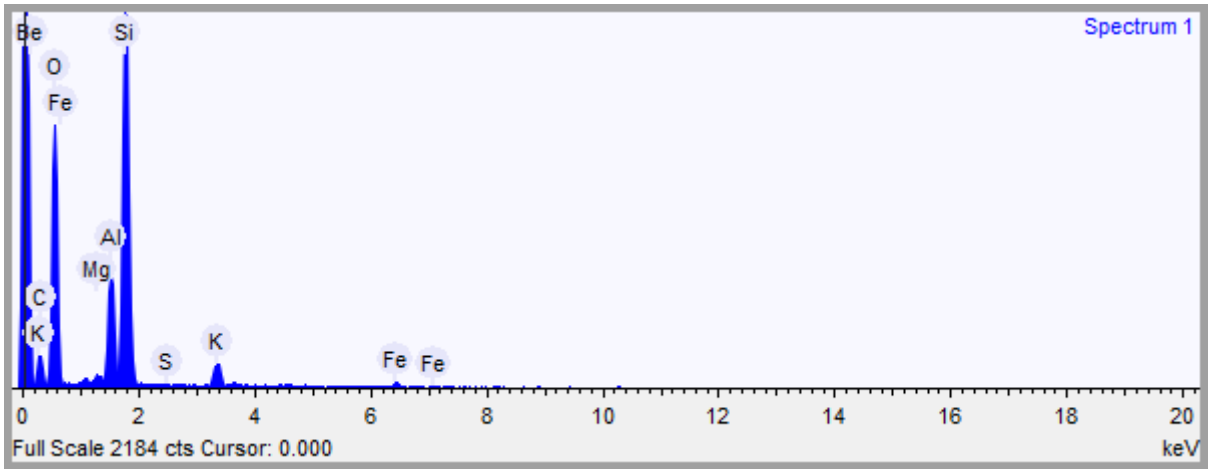
Laboratory code	Context	Sample	Context information	Depositional context	Material	$\delta^{13}C$ ‰	Radiocarbon Age BP	Calibrated date 95.4% probability
SUERC-64638 GU39503	113	11	fill of [F105] stone socket	secondary	hazel branchwood charcoal	-27.3	4475 ± 30	3339 (54%) 3206 cal BC 3196 (34.6%) 3085 cal BC 3063 (6.8%) 3029 cal BC
SUERC-64644 GU39506	118	12	fill of [F111] pit/ditch	primary	oak branchwood charcoal	-24.6	1520 ± 29	428 (29.2%) 496 cal AD 506 (66.2%) 609 cal AD
SUERC-64639 GU39504	120	15	fill of [F121] posthole	secondary	hazel nutshell (charred)	-24.4	5034 ± 29	3948 (92.5%) 3761 cal BC 3739 (1.1%) 3731 cal BC 3725 (1.8%) 3715 cal BC
SUERC-64640 GU39505	125	17	fill of [F124] pit/posthole	primary	hazel branchwood charcoal	-25.7	4527 ± 29	3359 (32.1%) 3264 cal BC 3241 (63.3%) 3104 cal BC
SUERC-64646 GU39508	214	7	fill of [F208] enclosure ditch	secondary	hazel branchwood charcoal	-27.3	4697 ± 29	3629 (14%) 3586 cal BC 3531 (21.8%) 3488 cal BC 3472 (1.0%) 3372 cal BC
SUERC-64645 GU39507	307	13	fill of [F303] enclosure ditch	secondary	hazel branchwood charcoal	-27.1	5063 ± 28	3952 (95.4%) 3794 cal BC
SUERC-65811 GU40000	307	13	fill of [F303] enclosure ditch	secondary	oak sapwood charcoal	-24.5	6196 ± 30	5287 (1.8%) 5269 cal BC 5230 (93.6%) 5047 cal BC

[The calibrated age ranges are determined using OxCal4.2.4 (Bronk Ramsey 2009); IntCal13 curve (Reimer *et al.* 2013)]

A1.5: SEM-EDS Bulk Analysis; Sample 1



Back-Scattered SEM image of Sample 1 (AAL15 (305) <20> XRF). Area of EDS analysis is shown in Green



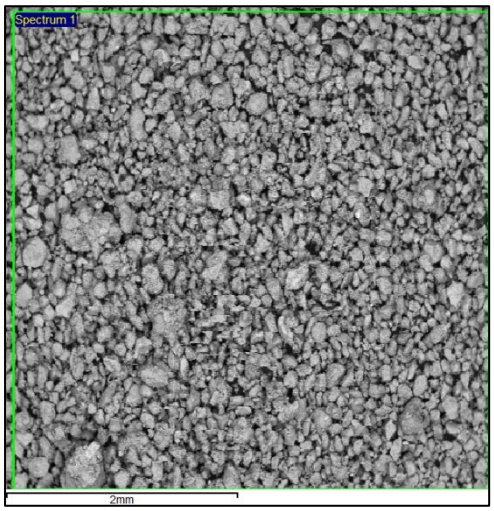
EDS Spectra resulting from the analysis of sample 1

Summary results

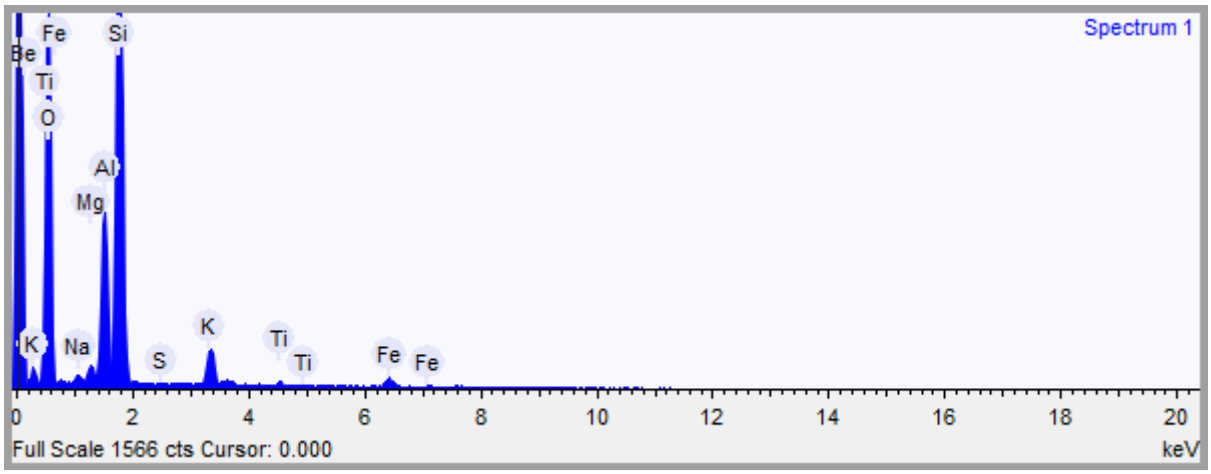
Element	Weight %	Weight % σ	Atomic %
Carbon	15.180	1.905	22.204
Oxygen	53.884	1.283	59.171
Magnesium	0.441	0.077	0.319
Aluminum	5.421	0.188	3.530
Silicon	21.151	0.546	13.231
Sulfur	0.056	0.062	0.030
Potassium	2.214	0.122	0.995
Iron	1.653	0.220	0.520

Quantitative values for various elements in sample 1 as determined by EDS analysis.

A1.6: SEM-EDS Bulk Analysis; Sample 2



Back-Scattered SEM image of Sample 2 (AAL15 (304) <3> XRF). Area of EDS analysis is shown in Green



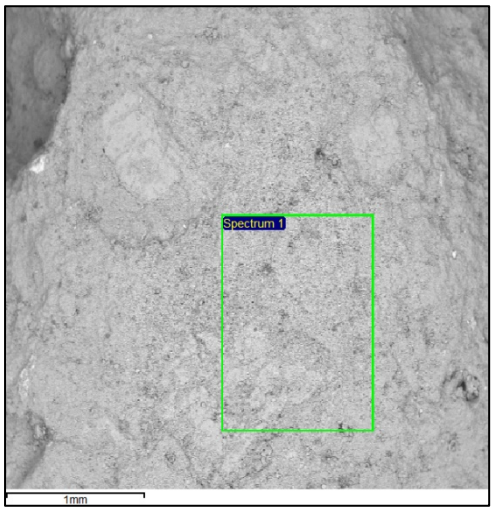
EDS Spectra resulting from the analysis of sample 2

Summary results

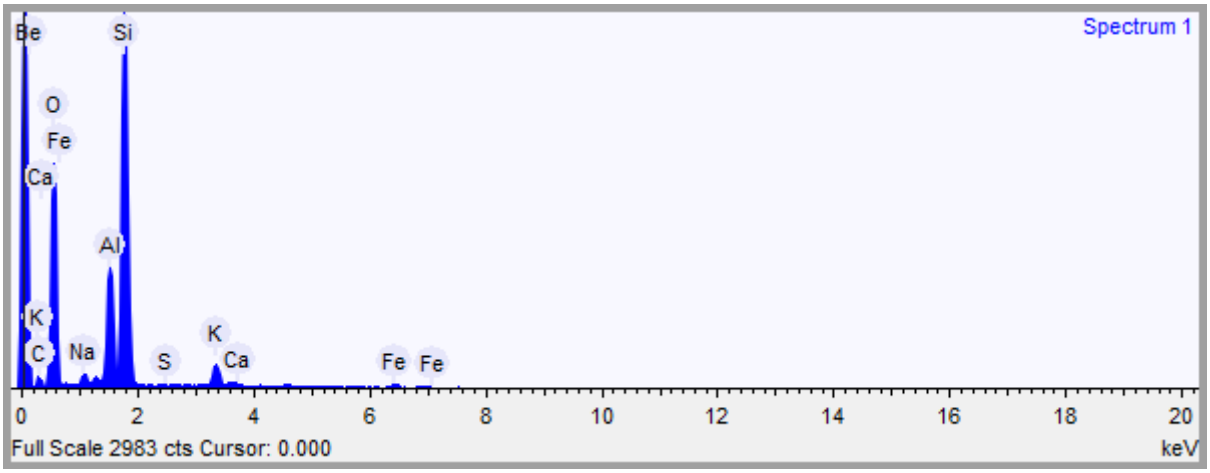
Element	Weight %	Weight % σ	Atomic %
Oxygen	58.621	0.486	72.225
Sodium	0.442	0.112	0.379
Magnesium	0.731	0.101	0.593
Aluminum	7.580	0.187	5.537
Silicon	26.468	0.351	18.576
Sulfur	0.000	0.000	0.000
Potassium	3.229	0.145	1.628
Titanium	0.467	0.128	0.192
Iron	2.462	0.276	0.869

Quantitative values for various elements in sample 2 as determined by EDS analysis.

A1.7: SEM-EDS Bulk Analysis; Sample 3



Back-Scattered SEM image of Sample 3 (AAL15 (304) <3> XRF), probably a weathered granite (rhyolite?). Area of EDS analysis is shown in Green



EDS Spectra resulting from the analysis of sample 3

Summary results

Element	Weight %	Weight % σ	Atomic %
Carbon	5.546	3.567	8.804
Oxygen	54.281	2.091	64.695
Sodium	0.979	0.107	0.812
Aluminum	7.624	0.328	5.388
Silicon	27.030	1.063	18.352
Sulfur	0.000	0.000	0.000
Potassium	2.685	0.156	1.309
Calcium	0.048	0.083	0.023
Iron	1.806	0.219	0.617

Quantitative values for various elements in sample 3 as determined by EDS analysis

Appendix 2: Stratigraphic matrix

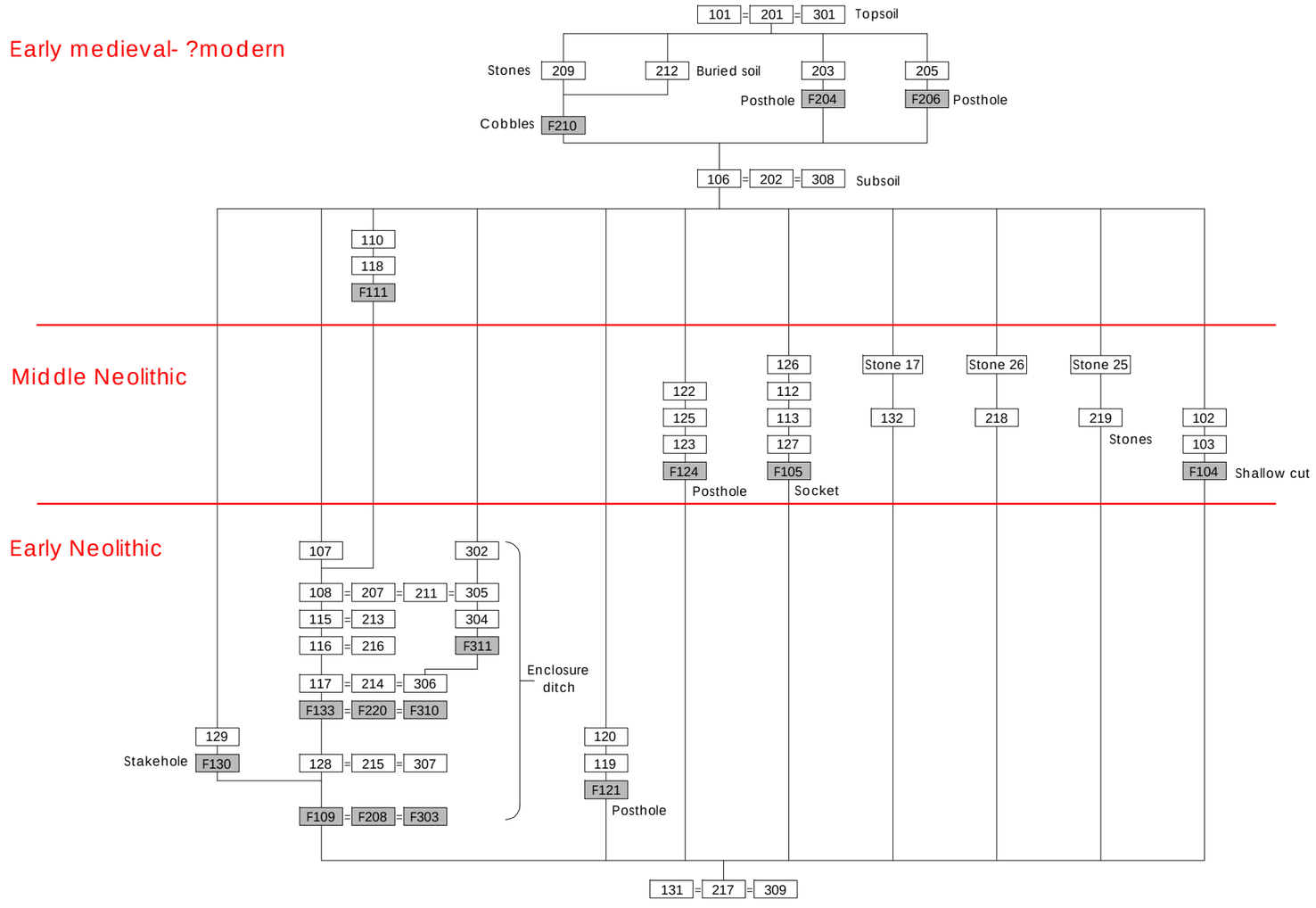


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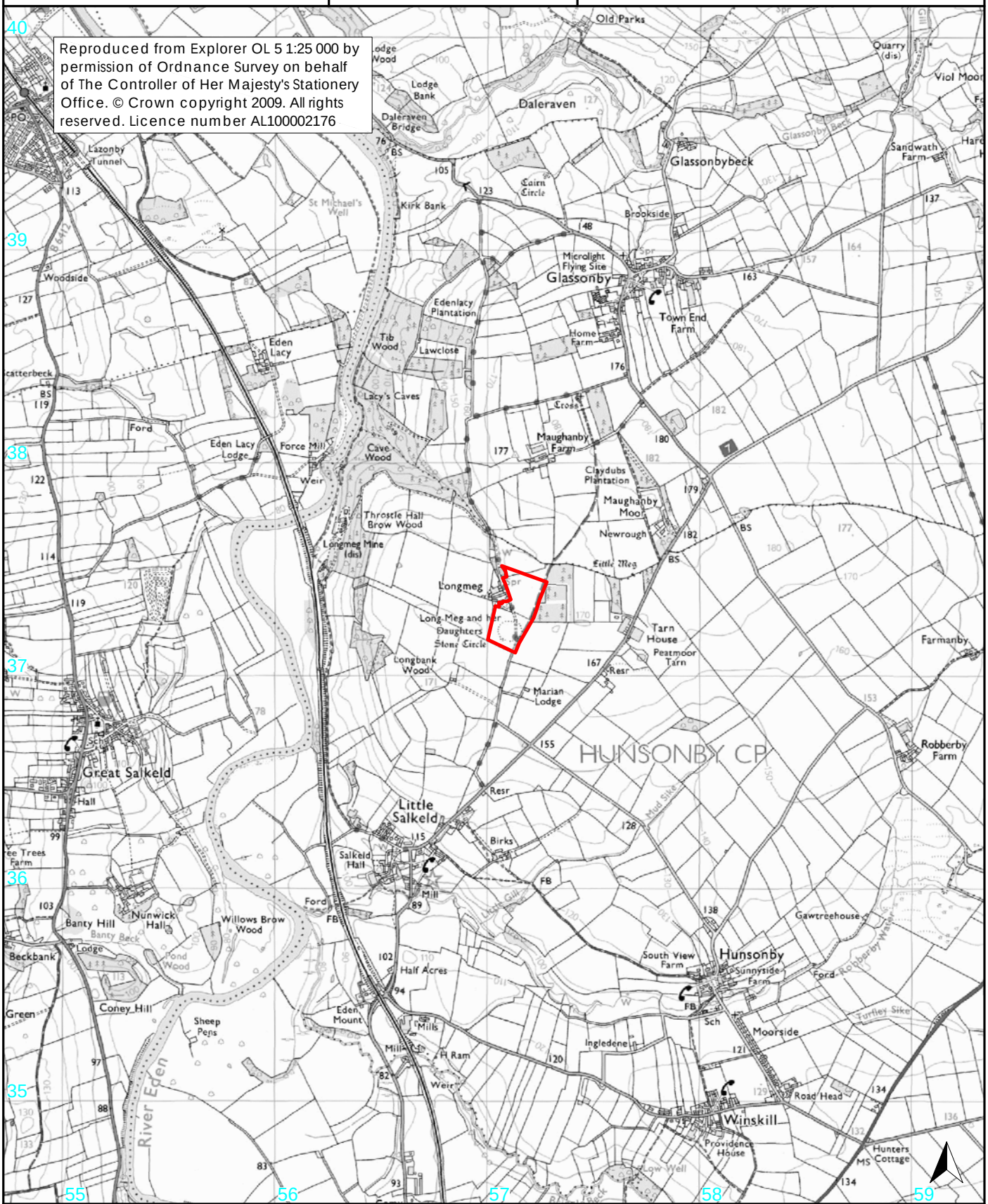
Figure 1: Site location



site boundary

0 1km
scale 1:25 000 for A4 plot

study boundary
survey area
1 stones
ditch transcribed from aerial photograph
soil-filled feature
possible stone / bank
former ploughing
track
bank
tree
metal sign
trench

inset showing trench 3 plan main features (red)
see figure 4

r2

Area 2

Springs

Track

Longmeg

Area 1

Long Meg and Her Daughters

1 2 3

inset showing trenches 1 & 2 main features (red)
see figures 3 & 4

r8 r9 r11

375 374 373 372 572 572 570 571

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0 50m
scale 1:1250 for A3 plot

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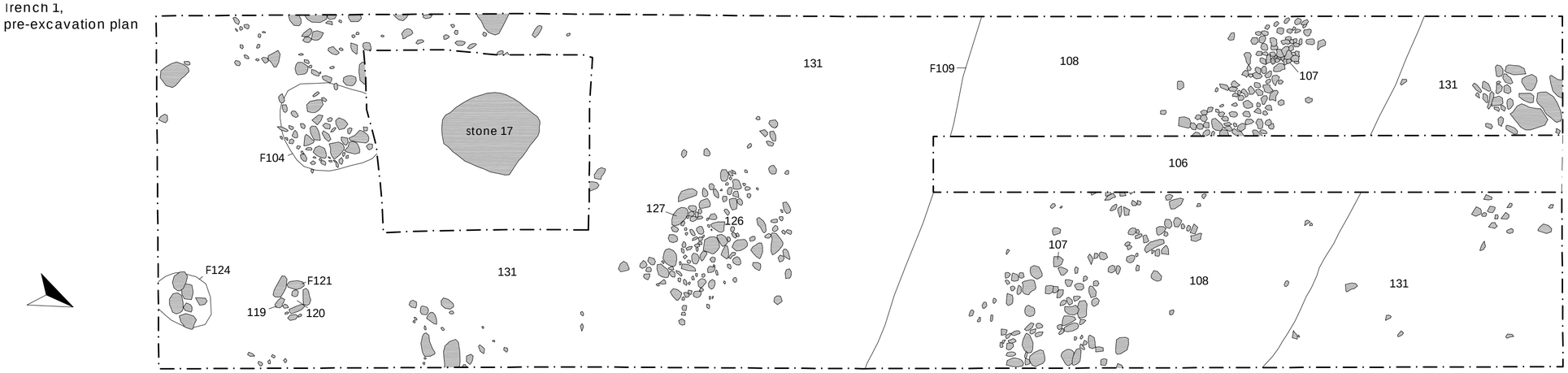
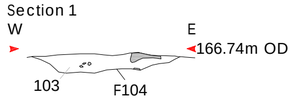
Figure 2: Trench locations on archaeological interpretation

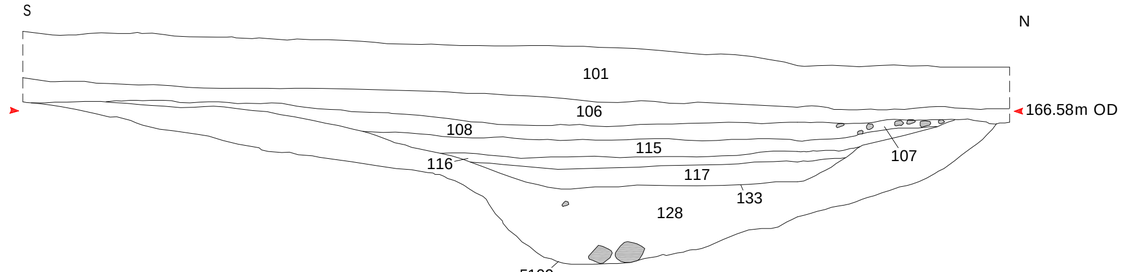
Trench 1,
pre-excavation plan



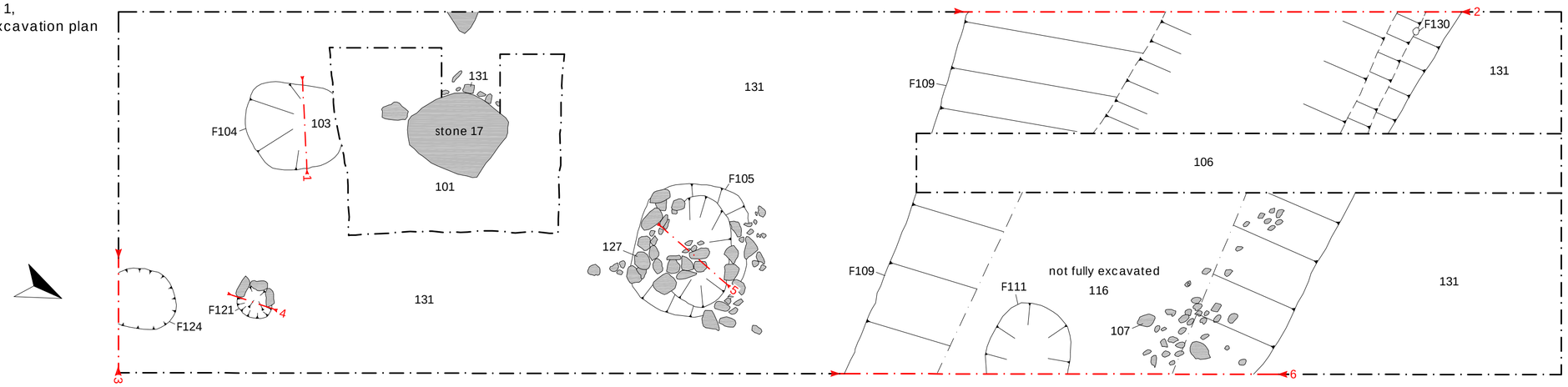
Section 1



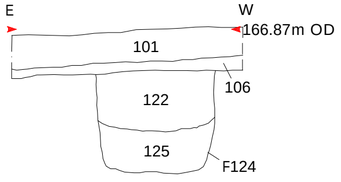
Section 2



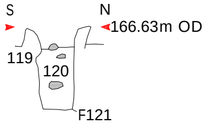
Trench 1,
post-excavation plan



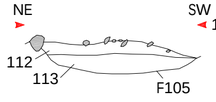
Section 3



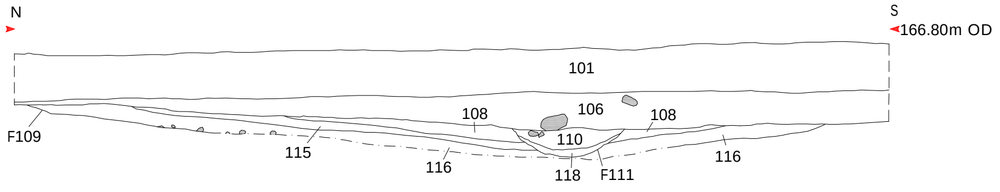
Section 4



Section 5



Section 6



extent of excavation

section 2

stone

0 1.5m
scale of sections 1:30 for A2 plot

0 2m
scale of plans 1:50 for A2 plot

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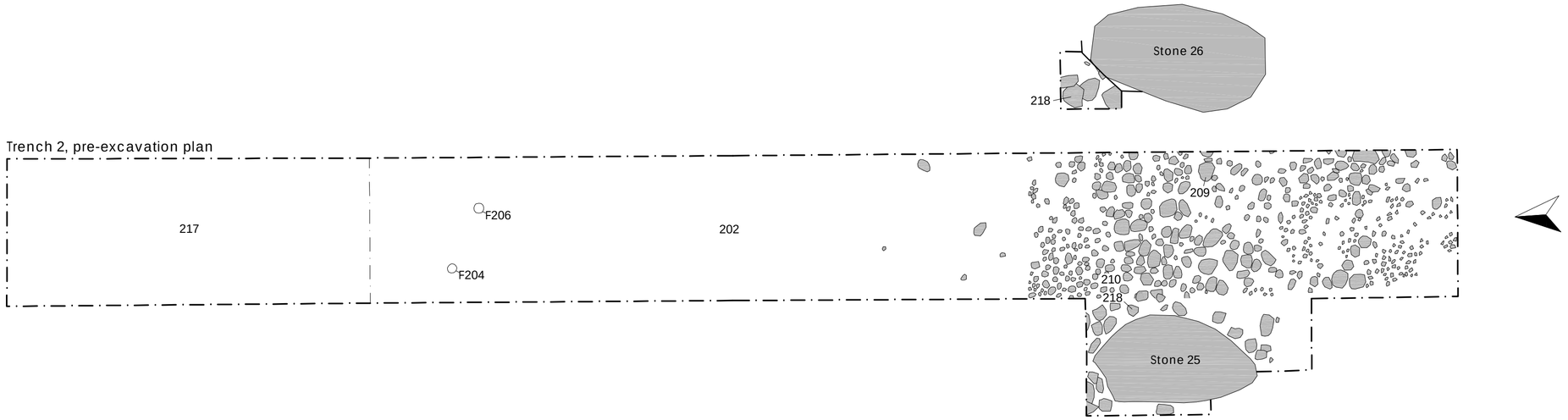
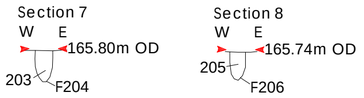
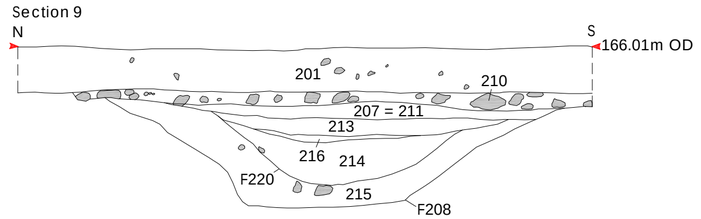
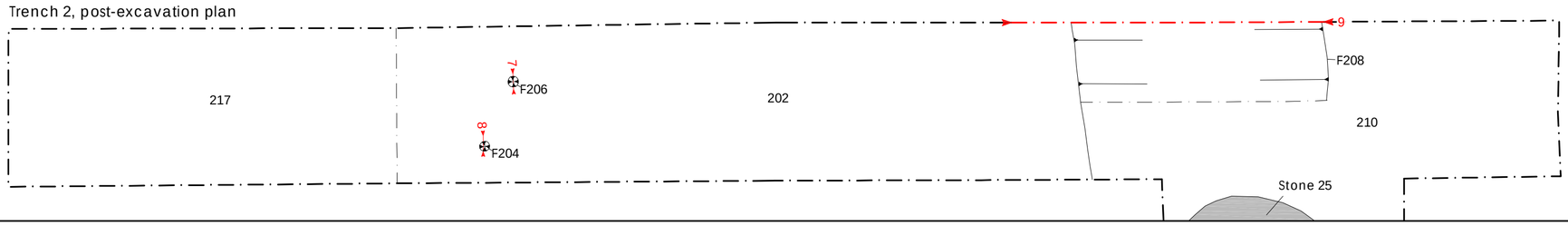
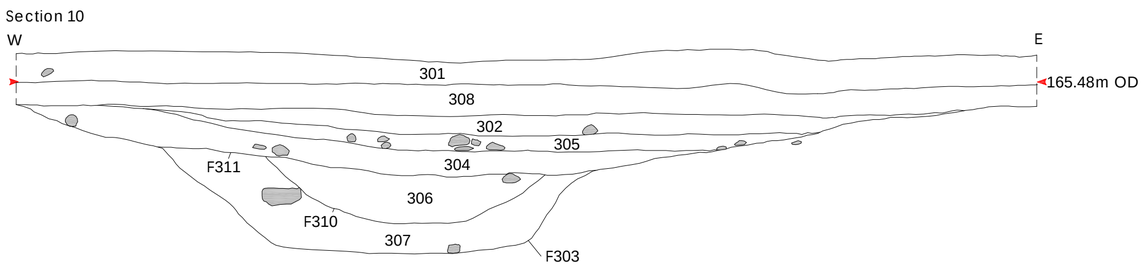
Figure 3: Trench 1, plans and sections

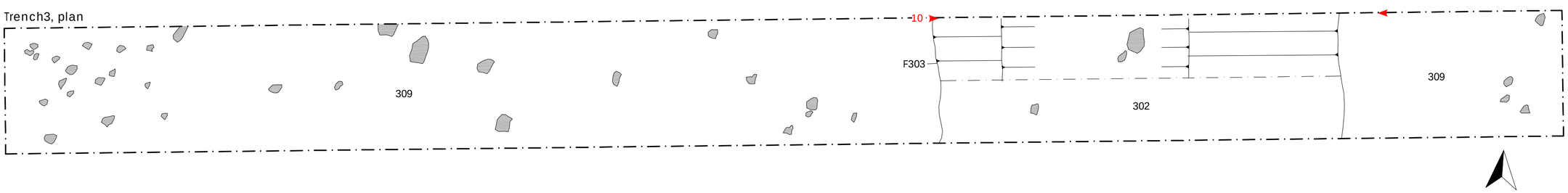












extent of excavation

section 2

stone

0 1.5m
scale of sections 1:30 for A2 plot

0 2m
scale of plans 1:50 for A2 plot

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Figure 4: Trenches 2 & 3, plans and sections

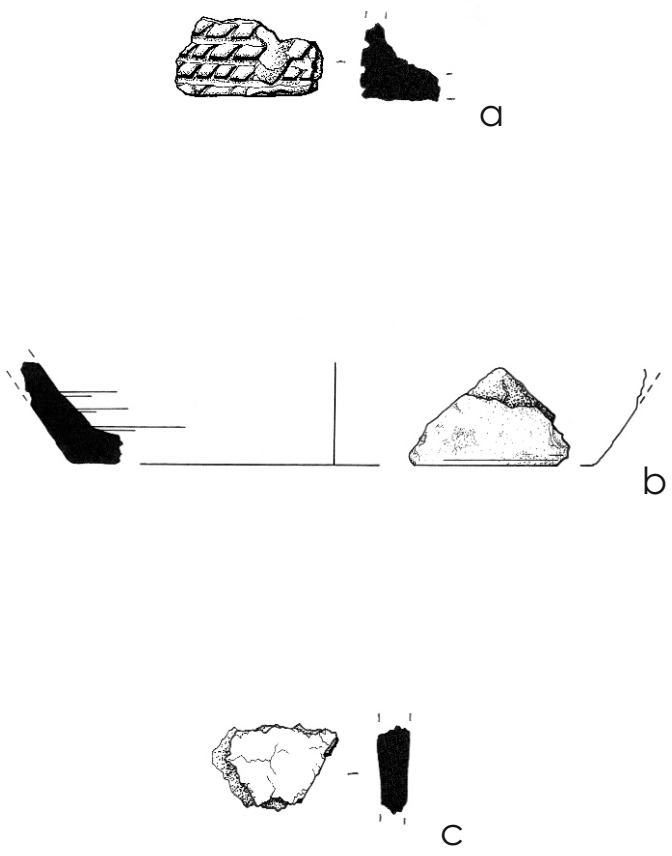

Figure 5: Pottery a - sf15 (116), b - (201), c - sf14 (215)

Figure 6: Trench 1, enclosure ditch F109, looking south-west

Figure 7: Trench 2, enclosure ditch F208, looking east

Figure 8: Trench 3, enclosure ditch F303, looking north-west

Figure 9: Trench 1, posthole F121, looking west

Figure 10: Trench 1, pit/posthole F124, looking south

Figure 11: Trench 1, stone socket F105 with standing stone 17 behind, looking south-west

Figure 12: Trench 2, prone standing stone 25 with possible cup mark along bottom left edge, looking south

Figure 13: Trench 2, detail of prone standing stone 25 showing possible cup mark underneath, looking north-west

Figure 14: Trench 1, burnt pit F111 (top right) cut through top of enclosure ditch F109, looking east

Figure 15: Trench 2, cobbled surface 210 with larger stones 209 on top, looking south-west

Figure 16: Trench 2, postholes F204 and F206, looking west

Figure 17: Curved pitchstone flake [101] (SF8)

Figure 18: Small pitchstone piercer [101] (SF2)

Figure 19: Thick curved pitchstone flake [201] (SF7)

Figure 20: Pitchstone distal flake fragment [201] (SF7)

Figure 21: Small pitchstone flake [301]