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What happened before the Middle Bronze Age land divisions and roundhouses? Prehistoric soil erosion and landscape change on Dartmoor, UK

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ABSTRACT

An extraordinary transformation in the character of human-landscape interaction occurred in the mid-second millennium BC across Britain and northern Europe. The landscapes of the Early Bronze Age (*c.* 2000–1600 BCE) dominated by funerary and ceremonial monuments change in the Middle Bronze Age (*c.* 1600–1000 BCE), into the landscapes of the living and domestic, characterised by land divisions and roundhouses. The prehistoric field systems (reaves) of Dartmoor are arguably the best-preserved example of this change, containing extensive surviving land divisions, with associated enclosures and numerous roundhouses. Surprisingly, despite the fame of these archaeological remains, there has been little recent investigation of these landscapes; basic questions remain unanswered, such as their chronology and the relationship between their construction and past environments. This contribution details the analysis of sediment sequences that predate the construction of a roundhouse and reave system at Holwell, Dartmoor. The results demonstrate there was localised, anthropogenically driven, soil erosion that predated both the roundhouse and the reaves, which continued after their construction. At this locality, rather than the construction of the 'domestic landscapes' of the Middle Bronze Age land divisions signifying an abrupt departure from the preceding landscape use, the analyses define some continuity in the use of this locale before and after reave construction. These data, therefore, suggest that interpretations of Middle Bronze Age land division are not related to changes in the use of landscapes, such as changes in agricultural practices and intensification, but instead can be considered as a formalisation of conceptual relationships between past societies and the landscapes they inhabited. As such, these Middle Bronze Age land divisions represent monumental agency, rather than wholesale changes in land use practices.

1. Introduction

The prehistoric archaeological record across Britain, and more widely over northwestern Europe, demonstrates a remarkable change during the Bronze Age (e.g. Bradley, 2007; Løvschal, 2020). During the Early Bronze Age, funerary monuments such as barrows and cairns dominate the archaeological narrative, producing a diversity of grave goods when excavated (e.g. Woodward and Hunter, 2015). By contrast, the Middle Bronze Age landscape was dominated by land divisions, roundhouses and field systems (Yates 2007; 2001). In essence, landscapes seemingly changed from associations with the realm of the dead (barrows and cairns), to the realm of the living (roundhouses and land divisions). Previously, this dramatic change in the character of the surviving archaeological record has been interpreted as representing a fundamental reorganisation of belief systems, social structures, and human-environmental relationships (Bradley, 2007). These interpretations have primarily been constructed from the morphologies and spatial arrangement of monuments (Field, 2001; Johnston, 2005), alongside excavation of typical features from these periods, such as barrows compared to roundhouses. However, comparing the Early and

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Middle Bronze Age is problematic, as the types of sites from each period are different, producing artefacts and assemblages associated with different spheres of life. On the one hand, the funerary assemblages of the Early Bronze Age produce real or constructed relational associations of the dead to people and places (e.g. Brück, 2019), whilst on the other hand Middle Bronze assemblages from roundhouses and settlements often demonstrate the realm of the everyday e.g. plant processing, cooking and craft activities such as weaving (Brück (ed) 2001), or very occasionally metal production (Jones et al., 2015). In simple terms, archaeologists have been comparing different realms or spheres of prehistoric worlds from different time periods.

Interpretations of the transition from the landscapes and monuments of the Early into the Middle Bronze Age have been wide ranging and have changed in tandem with dominant theoretical trends in archaeology. For example, processual archaeology interpreted the landscapes of the Middle Bronze Age as representing agricultural intensification to create a surplus for exchange, in order to obtain prestige goods, notably metals (e.g. Barrett, 1980). Such ideas have since been replaced with relational interpretations of land divisions, representing the connection of people to landscapes (Johnson 2021) and conceptualisation of the processes of land division (Løvschal, 2020). However, despite these advances in interpretations of Middle Bronze Age land divisions, fundamental questions remain unaddressed about the use of these landscapes. For example, in areas where both Early and Middle Bronze Age remains occur together or in close proximity, does the changing monumental form of the archaeological record also represent the different uses and activities within these landscapes between Early Bronze Age and Middle Bronze Age, or does the character of the monument form change, but the tempo of living within these landscapes remain similar across these time periods?

This contribution focuses on comparing the geoarchaeological records of pre- and post- division Middle Bronze Age landscapes at Holwell Tor, Dartmoor, UK. Dartmoor is one of several upland landscapes of southwest Britain and it contains a rich palimpsest of archaeological monuments. These include extensive prehistoric archaeological remains such as enclosed and open roundhouse settlements, stone circles and rows, cairns, barrows and cists, and extensive systems of Middle Bronze Age land divisions, known as reaves (Newman, 2011). The survey and targeted excavation of the reaves during the 1970 s and 1980 s established their Middle Bronze Age origin (Fleming, 2008), with Middle Bronze Age land divisions subsequently recognised across Britain, particularly lowland southern England (Yates, 2001; Roberts et al., 2017; Bradley 2007, 187-202). Extensive areas of waterlogged peat forming podzolic soils (Gatis et al., 2018) characterise the modern landscape of Dartmoor, however, the earlier Holocene environments of Dartmoor were temperate deciduous woodland growing on brown earth soils (Caseldine, 1999). This changing character of the Dartmoor landscape during the Holocene raises significant questions about the nature and use of these landscapes across the Early and Middle Bronze Age and whether Bronze Age communities were witnessing, causing and reacting to landscape changes.

1.1. Archaeological, palaeoenvironmental and geoarchaeological context of Bronze Age Dartmoor

Despite the impressive scale of the Middle Bronze Age landscapes on Dartmoor, they remain under researched and poorly understood. On Dartmoor there are estimated to be several thousand roundhouses and several hundred kilometres of land division (Fleming, 2008). During the earlier antiquarian movement in Britain, primarily during the C19th, many roundhouses were investigated by the Dartmoor Exploration Committee (e.g. Baring-Gould 1894) and this research established a broad prehistoric date for these monuments. However, the modern chronology of land division on Dartmoor is directly supported by just three radiocarbon dates (Amesbury et al., 2008) and the publication of excavated roundhouses on Dartmoor to modern standards numbers seven: five at Shaugh Moor (Wainwright and Smith, 1980), one at Teigncombe (Gerrard, 2016), and one at Bellever (Hughes, 2015).

The understanding of the palaeoenvironment and associated detectable human landscape impacts across the Holocene on Dartmoor is somewhat better understood, due to the presence of peat deposits that have facilitated palaeoenvironmental studies using pollen cores. From these pollen analyses, smaller scale woodland disturbance has been postulated during the Mesolithic, possibly forest or scrub burning to create clearances to attract game and a late Mesolithic oak, elm and hazel dominated woodland. It was originally suggested that widespread woodland clearance occurred on Dartmoor during the late Neolithic - Early Bronze Age, with large areas of open woodland and landscape existing prior to reave construction during the Middle Bronze Age (Caseldine, 1999; Caseldine and Hatton, 1996; Wilkinson and Straker, 2007).

However, this general sequence of change has been refined by more recent analyses. At Cut Hill, an area of higher altitude (*c.* 600 m OD) peat growth, the basal date for peat inception was 5900–5700 cal BC, with *Calluna* heath dominant and charcoal recorded. The pollen data demonstrated that during the Neolithic there would have been patches of open heath or bog on high ground within a generally wooded landscape (Fyfe and Greeves, 2010). Contrastingly, Fyfe and Woodbridge (2012) defined woodland cover on parts of northern Dartmoor until 450 – 150 cal BC (Mid-Late Iron Age), with major changes in land use occurring in the Late Iron Age. At Whitehorse Hill evidence of probable Neolithic woodland dominated by hazel with oak was present in areas away from early peat inception, and this woodland was interpreted as persisting throughout the Bronze Age, with clearance in the Mid to Late Iron Age (Fyfe et al. 2016). At Shovel Down, northeast Dartmoor, a peat sequence closely associated with archaeological remains from the Middle Bronze Age, showed a significant shift to grass dominated open vegetation occurred at 1610–1200 cal BC, although the character of the landscape during the late Neolithic/Early Bronze Age is one with areas of clearance and woodland, with some possible woodland re-establishment in the Early Bronze Age (Fyfe et al., 2008). So, whilst some woodland clearance and establishment of grassland did occur in the Middle Bronze Age, the picture is nuanced, with persistence of woodland into the Iron Age in some areas of the moor, and areas of pre-Neolithic peat inception at the higher altitudes, alongside some areas of open landscape in the Neolithic/Early Bronze Age.

The analysis of pollen sequences is complemented by a limited number of geoarchaeological analyses from the excavation of prehistoric monuments, across the wider southwest peninsula. Most recently, a section through the Great Western Reave, a 10Km long contour reave on Dartmoor, revealed a thin palaeosol, c. 0.1–0.2 m thick, sealed beneath the first phase of earthen bank reave construction, which was subsequently topped with a second phase of stone rubble (Simmonds and Champness, 2015). A monolith taken through this deposit sequence, analysed pollen from the palaeosol, which indicated a largely cleared landscape prior to reave construction, with evidence of localised areas of transition to acidic moorland soils (*Calluna*), with some wet woodland also visible (*Alnus)*. Significantly, the evidence suggested a largely cleared landscape prior to reave construction, with human landscape impacts recorded through a possible soil of colluvial origin against the reave on its eastern side, although this colluvial soil post-dated the construction of the reave.

The construction of reaves over different soil types and associated environments has also been the subject of some earlier research. Fleming (2008, 113) suggests that reaves were generally not built on peaty soils, i.e. soils that had started to podzolise, but on earthworm rich mineral soils. Investigations during the Shaugh Moor project (Smith et al., 1981) defined the method of reave construction, using either an earthen bank and ditch or fence (phase 1) post-dated by a phase 2 stone wall/deposit, with a hiatus of between 10 and 50 years between the two phases. Significantly, the phase 1 earthen banks buried the pre-existing land surface and at a number of locations this was dated and described. On

Saddlesbrough Reave, the phase 1 bank buried a peaty land surface in trench AJ. Here a radiocarbon sample (HAR 4005; sample 4005) provided a date of 1634 – 1260 cal BC (95.4 %, Oxcal ver 4.3, uncalibrated 1230 +/- 80 bc,). At Wrotter Reave in trench AF, the reave phase 1 bank is also described as overlying peat on the old land surface. A radiocarbon date of this peat (HAR 4181; sample 1015) produced a date of 1613–1233 cal BC (95.4 %, Oxcal ver 4.3, uncalibrated date of 1560 =/- 80 bc). Both of these excavations are significant, as both preserved land surfaces containing a peaty soil, defining podzolisation and waterlogging prior to reave construction, although it should be highlighted that these were the only soil matrices that preserved organic material suitable for radiocarbon dating (i.e. brown earth palaeosols were undatable). These descriptions are complemented by the detailed thin section analysis of the palaeosol underneath the Shaugh Moor phase 1 bank, which demonstrated the pre-reave soils were severely degraded prior to reave construction, with a peaty topsoil, Eag horizon and iron pan over a podzolic B horizon present (Balaam et al., 1982). Other sections at Shaugh Moor following a reave that ran uphill from a valley crossing the topographical gradient of the landscape, revealed peaty gleys in lower ground and better drained peaty gleyed podzols (ironpan and ferric stagnopodzols) on the slopes (Crampton, 1963; Avery, 1990, 270).

However, given the extensive nature of the land divisions and roundhouses across Dartmoor, the nature of the pre-reave environments and human environmental dynamics in the Bronze Age, is still in its infancy. It is clear that areas of localised podzolisation had already occurred when some reaves were constructed, alongside some woodland clearance prior to the Middle Bronze Age reave construction. However, detailed geoarchaeological analyses of pre-land division environments and roundhouses, coupled with site specific archaeological excavation and sampling has been lacking. This paper details the geoarchaeological investigation of sediments associated with an isolated roundhouse and two reaves, at Holwell, Dartmoor. Specifically, the construction of the stone built roundhouse and stone topped reave, sealed the old land surfaces, providing a window of opportunity to investigate this landscape prior to construction of these monuments and investigate human impacts on this site-scape, within a secure chronological framework.

2. Description of the study site and field data collection

Holwell Tor is located in Devon, UK, on the igneous granitic bedrock of the Dartmoor Intrusion (British Geological Survey, 2019). The Holwell Tor roundhouse is at an elevation of *c.* 375 m OD, on a gently sloping valley side (Fig. 1a and 1b), located between two granitic outcrops, Haytor to the southeast and Holwell Tor to the west (Fig. 1c and 1d). To the NNW (*c.* 200 m) of the Holwell roundhouse is a Scheduled prehistoric unenclosed settlement composed of three roundhouses connected to enclosures within the Rippon Tor coaxial field system. To the north (*c.* 500 m) is a further Scheduled unenclosed prehistoric settlement at Smallacombe Rocks, consisting of four roundhouses excavated

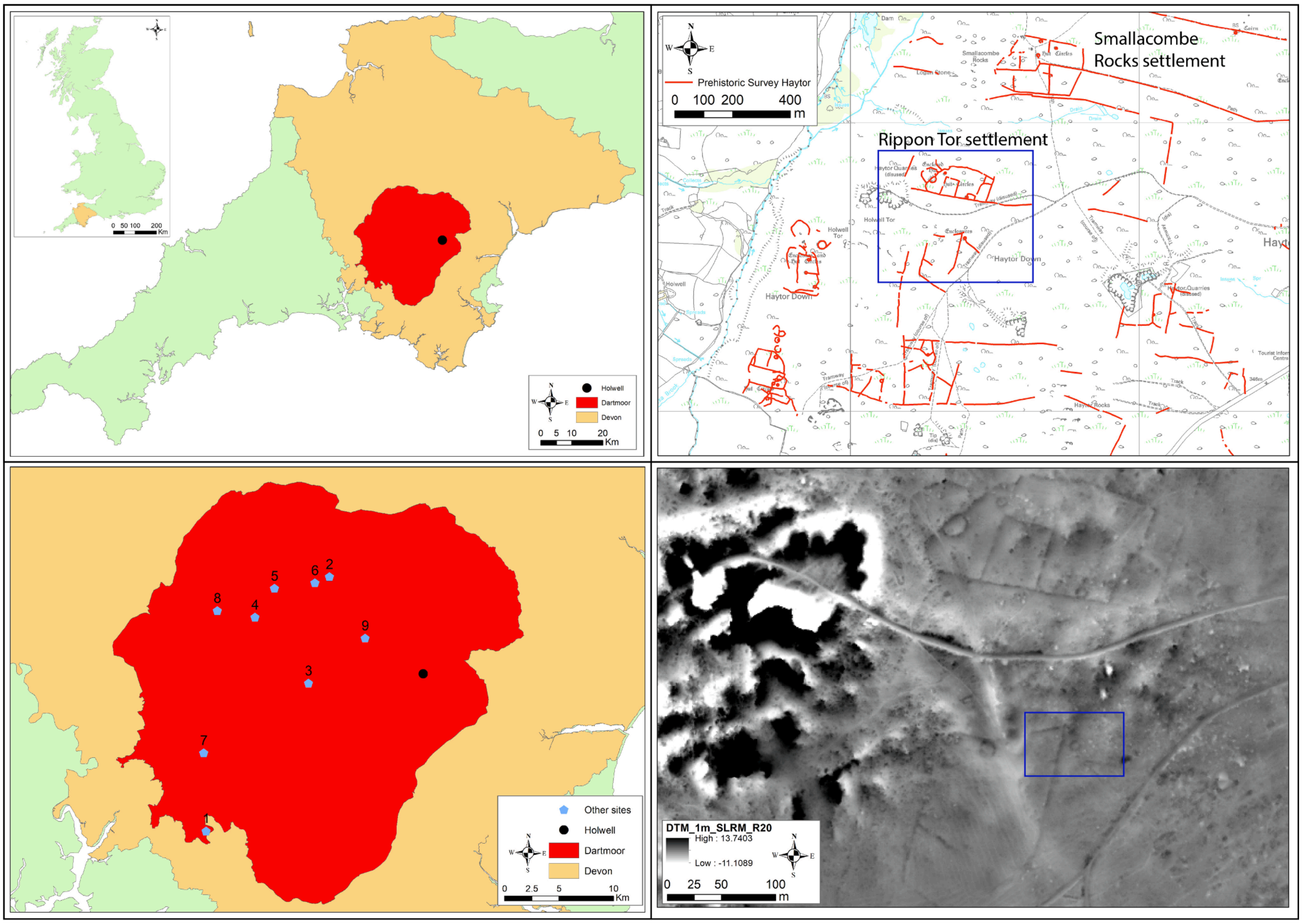


Fig. 1. The location and context of the Holwell roundhouse and reaves, showing: 1A) The site location on Dartmoor, Devon, UK (top left); 1B) location of the Holwell site on northeastern Dartmoor, with other key sites highlighted: 1 = Shaugh Moor; 2 = Teigncombe roundhouse; 3 = Bellever roundhouse; 4 = Cut Hill stone row; 5 = Whitehorse Hill cist; 6 = Shovel Down; 7 = Great Western reave; 8 = Watern Oke house 45; 9 = Grimspound (bottom left); 1C) the mapped prehistoric landscape around Holwell with the site location highlighted in the blue box (top right) and 1D) the immediate sitescape of Holwell shown from a Local Relief Model (LRM) derived form a 1 m lidar DTM, highlighting the extant upstanding prehistoric features around the Holwell roundhouse highlighted in the blue box (bottom right).

in 1896, from which some shards of Bronze Age pottery and a small number of flint artefacts and a stone muller were recovered (Baring-Gould et al., 1897).

The Howell roundhouse is associated with two reaves (Fig. 2a). The first, reave 1 runs for approximately 70 m in a NW/SE direction and is linked directly to the southern side of the roundhouse. However, part way along its length reave 1 changes direction slightly in order to connect to the roundhouse which potentially suggests a multiphase construction. Johnston (2005) also notes this process of adding a short length of wall, in order to connect reaves to roundhouses at Kestor and Shovel Down, on northeastern Dartmoor. Reave 2, is the second reave associated with the Holwell roundhouse and runs close to the building, traversing NNE/SSW for *c*. 150 m, before terminating against another reave to the north.

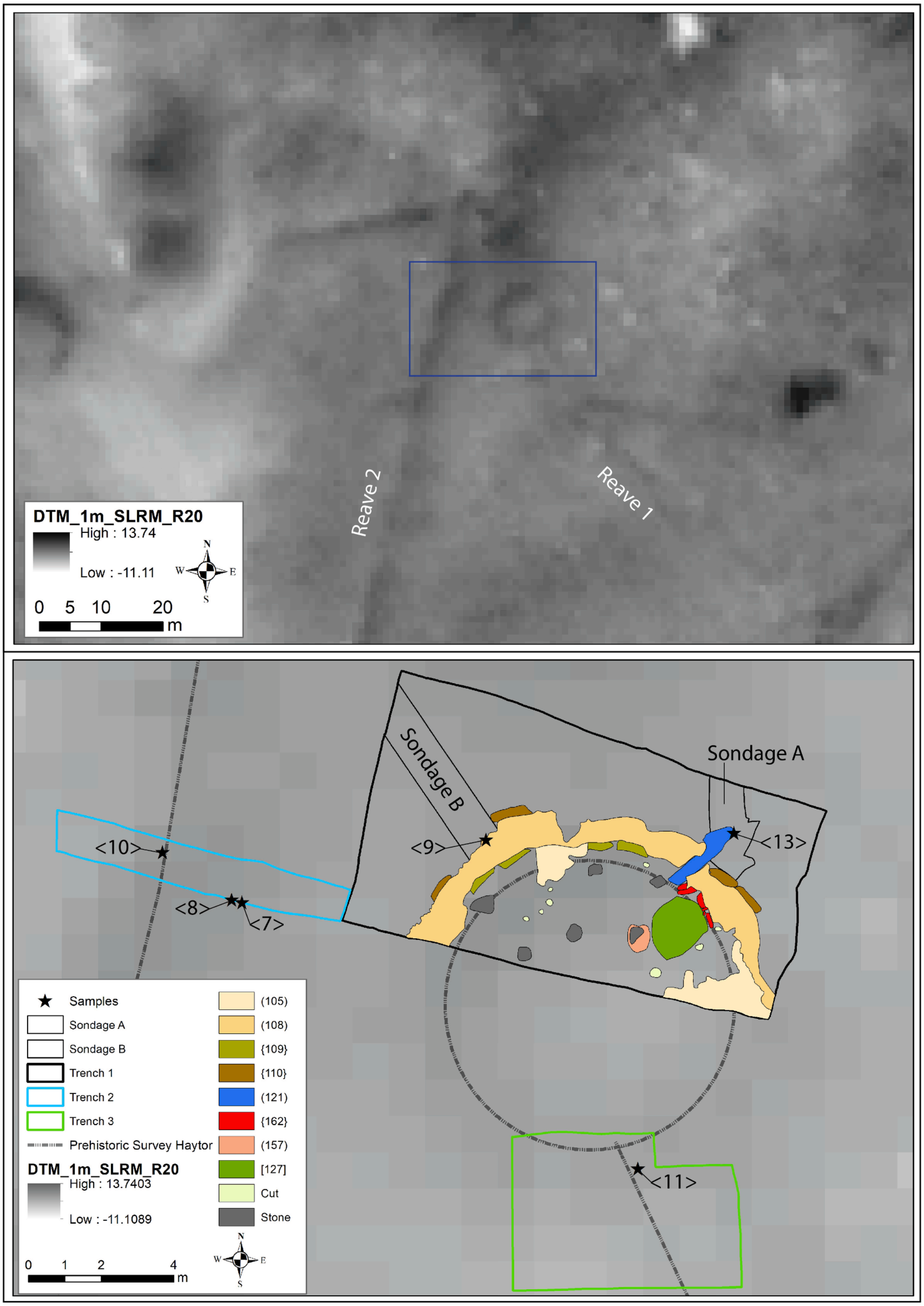


Fig. 2. The site-specific details of the Holwell site showing: 2A) The LRM model with the investigation area highlighted in the blue box and reave 1 and reave 2 labelled, (top image) and 2B) a simplified schematic excavation plan of the roundhouse with key contexts highlighted and the position of the trenches and samples (bottom image).

2.1. Laboratory and data analysis methods

The excavation focused on cleaning and excavating the northern half of the roundhouse (trench 1), with an extension to section reave 2 to the west (trench 2) and a further trench to investigate reave 1 to the south (trench 3) (Fig. 2b). These trenches provided opportunities for site specific sampling, facilitating geoarchaeological analysis of the sediment sequences. A full description of the sampled sections is provided in the results section. In addition to Fig. 2b the contexts sampled and the rationale for the sample collection is summarised in Table 1.

2.2. Sample collection

Monolith samples were collected from drawn trench sections during excavation, providing an intact, continuous sample of sediment stratigraphy. Prior to removal the context boundaries, the top and bottom of the sample, the sample number and site code were marked on the tins. The location of each sample was drawn onto relevant section and the sample photographed. After removal the samples were wrapped in clingfilm and black plastic and on return to the laboratory was placed into cold storage.

2.3. Subsample preparation

In the laboratory each monolith was unwrapped, cleaned and photographed. A visual description of each context was made and the context boundaries recorded. After logging, the monolith was subsampled using a scalpel on a contiguous 1 cm interval, collecting *c*.10 g of sediment per subsample, leaving a level surface on the original monolith sample for production of thin sections. The sub-samples were oven dried at 40°c for 7 days to remove any moisture, then homogenised using a ceramic pestle and mortar, fractionated with a 2 mm sieve. Both fractions (>2mm and ≤ 2 mm) were weighed to two decimal places, with the > 2 mm discarded and the ≤ 2 mm fraction retained for further analysis. A > 2 mm/<2mm sediment fraction was created by adding both sediment fractions together, before dividing by the < 2 mm sediment fraction.

2.4. Particle size analysis (PSA)

The < 2 mm subsamples were analysed using laser Particle Size Analysis (PSA), exporting data on the Wentworth scale. The PSA was used to identify the types of sediment and environment of deposition e.g. colluvial, and for identifying soil formation and other pedological processes, e.g. illuviation (Goldberg et al., 2022). Each subsample was disaggregated prior to measurement using 5 ml of sodium hexametaphosphate (Calgon) added to a spatula of subsample, which was agitated on a platform rotary shaker at 175 rpm for a minimum of one hour. Each subsample was measured using a Malvern Mastersizer 2000 laser analyser, which measures the angular intensity of scattered light produced by particles as they are passed through a focused laser beam using a Mie scattering model (Malvern Instruments, 2007). Each sample was analysed three times with a mean value calculated.

Table 1
The trenches, the monolith samples, the contexts sampled and the rationale for sample collection.

Trench	Sample	Contexts Sampled	Rational and archaeological questions
1	<13>	(191)	Sampling palaeosol under recumbent 'standing stone'
	<9>	(125) (111) (126)	Sampling deposit sequence beneath roundhouse outer wall
2	<10>	(207) (291) (209)	Sample pre-reave 2 deposit sequence
	<7>/ <8>	208 207 291 206 104	Sample the full sediment sequence adjacent to and against reave 2, situated between the reave and the roundhouse
3	<11>	(316) (391) (304)	Sample pre-reave 1 deposit sequence

2.5. Organic content

Organic content of the subsamples was calculated using Loss-on-ignition (LOI), which can be used to recognise soil development through increased organic matter (Canti, 2015), as well as a potential indicator of human activity including cultivation and farming practices (French, 2015). Crucibles were oven dried at 100^{O}C for 24 h, before adding a small spatula of sample (*c.* 0.5 g) and oven drying for a further 24 h at 100^{O}C. Samples were then weighed, fired at 450^{O}C for four hours before reweighing, in order to calculate the organic content (Heiri et al., 2001).

2.6. Magnetic susceptibility

Magnetic susceptibility can be used to identify human activities using fire, such as hearths and for recognising palaeosols, as maghemite levels usually increase during periods of soil formation, as well as sediment inwashing containing soil fractions (Goldberg et al., 2022,491-492; Tite and Mullins 1971). To measure magnetic susceptibility each subsample was placed into a weighed 10 ml lidded plastic pot, and then reweighed to provide a mass specific sample measurement. The magnetic susceptibility of each sample was recorded using a Bartington MS2B magnetic susceptibility meter with the reading calibrated to the mass of the sample. To mitigate against magnetic drift, the magnetic susceptibility meter was zeroed, before a 5 s measurement of sample, followed by a further zeroed measurement.

2.7. Micromorphology

Soil/sediment micromorphology is used for understanding site formation processes, recognising cultural and environmental impacts on archaeological sites at a microscale and providing detail of depositional environments (Courty et al., 1989; Macphail and Goldberg, 2018; Nicosia and Stoops, 2017). Five thin sections (75 x 50 mm) were used in this study. The thin section sub-samples were impregnated with a clear polyester resin-acetone mixture in preparation for manufacture by Spectrum Petrographics in Vancouver, Washington, USA. After further polishing using 1,000 grit papers, all thin sections were analysed using flatbed scans and a petrological microscope under varying light at magnifications ranging from x1 to x200/400. Thin sections were described, ascribed soil microfabric types (MFTs) and microfacies types (MFTs), and counted accordingly (Macphail and Goldberg, 2018, 66-93; Stoops et al., 2018). Key soil micromorphology features are given in the text, with a table providing complete micromorphology descriptions for each sample. This data is semi-quantitative. For inclusions the ranges used are: very few 0–5 %; few 5–15 %; frequent 15–30 %; common 30–50 %; dominant 50–70 % and very dominant > 70 %. For burrows and organo-mineral excrements the ranges used are: rare < 2 %; occasional 2–5 %; many 5–10 %; abundant 10–20 %, and very abundant > 20 % (from Bullock et al., 1985). EDS (Energy Dispersive X-ray Spectrometry; Weiner 2010) was also undertaken on one thin section (M13).

2.8. Radiocarbon dating

During excavation, bulk samples totalling 230.6 L in volume were taken from fourteen contexts. The samples were processed using flotation to recover charred plant macrofossils and charcoal with a 250 μm mesh used to collect the flot and a 1 mm mesh the residue. The flot was then examined using low power microscopy in order to identify macrofossils and charcoal and select suitable radiocarbon samples. Six samples from four contexts were submitted to SUERC for radiocarbon dating.

2.9. *Optically stimulated luminescence (OSL) dating*

During excavation, three samples were taken for OSL dating of the sediment sequences associated with reave 2. For relatively young (<150 ka) deposits OSL dating of quartz in the fine sand or fine silt fraction is used to estimate the burial age of a sediment, establishing the time elapsed since minerals within a deposit were last exposed to sunlight (Huntley et al., 1985). The OSL signal relates to the total ionising radiation dose absorbed from the surrounding sediment and cosmos since sediment burial. An equivalent dose (D_e) value was established from multi-grain, single-aliquot regenerative-dose OSL measurements (Murray and Wintle, 2000; 2003). That estimate of absorbed dose was converted to a measure of time by dividing by the dose rate. The rate of dose absorption arising from gamma radiation was established from *in situ* NaI gamma spectrometer measurements of the lithogenic gamma field surrounding each sample. *Ex situ* Ge gamma spectrometer measurements were used to establish concentrations of U, Th and K within each sample, converting to alpha and beta dose rates (Adamiec and Aitken, 1998) and accounting for grain size effects (Mejdahl, 1979), present moisture content (Zimmerman, 1971) and, for fine silt quartz measurements, reduced signal sensitivity to alpha radiation. Cosmogenic dose rate was calculated on the basis of location and depth (Prescott and Hutton, 1994).

2.10. *Presentation of results*

After laboratory analysis the sediment data was sorted in Excel, before importing into SPSS. Line graphs of the sediment proxies were drawn and exported to Adobe Illustrator for presentation and integration with the sample logging sheets and context boundaries. Contexts were quantified and the data from micromorphology and absolute dating were integrated.

2.11. *Results*

The detailed descriptions of the different sediment analyses are provided within the Supplementary Information, quantified and described for each recognised archaeological context. All the depths used for context descriptions are derived from the sample tins. All values displayed in brackets (%) are mean values for the context rounded up to the nearest whole number, except for mean values beneath 1 %. Data is given to two decimal places in the accompanying tables. The presentation of each sample has a context summary that can be related to the context description in the Supplementary Information, before an overall sequence summary. The results from the analysis of five sediment sequences are presented, before an integrated discussion.

2.12. *Trench 1 roundhouse: Samples < 13 > and < 9>*

The excavation demonstrated the roundhouse walls incorporated large, edge-set granite orthostats that were the earliest components of the roundhouse structure, contexts {109} and {110}; the inner and outer facing of the wall respectively (Fig. 2b). These contexts were separated by *c.* 1.0 m, filled by context {108}, a mass of sub-rounded to sub-angular granite fragments, *c.* 0.1 to 0.4 m in size, surviving to a height of up to 0.5 m. The walls have suffered significant disturbance and only a handful of the orthostats were *in situ* with others apparent as tumble.

The excavation recorded several contexts in the northern half of the roundhouse interior although the base of the sequence was not reached. Stratigraphically the lowest of these was (124) that covered much of the western and central part of the roundhouse. It was a compact, mottled, gritty silt containing locally frequent flecks of charcoal and interpreted as an occupation deposit. A shallow scoop (157) with a diameter of around 250 mm, a depth of c. 20 mm and sealed by a flat triangular slab of granite was set within a depression in the surface of context (124). Its fill (157), a dark, homogenous silt, produced a significant assemblage of charcoal which was dominated by *Quercus*, but also included *Corylus* (Simmons, 2019). A sample of this material yielded a radiocarbon date of 1660–1526 cal BC on *Quercus* charcoal (95.4 %; SUERC 87580) (Table 8).

Within trench 1, two sondages were dug in order to investigate different aspects of the site stratigraphy, with Sondage A being excavated at the eastern end of trench 1 and Sondage B in the west. These sondages and their respective samples and sections form the basis for the results from trench 1 considered in this paper. Both of these samples are located stratigraphically beneath the roundhouse and occupation deposit (124).

2.13. *Sondage A: sample < 13>*

Sondage A investigated a suspected recumbent ‘standing stone’ (121) with a ‘post like’ morphology, in the north-eastern quadrant of the roundhouse, measuring *c.* 1.4 m x 0.5 m x 0.4 m, which underlay the roundhouse wall ({109}, {110}, {108}). Context (121) was stratigraphically earlier than the roundhouse, with the roundhouse walls built over it. The majority of (121) was outside of the building, but its tip projected into the interior, directly opposite the entrance (Fig. 3a). The stone (121) rested on context (191), a medium brown clay silt, containing common, gravel-sized stone inclusions, before granite bedrock. Sample < 13 > was collected from beneath (121), being 10 cm long, sampling (191) onto the top of bedrock. The soil micromorphology and sediment analyses necessitated the subdivision of this context within the laboratory into (191 lower) and (191 upper). Sample < 13 > sediment data (Fig. 4; Table 2) and thin section detail (Fig. 5; Table 3) accompany the following interpretations, with the detailed descriptions of this sequence provided in the Supplementary Information.

2.13.1. *Sample < 13 > context interpretations*

Context (191 lower) 10–2 cm Interpretation: this is an acidic brown earth C/Bw horizon, characterised by an earthworm worked poorly sorted gravelly subsoil featuring embedded grains, which are relicts of periglacial soil formation (Bullock and Murphy, 1979; Van Vliet-Lanoë and Fox, 2018) in part a loess derived silt loam soil (cf. Neolithic Carn Brea and Bronze Age Chysauster) (Macphail, 1989; Smith et al., 1996). This unit contained rare fine and trace amounts of very fine charcoal.

Context (191 upper) 2–0 cm interpretation: this is a continuation of the B horizon of the acid brown earth palaeosol, with organic matter and magnetic susceptibility both increasing throughout. The fine sediment fractions reduce, alongside a corresponding increase in the coarser sediment fractions (sands), indicating some post depositional acidity/waterlogging impacts removing finer fractions. Post-depositional pedogenic processes (podzolisation) has subsequently weakly affected this unit, visible through the reduction in the finer sediment fractions and sesquioxide staining. The charcoal free nature of this unit could potentially indicate truncation. The phosphate elevation could be derived from overlying house occupation, while readings of Cu of 0.22 % and 0.44 % from the EDS, provide tantalising indications of earlier human activity at this locale, although this aspect has not been investigated further.

2.13.2. *Sample < 13 > sequence summary*

This is the C and B horizon of the original acid brown earth soil at this location, prior to burial by the recumbent stone (121). The soil has a definable loessic component (fine-coarse silts) and *peri*-glacial material, with the charcoal defining previous activity close to this location, prior to placement of (121). The palaeosol has subsequently been weakly

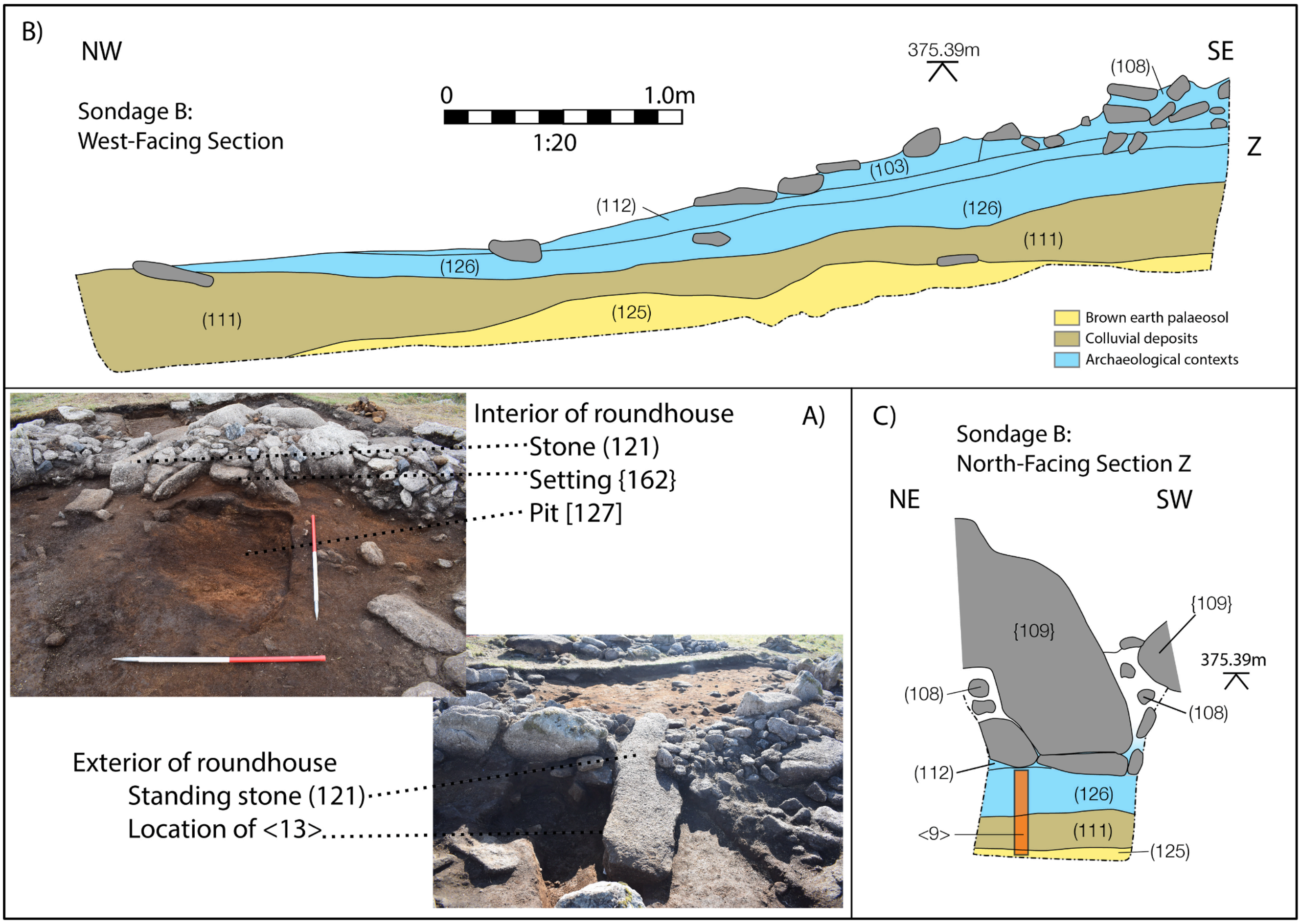


Fig. 3. The details for samples < 13 > and < 9 > showing: 3A) working photograph of the suspected recumbent standing stone (121), stone setting {162} and pit [127] with the location of < 13 > highlighted, view looking northeast (top left) and view looking northwest (bottom right) and 3B) Sondage B section, and 3C) with sample < 9 >.

affected by post depositional podzolisation. Given the analysis of analogous examples at Carn Brea and Chysauster (Macphail, 1989; Smith et al., 1996), it can be suggested that this is a probable Neolithic – Early Bronze Age clearance affected soil, which was buried prior to roundhouse construction. There was no absolute dating applied to these sediments, but they predate the roundhouse, with charcoal from fill (157) dated to 1660–1526 cal BC (95.4 %; SUERC 87573) (Table 8). The elevated Cu values produce a tantalising hint of human activity at this locale prior to roundhouse construction, but without further investigation the nature of this activity is not defined, although metalworking should be considered a possibility (Carey et al., 2019).

2.14. Sondage B Sample < 9>

Sondage B was oriented northwest to southeast, extending from the outer edge of the roundhouse wall in its north-west quadrant to the western edge of trench 1. It investigated whether the roundhouse was located on a shallow platform cut into the hillslope, with the removed sediment being dumped downslope to level the platform. In Sondage B (Fig. 3B), the earliest context was (125), a yellow, gritty silt. Context (125) was overlain by (111), a compact, slightly mottled, orange clay silt. Overlying (111) was context (126), an orange-brown clay silt although the difference between this and the underlying (111) was slight during excavation. Context (112) was a mottled, dark, orange-brown clay-silt. Sample < 9 > was taken from the north facing section of this sequence, sampling contexts (125), (111) and (126) (Fig. 3C). Sample < 9 > sediment data (Fig. 6; Table 4) and thin section detail (Fig. 7; Table 5) accompany the following interpretations, with the detailed descriptions of this sequence provided in the Supplementary Information.

2.14.1. Sample < 9 > Context interpretations

Context (125) 34–31 cm interpretation: given the moderate organic content, high sand and > 2 mm fraction, this is interpreted as the regolith (C horizon) of an acid brown earth. It is partially derived from Late Pleistocene loessic material, defined through the high medium and coarse silt values.

Context (111) 31–17 cm interpretation: this unit is somewhat anomalous and at *c.* 14 cm deep it is interpreted as a palaeosol. The unit does appear to have some sorting in it, showing a reduction in the coarser > 2 mm clasts, with a high organic content, and a slight rise in magnetic susceptibility, characteristics of a soil, with medium and coarse silts remaining dominant, defining a loessic component. The thin section records the stony, gravelly nature of this deposit but also the presence of lower subsoil Bw material, from a brown earth soil. However, the palaeosol is poorly preserved, with the somewhat spikey nature of the > 2 mm fraction, medium sand and coarse sand, potentially indicating the inwashing of some limited colluvial material that has subsequently been incorporated into the soil profile. The clay – coarse silt values are virtually identical to (125) beneath, defining Pleistocene loessic sediment within the soil matrix.

Context (126 lower) 17–5 cm interpretation: the field interpretation of this context was as a ‘make up’ levelling deposit for the construction of the roundhouse, redeposited from the valley side. The base of (126

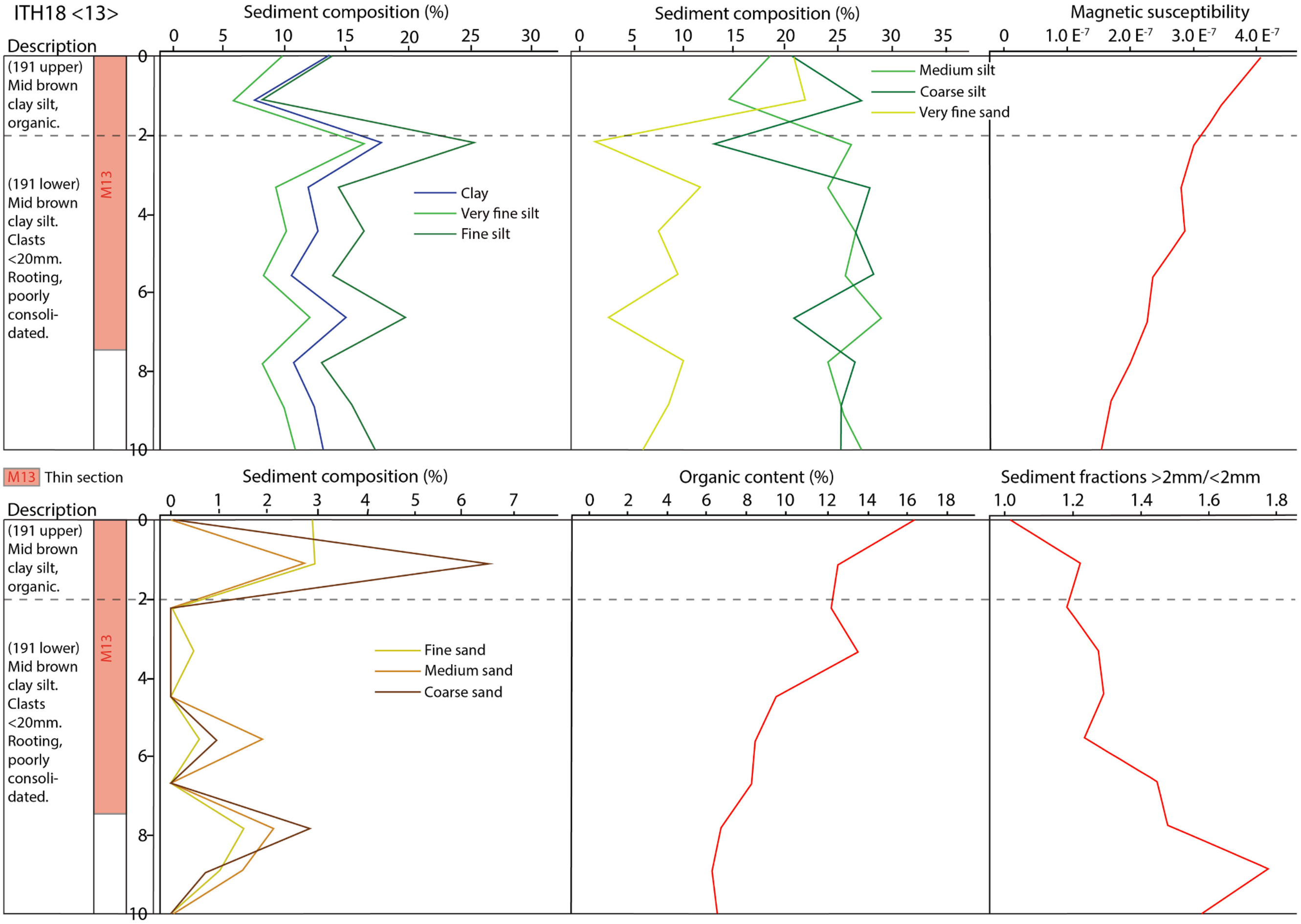


Fig. 4. Sample < 13 > sediment data.

lower) is a poorly sorted soil dump. Higher up (126) contains a better sorted soil dump, which contained silt loam Bw and more humic A1h (turf) soil, and some gravel. This soil included small amounts of fine charcoal and traces of original rooting material; possible burnt mineral material is also present. Post depositional processes involved rooting, biological mixing of acid humic topsoil and minor podzolisation with weak sesquioxidic staining. Essentially, acid brown soils were still extant during the construction of the roundhouse, the same as recorded in sample < 13 >. There is broad agreement between the increase in coarse sediment fraction (coefficient of > 2 mm/<2mm fraction) with a rise in organic matter associated with soil dumping and humic soil mixing at the top of this unit. Equally, magnetic susceptibility enhancement is a likely response to brown soil Bw and turf material being present.

Context (126 upper) 5–0 cm interpretation: this deposit appears to have been affected by the overlying deposits associated with podzol soils. It is likely that some mildly acidic waterlogging has caused the reduction in the clay and fine silt fractions. The rise in the organic contents immediately beneath the roundhouse wall is explained through the incorporation of more recent root material at the base of the roundhouse wall. This unit is essentially a continuation of (126 lower) that has been affected by podzolisation at the top of the unit.

2.14.2. *Sample < 9 > summary*

Sample < 9 > describes a poorly preserved palaeosol present at the base of this sequence, with a C-B horizon (125) and a B horizon (111) of an original acid brown soil ('Cambic'). Context (111) has received some colluvial material, displaying elevations in the coarse and medium sand fractions, alongside some rises > 2 mm clasts, creating a poorly sorted soil profile. However, these colluvial additions, are very limited and poorly defined, indicating small-scale, highly localised erosive events, rather than large scale valley side movements. Context (126) is a deliberate make up deposit to construct the roundhouse, although it is composed of two distinct layers, with the upper part of this showing a notable reduction in the coarse clast fraction. The unconsolidated nature of (126) is a product of it being a dump to construct the roundhouse on the western side. The loss of fine sediments from (126 upper) indicate this deposit has been affected by some waterlogging and acidification inducing clay translocation, although this is post depositional. Scoop [157] in the roundhouse has a radiocarbon date of 1660–1526 cal BC (95.4 %; SUERC 87580) (Table 8), which is stratigraphically above sample < 9>, demonstrating this sequence is Middle Bronze Age or earlier.

2.15. *Trench 2 sample < 10 > and samples < 7 and < 8>*

Trench 2 measured *c.* 8 m long by 1 m wide (Fig. 8A) and investigated reave 2 to the west of the roundhouse (Fig. 8B and 8C), alongside the stratigraphic sequence between the reave and the roundhouse. At the base of the sequence was context (208), a discontinuous heterogeneous, yellow/buff, sandy clay silt. Overlying this was (207), a heterogeneous, orange brown, gritty, clay silt. This was overlain by (291), which had originally constituted the upper portion of context (207), but was renumbered in post excavation due to the laboratory analysis. Context (291) was an orange-brown, sand silt, which at the western end of trench 2 (291) was overlain by context (209), a dark, orange brown, poorly sorted, sandy silt. Context (209) is interpreted as an earth bank beneath the stone structure of the reave (203), which was a packed mass of sub-rounded to sub-angular granite fragments and incorporated an

Table 2
ITH18 sample < 13 > sediment data.

		Clay (%)	Very fine silt (%)	Fine silt (%)	Medium silt (%)	Coarse silt (%)	Very fine sand (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)	Very coarse sand (%)	>2mm/ <2mm fraction	Organic matter (%)	Magnetic susceptibility
(191 lower)	Mean	13.01	10.62	16.88	26.02	24.23	7.41	0.46	0.68	0.57	0.14	5.17	8.95	0.0000002337500
	Minimum	10.53	8.20	12.95	23.79	12.98	1.72	0	0	0	0	2.37	6.31	0.0000001550000
	Maximum	17.69	16.32	25.18	29.43	28.28	11.87	1.52	2.14	2.82	1.06	9.60	13.53	0.0000003060000
(191 upper)	Mean	10.62	7.85	11.07	16.50	23.88	21.34	2.93	1.36	3.25	1.20	1.66	14.50	0.0000003800000
	Minimum	7.65	5.92	8.24	14.37	20.42	20.77	2.92	0	0	0	1.04	12.60	0.0000003520000
	Maximum	13.59	9.78	13.90	18.64	27.34	21.92	2.95	2.73	6.49	2.40	2.27	16.39	0.0000004080000

outcrop or boulder with a size in excess of 1 m that was partially exposed within trench 2. Also overlying (209) at the foot of the reave bank on its upslope side was context (210), which was a thin layer of mid grey brown, fine, sand silt, interpreted as material eroded from the reave.

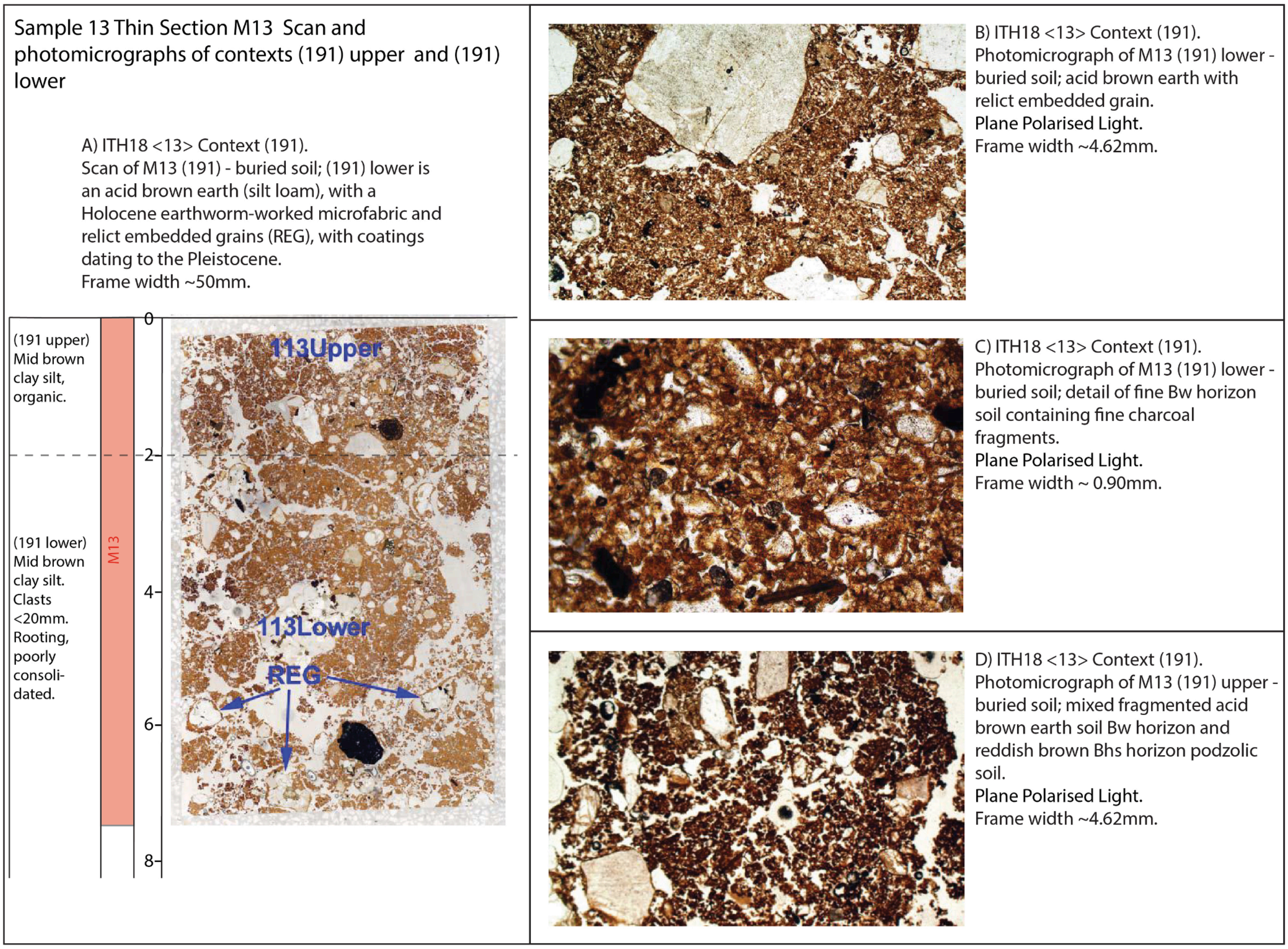
On the western side of reave 2, stones from (203) had tumbled downslope form context (204). Overlying (210) on the eastern side was context (206), a relatively loose and unconsolidated, orange brown, gritty clay silt. Within this deposit, against the eastern side of the reave bank, was a lens of material (205), which consisted of a jumble of granite fragments and a matrix of orange brown, gritty clay silt. Context (205) is interpreted as the counterpart of (204) on the reave's western side; a mix of stones and sediment eroded from the reave bank. Context (102), the lowest layer of the current humic gley podzol overlay (205) was overlain by (104), and (100), the A and E horizons of the current podzol. Two sequences were sampled in this trench, being the sediment sequence underneath the reave (Fig. 8C, sample < 10 >) and the section of sediments between the reave and the roundhouse (Fig. 8A, samples < 7 > and < 8 >).

2.15.1. Sample < 10>

Sample < 10 > sediment data (Fig. 9; Table 6) and thin section detail (Fig. 10; Table 7) accompany the following interpretations, with the detailed descriptions of this sequence provided in the Supplementary Information. Table 8 provides the OSL and radiocarbon samples and details for this sample.

Context (207) depth 36 – 27 cm interpretation: the moderate to high organic content, coupled with the high > 2 mm fraction and coarse, medium and fine sand at the base of the context, with high fine to coarse silt fractions, again indicate this is a C/lower B horizon of brown earth palaeosol with loessic material, similar to the one described in sample < 13 >. The upper part of the context is a B horizon with increasing organic matter and magnetic susceptibility, although no A horizon is definable. The radiocarbon analysis of a sample of heartwood charcoal (*Quercus* heartwood) from this context gave a very late 5th millennium BC date (4234–4191 cal BC (24.4 %); 4172–4043 cal BC (68.3 %); 4012–3990 cal BC (2.8 %); 95.4 %; SUERC 101361) (Table 8), and when taking into an account a potential old wood effect, it demonstrates Late Mesolithic - Early Neolithic activity at this locale. It is tempting to see this activity as Neolithic woodland clearance, although without further radiocarbon dates and excavation this interpretation is speculative. The presence of charcoal confirms a Holocene date for this context and the overlying deposit sequence, although there is a clear presence of relict Pleistocene loessic material from the silt fractions that has been incorporated into the soil matrix.

Context (291) 27 – 16 cm interpretation: the lower part of the context, between 27.5 cm and 25 cm shows notably less spikey sediment fractions, and this represents the upper B horizon of the underlying brown earth palaeosol. However, from 25 cm upward the spikey nature of the sediment particle size data, high organic content and elevated magnetic susceptibility tally with the soil micromorphology, defining a heterogeneous clast-rich colluvium composed of lower (Bw horizon) subsoil and upper subsoil (Bhs horizon) material, *cf*. Chysauster (Smith et al., 1996), and with anomalous humic staining and inclusions, and charcoal fragments, which occur alongside soil-embedded fine charcoal. The nature of the inwashed sediment material (smaller clasts and sands-coarse silt) indicate it is derived from upper soil horizon erosion and could potentially relate to an eroded manured and cultivated soil (Courty et al., 1989, 309-325; Deák et al., 2017; Macphail and Goldberg, 2018, 121). The presence of relict soil faunal burrows demonstrates some pedogenesis of these sediments after deposition. This context defines considerable human activity and associated low level soil erosion upslope prior to reave construction. The OSL dates both define a Late Pleistocene age range for this unit. These dates clearly contradict the sediment data, the thin section and the radiocarbon date from the preceding context (207). Given the balance of evidence, the most likely explanation for this discrepancy is that the OSL dates are rooted in


Sample 13 Thin Section M13 Scan and photomicrographs of contexts (191) upper and (191) lower

A) ITH18 <13> Context (191).
Scan of M13 (191) - buried soil; (191) lower is an acid brown earth (silt loam), with a Holocene earthworm-worked microfabric and relict embedded grains (REG), with coatings dating to the Pleistocene.
Frame width ~50mm.

B) ITH18 <13> Context (191).
Photomicrograph of M13 (191) lower - buried soil; acid brown earth with relict embedded grain.
Plane Polarised Light.
Frame width ~4.62mm.

C) ITH18 <13> Context (191).
Photomicrograph of M13 (191) lower - buried soil; detail of fine Bw horizon soil containing fine charcoal fragments.
Plane Polarised Light.
Frame width ~ 0.90mm.

D) ITH18 <13> Context (191).
Photomicrograph of M13 (191) upper - buried soil; mixed fragmented acid brown earth soil Bw horizon and reddish brown Bhs horizon podzolic soil.
Plane Polarised Light.
Frame width ~4.62mm.

Fig. 5. Sample < 13 > soil micromorphology data.

Table 3
Sample < 13>, thin section M13 soil micromorphology counts.

Thin section	Relative depth	Layer	MFT	SMT	Voids	Gravel	Soil clasts	Roots	Charcoal	Fungal sclerotia	Arbusc mychor	Embedded Gr/ (LinkCap)
M13	0–20 mm	113 upper	B1	2a,2b(1a)	40 %	fff		a		a*		aa
M13	20–75 mm	113 lower	A1	1a(2c)	35 %(60 %)	fff		a	a*	a*		aaaa

Thin section	Relative depth	Poss-Matrix intercal	Organo sesq.	Secondary Fe	Thin burrows	Broad burrows	Extr. Thin org. excr	V. thin org. excr.	Thin org. excr.	V. thin O-M excr.	Thin O-M excr.	Broad O-M excr.
M13	0–20 mm		aaaa	a	aaaa	aaaa				aaaa	aaaa	aaa
M13	20–75 mm		a	a	aa	aaaa		a		aa	aa	aaaa(tot)

* - very few 0–5 %, f - few 5–15 %, ff - frequent 15–30 %, fff - common 30–50 %, ffff - dominant 50–70 %, fffff - very dominant > 70 %; a - rare < 2 % (a*1%; a-1, single occurrence), aa - occasional 2–5 %, aaa - many 5–10 %, aaaa - abundant 10–20 %, aaaaa - very abundant > 20 %.

limited exposure of quartz to sunlight at the time of the archaeological events, producing an age overestimate that probably relates to the loessic parent material. It is possible that the OSL signal in a small portion of quartz grains was zeroed at the time of archaeological events, however the absence of fine sand in OSL samples HTOR06 and HTOR08 preclude an assessment of inter-grain variations in age (Duller et al., 1999).

Context (209) 16 – 0 cm interpretation: this is a complex deposit, that has formed the reave bank, prior to the construction of the stone topping. The material used to create the reave is redeposited colluvial soil, as seen beneath in context (291). The charcoal within (209) is likely to predate the colluvium, similar to the charcoal seen in sample < 13 >. The sediment used to create the bank contains both relict brown earth clasts as well as podzol subsoil material; this podzol subsoil defines podzolisation had occurred in some areas close to the reave, although it is not present in the colluvium under the bank. The original excavations at Shaugh Moor suggested a two phase sequence of reave construction, with a bank and ditch initially, being later topped with stone. The bank

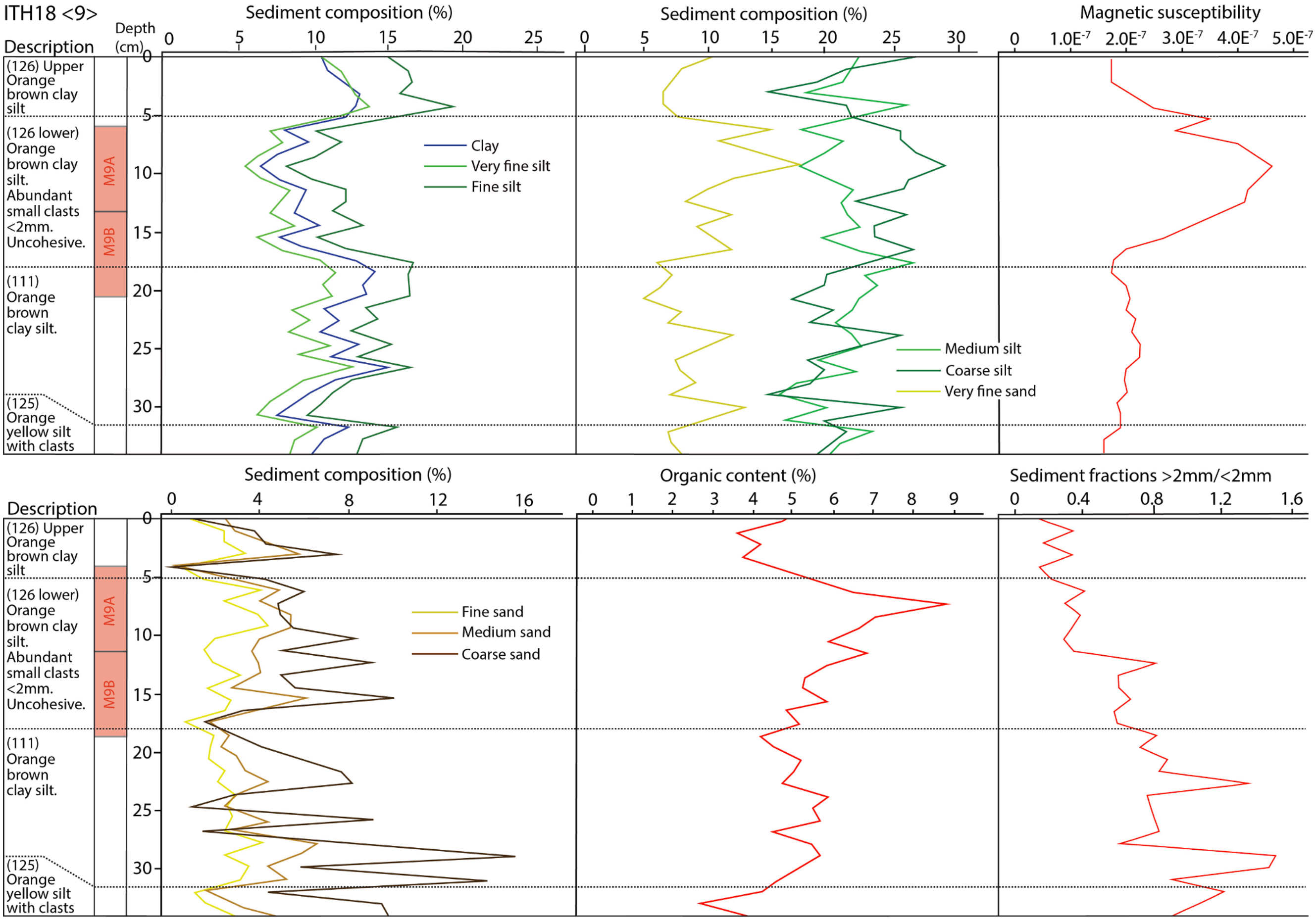


Fig. 6. Sample < 9 > sediment data.

here is the first phase of this reave, although no ditch cut was evident in the section. It is probable that the unconsolidated colluvium was simply scraped up to form the reave bank. Again, the OSL age overestimate of archaeological events likely relates to the incorporation of relict Pleistocene material within the deposit that received insufficient exposure to sunlight prior to incorporation within the bank. There remained insufficient fine sand quartz to attempt follow-up single grain measurements and identify the most well reset, minimum age population to refine the OSL date.

2.15.2. *Sample < 10 > summary*

This sample records a weakly preserved brown earth palaeosol at the base of the sequence (125; the bottom of (291), up to 25 cm). This palaeosol is relatively thin c. 0.1 – 0.2 m, although a similar depth of palaeosol was recently recorded at the Great Western Reave (Simmonds and Champness, 2015). This context provided a radiocarbon date of very late Mesolithic/Early Neolithic and defines human activity at this locale when this palaeosol was extant. It is tempting to see this charcoal as associated with Early Neolithic woodland clearance, given that it is *Quercus* heartwood, and an old wood effect potentially occurred, making the radiocarbon date appear older, although woodland burning has also been recorded in the Mesolithic on Dartmoor (Caseldine and Hatton, 1996). However, this date is used to define when the palaeosol was extant and a date before which (291) formed. Context (291) above this is a continuation of this palaeosol, but it is a soil with colluvial additions caused by soil erosion upslope of the reave, predating the reave construction. This colluvium contained brown earth clasts, demonstrating the erosion of the original soils and it also contained fine charcoal, related to earlier activities in the catchment that were eroded with the brown earth soils. The colluvial soil (291) is chronologically bracketed by the radiocarbon date from (207) (4234–4191 cal BC (24.4 %); 4172–4043 cal BC (68.3 %); 4012–3990 cal BC (2.8 %); 95.4 %; SUERC 101361) and the later undated construction of the reave, which typologically was during the Middle Bronze Age.

However, context (291) was also deposited against the reave, showing a continuation of this process after reave construction (see samples < 7 > and < 8 > below). It is therefore interpreted that this deposit was forming prior to reave construction and continued after construction, i.e. a continual depositional process. The nature of the colluvial additions indicates incremental soil erosion, rather than wholesale valley side movements, potentially indicating the presence of active pastoral or even horticulture areas upslope, with the deposit subjected to some pedogenesis. The sediment characteristics of this deposit are extremely similar to context (111) beneath the roundhouse, and given their close proximity are almost certainly the same deposit sequence, with the roundhouse colluvium dating to pre-1660–1526 cal BC (95.4 %; SUERC 87580). Unfortunately, the OSL dates do not help define the date of this deposit further and can only be used to demonstrate the presence of relict Pleistocene loess in the deposit. Above (291) is the reave bank (209), constructed from this colluvial soil material, with no ditch cut evident in the excavation; therefore, it is likely the reave bank was formed by scraping up the surrounding relatively unconsolidated material. Significantly, the reave bank contains podzol subsoil material, indicating that podzolisation was already occurring in some of the soils used to make the reave bank, although this material is not evident in the colluvium (291) underlying the reave (209).

Table 4
ITH18 sample < 9 > sediment data.

Context		Clay (%)	Very fine silt (%)	Fine silt (%)	Medium silt (%)	Coarse silt (%)	Very fine sand (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)	Very coarse sand (%)	Organic matter (%)	>2mm/<2mm fraction	Magnetic susceptibility
(125)	Mean	10.92	9.00	13.90	21.35	19.86	7.29	1.88	3.04	7.93	4.84	3.61	2.08	0.0000017056667
	Minimum	9.93	8.27	12.91	19.84	18.84	6.79	1.14	1.49	4.42	3.72	2.72	1.93	0.0000016140000
	Maximum	12.28	10.18	15.57	23.37	21.05	7.91	2.84	4.75	9.82	5.89	4.28	2.23	0.0000018760000
(111)	Mean	11.61	9.40	13.83	20.82	20.09	8.12	2.49	3.75	6.42	3.49	5.12	1.94	0.0000019881429
	Minimum	7.42	5.96	9.41	15.72	14.96	4.81	0.58	1.80	1.01	0	4.23	1.61	0.0000017580000
	Maximum	15.04	12.45	16.67	26.66	25.75	12.93	4.16	6.64	15.58	9.64	5.91	2.53	0.0000022360000
(126 lower)	Mean	8.72	7.39	11.36	20.34	25.21	11.65	2.64	4.22	5.99	2.48	6.24	1.47	0.0000036010833
	Minimum	6.35	5.12	8.04	17.44	21.54	7.62	1.49	2.71	3.30	0.66	4.85	1.22	0.0000019860000
	Maximum	12.00	11.45	15.43	22.18	29.01	17.59	4.33	6.05	10.04	5.33	8.87	1.83	0.0000045830000
(126 upper)	Mean	11.83	12.27	16.65	21.82	20.64	7.65	1.87	3.05	3.25	0.98	4.21	1.24	0.0000019680000
	Minimum	10.59	10.75	14.95	17.98	14.83	6.47	0.58	0	0	0	3.65	1.15	0.0000017340000
	Maximum	13.05	13.57	19.48	26.14	26.76	10.40	3.41	5.79	7.52	2.14	4.75	1.35	0.0000025030000

2.15.3. Trench 2 samples < 7 > and < 8>

Two samples were collected from the north-facing section of trench two between the reave and the roundhouse. The samples were collected to obtain a continuous profile through this section (Fig. 8A and 8C). Samples < 7 > and < 8 > sediment data (Fig. 11; Table 9) and thin section detail (Fig. 12; Table 10) accompany the following interpretations, with detailed descriptions in the Supplementary Information

Contexts (208) 54 – 50.5 cm and (207) 50.5 – 41 cm combined Interpretation: Contexts (208) and (207) combined represent an acidic brown earth palaeosol. The moderate to high organic content in (207), coupled with the decreasing > 2 mm fraction indicates sorting of a soil profile. There is again relatively high fine to coarse silt fractions, with a significant clay component, defining a C/lower B horizon of brown earth palaeosol with loessic material, similar to the one described in sample < 13 >. The upper part of context (207) is a B horizon with increasing organic matter and magnetic susceptibility, with a notable increase in organic content at the top of (207), potentially indicating part of an A horizon. The clay content in (207) is comparable to the clay content of the palaeosol (191) in sample 13 and (207).

Context (291) 41 – 30 cm Interpretation: the heterogenous nature of (291), with an increase in the > 2 mm/<2mm sediment fraction and the increase in the sand fractions, with episodic spiking, defines a sediment deposit containing episodic higher energy colluvial inputs. The medium and coarse silt fractions have proportionately decreased, but still define a loessic parent material input into soils, which have been subsequently eroded. The increase in magnetic susceptibility possibly indicates the presence of burnt material, alongside inwashing of eroded A horizon material from a brown earth soil upslope of the roundhouse and reave, likely resulting from Neolithic/Bronze Age (?) vegetation clearance/ burning activity in this location.

Context (206) 30 – 7 cm interpretation: this context is effectively a continuation of (291), although in this sequence of samples < 7 > and < 8>, this unit is deposited post reave construction. It is a colluvium of subsoil origin which had undergone pedogenic development, with slight increases in fine, medium and coarse silt compared to the underlying (291), and a corresponding decrease in clay and very fine silts. The magnetic susceptibility is initially relatively high, potentially indicating topsoil and/or burnt material inwashing. The sand fractions continue to fluctuate throughout this unit, with the micromorphology recording the presence of small clasts as part of the colluvial inwashing. The upper portion of (206) is a pellety topsoil impacted by ensuing podzol development in context (104). The effects of podzolisation are evident in (206) upper, with a decrease in magnetic susceptibility, the presence of sand and clasts, and the increase in the finest sediment fractions caused by the leaching clay, very fine silt and fine silt from (104), resulting in an illuvial horizon in (206) upper, caused by increasingly waterlogged conditions.

Context (104) 7 – 0 cm interpretation: this unit represents the overlying weakly formed thin podzolic soil. There is a decrease in the clay and very fine silt fractions that have been translocated down profile in the illuvial layer (206) upper, whilst there is a corresponding increase in the coarser sand fractions. The magnetic susceptibility clearly defines the A horizon of the soil, although the podzol is relatively thin and the organic contents are moderate for waterlogged peat forming soils.

2.15.4. Samples < 7 > and < 8 > summary

The sequence recorded by samples < 7 > and < 8 > is initially the same sequence defined by sample < 10>, although sample < 10 > was underneath the reave, whilst samples < 7 > and < 8 > were adjacent to it. However, they describe the same sequence of a brown earth palaeosol at the base of the sequence (208) and (207) with high organic contents, and this palaeosol is again relatively thin at *c.* 0.13 m. Above this (291) is a continuation of this palaeosol, but it is a soil with colluvial additions caused by soil erosion upslope of the reave, predating the reave construction. This colluvium contained brown earth clasts, demonstrating

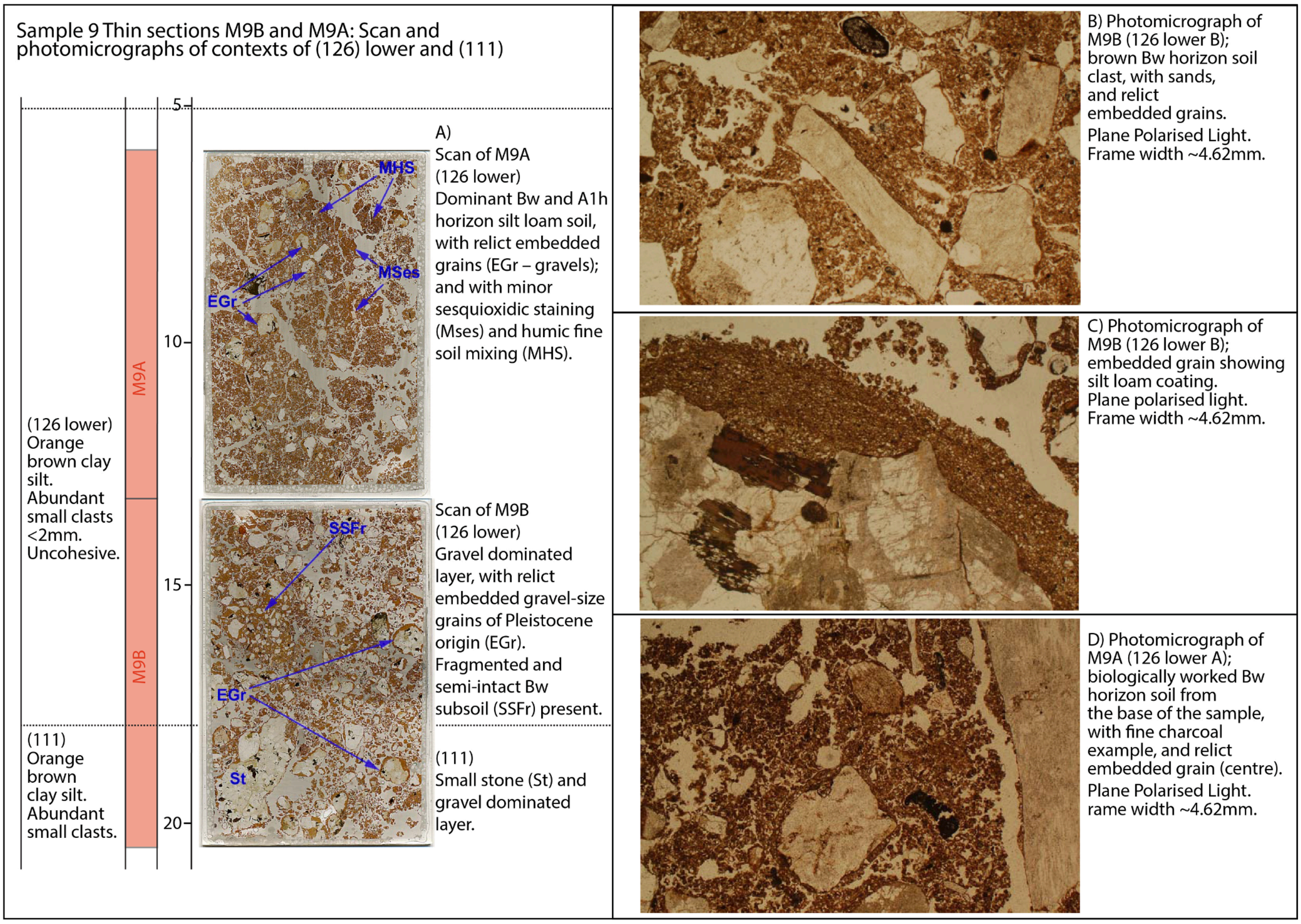


Fig. 7. Sample < 9 > soil micromorphology data.

Table 5
Sample < 9>, thin sections M9A and M9B soil micromorphology counts.

Thin section	Relative depth	Layer	MFT	SMT	Voids	Gravel	Soil clasts	Roots	Charcoal	Fungal sclerotia	Arbusc mychor	Embedded Gr/ (LinkCap)
M9A	60–135 mm	126 lower A	B1	CSGr,1a,2a-2b,3b	30 %(40 %)	ff		aa	a	a*		(aaa)
M9B	135–210 mm	Lower 126B	A1	(3a),2a,1a, CSGr	20 %, 60 %	fffff		aaa	a*	a*		(aaaa)

Thin section	Relative depth	Poss-Matrix intercal	Organo sesq.	Secondary Fe	Thin burrows	Broad burrows	Extr. Thin org. excr	V. thin org. excr.	Thin org. excr.	V. thin O-M excr.	Thin O-M excr.	Broad O-M excr.
M9A	60–135 mm		aa	a*	aaaaa	aaaa	a*			aaaaa	aaa	aaaa
M9B	135–210 mm		a*	a*	aaaa	aaaa	a*			aaaaa	aaa	aaa

* - very few 0–5 %, f - few 5–15 %, ff - frequent 15–30 %, fff - common 30–50 %, ffff - dominant 50–70 %, fffff - very dominant > 70 %; a - rare < 2 % (a*1%; a-1, single occurrence), aa - occasional 2–5 %, aaa - many 5–10 %, aaaa - abundant 10–20 %, aaaaa - very abundant > 20 %.

the erosion of the original soils within the catchment and also contained fine charcoal, related to earlier activities in the catchment that were eroded with the brown earth soils. Critically, whilst the deposition of colluvium was stopped in sample < 10> (291) by the construction of the reave, in samples < 7 > and < 8>, the colluvial additions to a soil continued, demonstrated by (206). Therefore, the same or similar processes in this immediate site-scape that were causing soil erosion in (291) were continuing after reave construction in (206). The nature of the colluvial additions indicates incremental soil erosion, rather than wholesale valley side movements although B horizon soil material is included, potentially indicating the presence of pastoral or even horticulture areas upslope. The upper part of (206) records the translocation of the fine sediment fractions and in (104) the development of a thin podzolic soil. The date for the onset of podzolisation was not established.

2.15.5. *Trench 3 sample < 11>*

Trench 3 was located on the southern side of the roundhouse, measuring 6 m x 4 m and investigated reave 1, using a 1 m wide

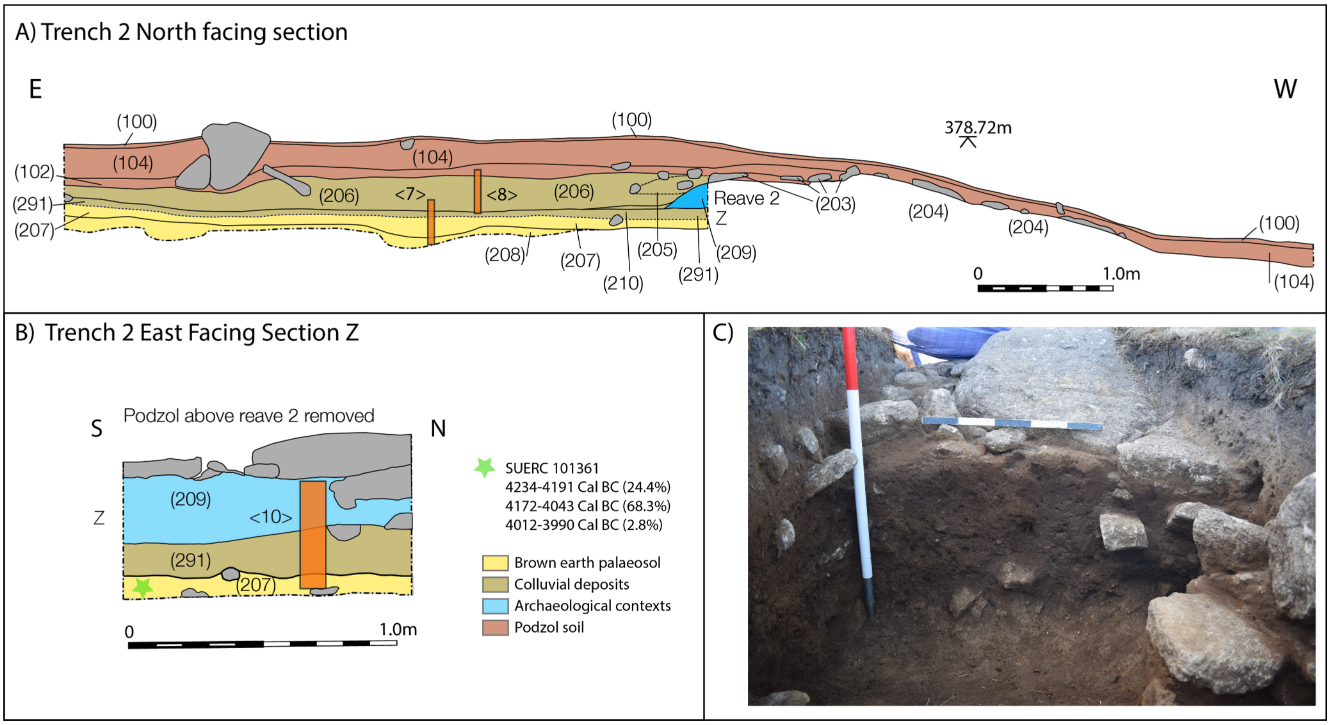


Fig. 8. The details for samples < 10>, <7 > and < 8>, showing: 8A) trench 2 north facing section and the locations of samples < 7 > and < 8>; 8B) the location of sample < 10 > under reave 2, and 8C) photograph of trench 2 during excavation, showing the sediment section under the reave view looking WNW.

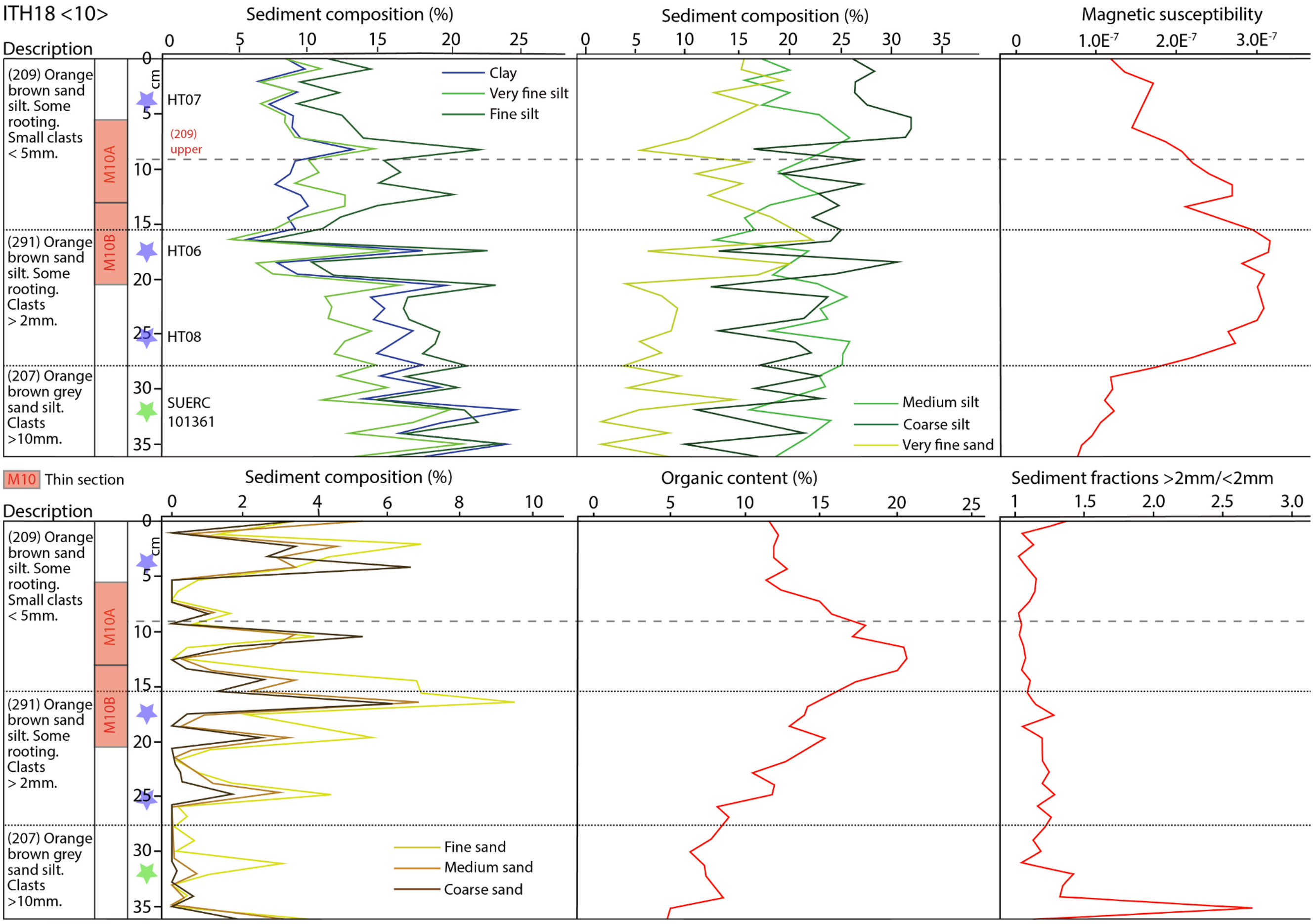
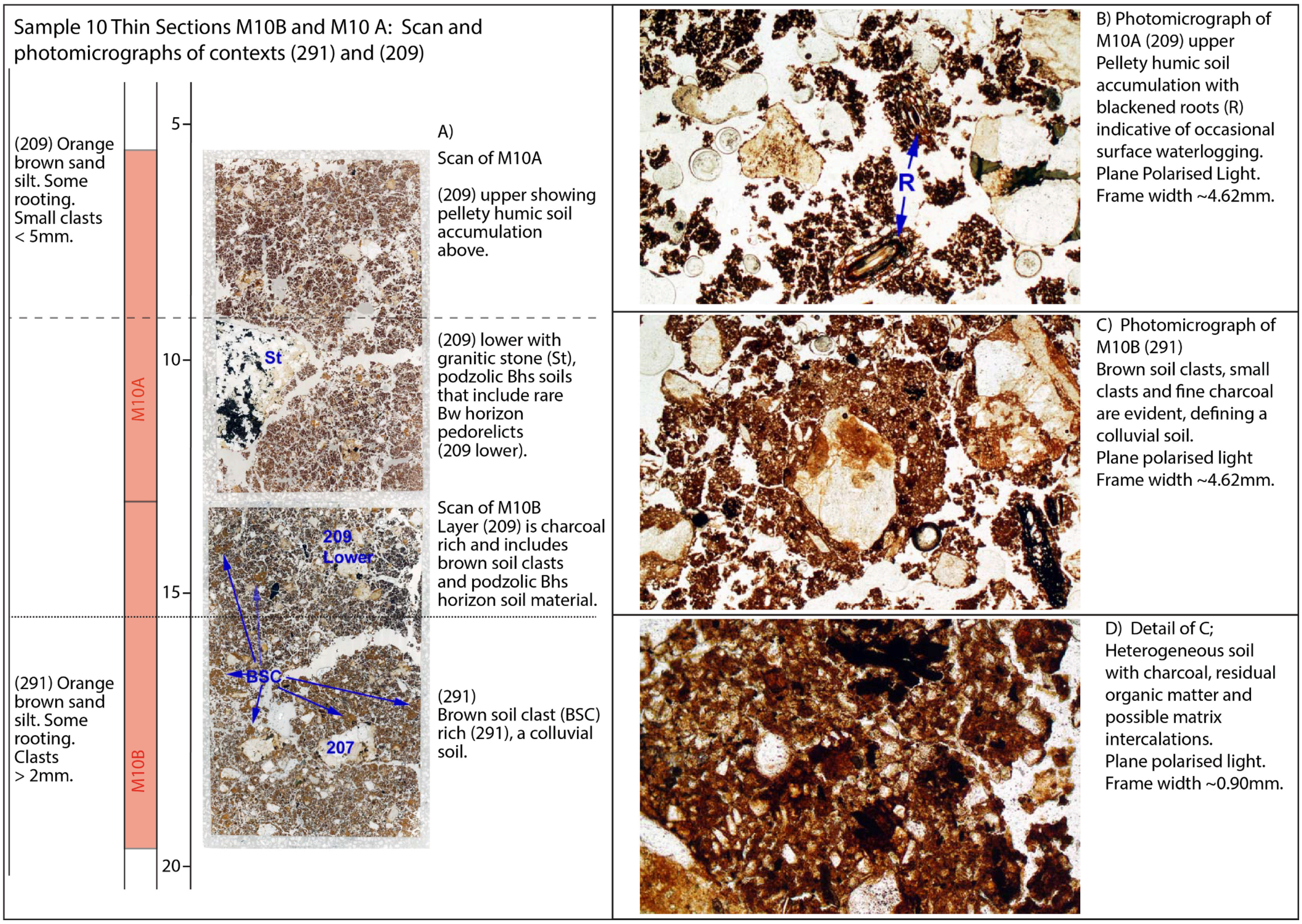


Fig. 9. Sample < 10 > sediment data.

Table 6
ITH18 sample < 10 > sediment data.

Context		Clay (%)	Very fine silt (%)	Fine silt (%)	Medium silt (%)	Coarse silt (%)	Very fine sand (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)	Very coarse sand (%)	Organic matter (%)	>2mm/ <2mm fraction	Magnetic susceptibility
(207)	Mean	18.97	15.43	18.98	21.00	17.03	6.48	1.12	0.58	0.35	0.08	6.87	1.41	0.00000010382500
	Minimum	14.18	11.19	14.59	16.11	9.67	1.36	0	0	0	0	4.90	1.04	0.00000007620000
	Maximum	24.50	20.77	23.91	24.11	23.02	14.48	3.74	3.43	1.94	0.38	8.56	2.72	0.00000012140000
(291)	Mean	15.09	12.18	17.86	22.77	20.13	8.74	1.81	0.90	0.47	0.06	11.67	1.21	0.00000027930000
	Minimum	7.89	6.42	10.60	18.17	12.37	3.68	0.02	0	0	0	8.22	1.05	0.00000018040000
	Maximum	19.59	16.42	23.14	26.18	30.76	20.35	5.49	3.20	2.52	0.36	15.22	1.29	0.00000031420000
(209)	Mean	8.84	9.36	13.54	19.69	25.87	14.80	3.14	2.22	2.05	0.49	15.21	1.10	0.00000020605882
	Minimum	5.51	4.54	7.00	12.62	16.50	5.37	0.03	0	0	0	11.40	1.02	0.00000012100000
	Maximum	13.09	14.63	22.02	25.93	32.10	22.26	9.53	7.06	6.58	2.47	20.64	1.37	0.00000031680000


Sample 10 Thin Sections M10B and M10 A: Scan and photomicrographs of contexts (291) and (209)

(209) Orange brown sand silt. Some rooting. Small clasts < 5mm.

(291) Orange brown sand silt. Some rooting. Clasts > 2mm.

A) Scan of M10A

(209) upper showing pellety humic soil accumulation above.

(209) lower with granitic stone (St), podzolic Bhs soils that include rare Bw horizon pedorelicts (209 lower).

Scan of M10B Layer (209) is charcoal rich and includes brown soil clasts and podzolic Bhs horizon soil material.

(291) Brown soil clast (BSC) rich (291), a colluvial soil.

B) Photomicrograph of M10A (209) upper Pellety humic soil accumulation with blackened roots (R) indicative of occasional surface waterlogging. Plane Polarised Light. Frame width ~4.62mm.

C) Photomicrograph of M10B (291) Brown soil clasts, small clasts and fine charcoal are evident, defining a colluvial soil. Plane polarised light Frame width ~4.62mm.

D) Detail of C; Heterogeneous soil with charcoal, residual organic matter and possible matrix intercalations. Plane polarised light. Frame width ~0.90mm.

Fig. 10. Sample < 10 > soil micromorphology data.

east–west section (Fig. 13A and 13C). At the base of the sequence was context (316) a fine, mid brown yellow silt containing rare charcoal fragments. A faint possible turf line was visible at the top of the layer. Two features were identified cutting within (316) and these were interpreted as small stake holes and were located *c.* 150 mm apart, cuts [312] and [314] (Fig. 13C).

Cut [312] was sub oval with one straight side and a maximum dimension of 150 mm, vertically sided, with a dished, uneven base, to a depth of 14 cm, and was filled by (313). Cut [314] was located *c.* 150 mm to the west and was sub oval in plan, with a maximum dimension of 200 mm, vertically sided, with a concave base, to a depth of 150 mm and was filled by (315) (neither cut is included Fig. 11A, as they were identified in plan when discovered within the excavation). The fills of these features (313) and (315) were very similar, being homogenous dark grey clay silt, yielding abundant fragments of mature oak charcoal. Four samples were submitted for radiocarbon dating from these features and returned dates for (315) of 5020–4850 cal BC (SUERC 87575; 95.4 %) and 4978–4834 cal BC (SUERC 87576; 95.4 %); for (313) 4935–4797 cal BC (SUERC 87574; 95.4 %) and 5057–4936 cal BC (SUERC 87,573 95.4 %) (Table 8). Even accounting for an 'old wood' effect they fall comfortably within the Late Mesolithic period and demonstrate earlier human activity at this locale.

Above this was (391), a medium brown sand silt, although the relationship between (391) and the underlying context (316) and context (317) to the west was diffuse. Context (317) was a light brown silt sand containing some large, angular to sub-rounded poorly sorted

Table 7
Sample < 10>, thin sections M10A and M10B soil micromorphology counts.

Thin section	Relative depth	Layer	MFT	SMT	Voids	Gravel	Soil clasts	Roots	Charcoal	Fungal sclerotia	Arbusc mychor	Embedded Gr/ (LinkCap)
M10A	55 100 mm	(209) upper	F1	2c(1a,2a,2b)	45 %	f		a*	a*			
M10A	100–135 mm	(209) lower	E1	2c,2a,2b(1a)	40 %	*(fffff)	*	a*	a*			a*
M10B	135–160 mm	(209) lower	D2	2a,2b,1a	45 %	ff	*	a	aaa		(a*)	a
M10B	160–195 mm	(291)	D1	1a,2a,2b	40 %	ff	f	a*	aa			a
Thin section	**Relative depth**	**Poss-Matrix intercal**	**Organo sesq.**	**Secondary Fe**	**Thin burrows**	**Broad burrows**	**Extr. Thin org. excr**	**V. thin org. excr.**	**Thin org. excr.**	**V. thin O-M excr.**	**Thin O-M excr.**	**Broad O-M excr.**
M10A	55–90 mm		aaaaa?	a*	aaaa	aaaa		aaaa	aaaa			
M10A	90–130 mm		aaaa?	a*	aaaa	aaaa		aaa	aaa	aa		
M10B	130–155 mm	a*	aaaa	a*	aaaaa	aa				aaaaa	aaa	a
M10B	155–195 mm	a*	aaa	a*	aaaaa	aaa				aaaa	aaa	aa

* - very few 0–5 %, f - few 5–15 %, ff - frequent 15–30 %, fff - common 30–50 %, ffff - dominant 50–70 %, fffff - very dominant > 70 %; a - rare < 2 % (a*1%; a-1, single occurrence), aa - occasional 2–5 %, aaa - many 5–10 %, aaaa - abundant 10–20 %, aaaaa - very abundant > 20 %.

Table 8
Radiocarbon and OSL dates from the Holwell project.

Radiocarbon dates (Oxcal. v. 4.3.2)						
Feature	Context	Sample	Material	Age years BP	Calendrical years (68.2 %)	Calendrical years (95.4 %)
Roundhouse floor (124)	(157)	87,580	Charcoal; Quercus	3314 +/−23	1626–1601 cal BC (24.3 %) 1585–1535 cal BC (43.9 %)	1660–1526 cal BC (95.4 %)
Basal palaeosol under reave 2	(207)	101,361	Charcoal: Quercus heartwood	5288 +/−23	4226–4198 Cal BC (19.4 %) 4166–4124 Cal BC (26.8 %) 4115–4097 Cal BC (10.7 %) 4068–4049 Cal BC (11.4 %)	4234–4191 Cal BC (24.4 %) 4172–4043 Cal BC (68.3 %) 4012–3990 Cal BC (2.8 %)
Pit [312] cutting basal palaeosol (316) under reave 1	(313)	87,573	Charcoal: Quercus	6084 +/−23	5028–4959 cal BC (68.2 %)	5057–4936 cal BC (95.4 %)
Pit [312] cutting basal palaeosol (316) under reave 1	(313)	87,574	Charcoal: Quercus	5979 +/−23	4905–4863 cal BC (40.2 % 4857–4830 cal BC (23.8 %) 4814–4808 cal BC (4.2 %)	4935–4808 cal BC (95.4 %)
Pit [314] cutting basal palaeosol (316) under reave 1	(315)	87,575	Charcoal; Quercus	6048 +/−23	4996–4932 cal BC (63.3 %) 4920–4912 cal BC (4.9 %)	5020–4894 cal BC (89.5 %) 4868–4850 cal BC (89.5 %)
Pit [314] cutting basal palaeosol (316) under reave 1	(315)	87,576	Charcoal; Quercus	6007 +/−23	4936–4880 cal BC (48.8 % 4871–4894 cal BC (19.4 %)	4978–4834 cal BC (95.4 %)
Cut {306} running parallel to reave 1	(305)	87,572	Genista; Cytisus; Ulex	620 +/−23	1299–1322 Cal AD (28.0 % 1348–1370 Cal AD (26.3 %) 1380 – 1392 Cal AD (13.8 %)	1293 – 1332 Cal AD (37.4 %) 1337–1398 Cal AD (58 %)
OSL dates						
Feature	Context	Field Code	Lab Code	Total Dr (Gy. ka^{-1})	De (Gy)	Age (ka)
Colluvial soil under reave 2	(291)	HTOR06	GL20063	4.34 +/- 0.33	61.5 + 2.7	14.2 +/- 1.3 (1.1)
Reave 2	(209)	HTOR07	GL20064	2.94 +/- 0.47	24.1 + 1.0	8.2 +/- 1.3 (1.3)
Colluvial soil under reave 2	(291)	HTOR08	GL20065	5.40 +/- 0.41	77.4 + 4.2	14.3 +/- 1.3 (1.2)

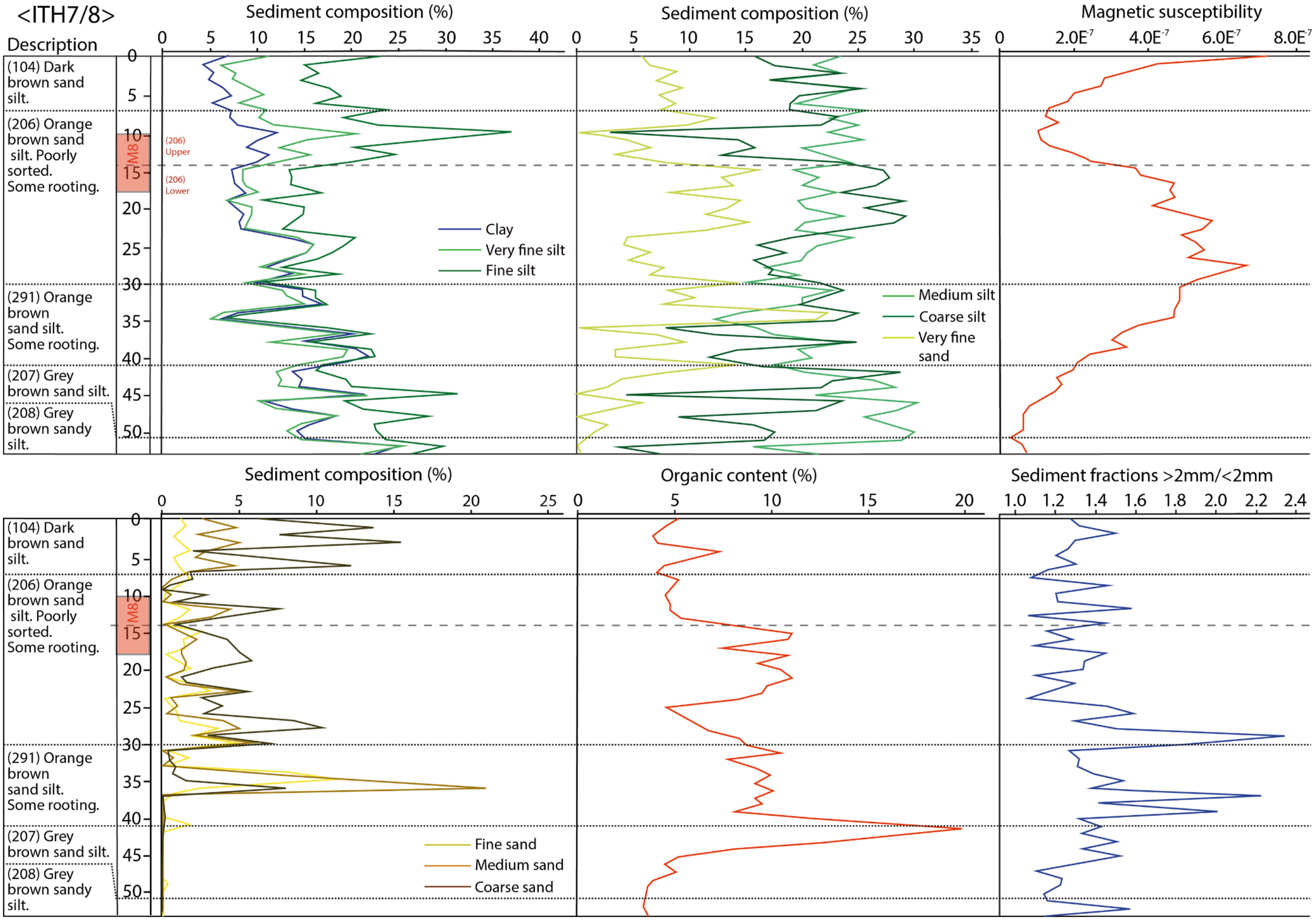


Fig. 11. Samples < 7 > and < 8 > sediment data.

inclusions of granite. At its eastern end context (391) was cut by [318] which dipped to the east, and was filled by context (320), a fine, dark grey silt clay, which was visible at the base of the section. The ditch [318] is probably the source material for context (304), which formed a bank to the south and a structural element of the eastern reave on the site. It consisted of a light brown to orange sandy, clay and sealed (316) and [312] and [314]. Context (319) was a mid to dark brown grey silt sand, containing common large, sub-angular to sub-rounded fragments of granite and it accumulated against the reave to its west suggesting it is tumble from the roundhouse wall to the north.

Next in the stratigraphic sequence was cut [306] (not visible in the section Fig. 13A), a linear cut running broadly parallel to the reave on its eastern side. This feature was up to *c*. 1.0 m wide, but shallow, reaching a maximum depth of 80 mm. It was filled by (305), a dark grey to black silt–clay. This material yielded an assemblage of charcoal dominated by scrub species such as broom and gorse (Simmons, 2019). A radiocarbon date on a group of charcoal of *Ulex/Genista/Cytisus* provided a date of 1398 – 1293 cal AD (95.4 %; SUERC 87572) (Table 8). This indicates that [306] was infilled during or after the medieval period although its origins are obscure, its shallowness perhaps suggesting that it was a feature formed through erosion either draining water and/or animal trample along the reave edge. Context (302) was a compact layer of brown black clay silt with a high organic content and is the same context as (102) which formed the lower horizon of the modern podzol in trenches 1 and 2. Finally, (302) was overlain by (101), the upper podzol A horizon. Sample < 11 > was located on the south facing section and sampled contexts (316), (391) and (304), measuring 42 cm in length. This sample was not analysed using micromorphology with the sediment data (Fig. 14; Table 11) accompanying the following interpretations, with the detailed descriptions of this sequence provided in the Supplementary Information. Radiocarbon details are provided in Table 8.

Context (316) 42 – 29 cm interpretation: this context is interpreted as a palaeosol, with high medium and coarse silt fractions and increasing magnetic susceptibility and organic content, consistent with a soil profile, with loessic parent material. The palaeosol shows evidence of sorting, with an increase in the sand fractions at the base of the unit. The high level of clay, very fine silt and silt at *c*. 38 cm at the base of the unit is interpreted as illuvial Bt horizon in the palaeosol, indicating translocation of some of the fine sediment fractions as a consequence of waterlogging and/or acidification. This demonstrates a stressed soil prior to the deposition of the overlying deposits and later reave construction. This palaeosol contained the cut features [312] and [314].

Context (391) 29 – 16 cm interpretation: the episodic high sand content and high > 2 mm/<2mm sediment fraction, indicates episodic colluvial inwashing of sediment. The increase in magnetic susceptibility is consistent with increased soil inwashing, with definable spikes in the > 2 mm clast mass, potentially indicating some erosion of lower B/C horizons, of an acid brown earth soil. The reduction in organic content, is consistent with erosion of lower soil horizons in conjunction with the finer upper soil horizons. Like with context (291), context (391) indicates colluvial additions to a palaeosol, defining a colluvial soil.

Context (304) 16 – 0 cm interpretation: during the field excavation this context was interpreted as forming the reave structure. The sediment data is consistent with this interpretation, with a reduction in the > 2 mm/<2mm fraction compared to the underlying colluvium (391). However, the boundary was somewhat diffuse and difficult to identify in the excavation, with the sand fractions still showing a number of spikes throughout, which are in places higher than the underlying colluvium.

Table 9
ITH18 samples < 7 > and < 8 > sediment data.

Context		Clay	Very fine silt	Fine silt	Medium silt	Coarse silt	Very fine sand	fine sand	Medium sand	Coarse sand	Very coarse sand	2 mm fraction	Organic matter (%)	Magnetic susceptibility
(208)	Mean	19.19	18.58	25.62	24.24	11.57	0.80	0	0	0	0	1.26	3.64	0.000000063450000
	Minimum	14.37	13.39	22.68	15.90	4.04	0.05	0	0	0	0	1.14	3.51	0.000000038400000
	Maximum	24.85	25.36	29.81	30.19	17.65	1.72	0	0	0	0	1.60	3.75	0.000000078600000
(207)	Mean	15.72	14.31	21.69	25.20	18.30	4.58	0.21	0	0	0	1.34	8.94	0.000000138822222
	Minimum	10.73	10.20	16.31	17.65	4.57	0.08	0	0	0	0	1.09	3.72	0.000000069200000
	Maximum	21.08	21.65	31.24	30.36	28.94	14.25	1.64	0	0	0	1.55	20.03	0.000000218200000
(291)	Mean	14.86	13.16	16.09	18.49	18.87	9.90	2.69	4.00	1.73	0.22	1.58	9.66	0.000000415172727
	Minimum	6.32	5.16	7.15	12.50	8.05	0.44	0.01	0	0	0	1.27	7.89	0.000000246800000
	Maximum	21.85	19.66	22.50	22.77	25.13	22.25	11.30	20.90	7.86	1.39	2.31	13.13	0.000000531700000
(206)	Mean	9.99	11.81	18.56	21.75	20.90	8.96	1.30	1.72	3.72	1.30	1.35	7.49	0.000000383456522
	Minimum	6.95	6.849	10.75	17.03	3.12	0.38	0.17	0	0	0	1.05	4.1468	0.000000108600000
	Maximum	15.99	20.42	37.02	25.83	29.27	16.20	3.45	5.39	10.39	4.58	2.43	11.05	0.000000669600000
(104)	Mean	5.83	8.62	17.390	21.88	19.85	7.731	1.19	3.51	9.27	4.72	1.32	5.08	0.000000349671429
	Minimum	4.49	6.27	14.597	18.377	15.967	5.93	0.74	2.17	2.127	0.238	1.21	3.91	0.00000018890000
	Maximum	7.22	10.93	22.83	24.74	25.20	9.35	1.78	4.93	15.51	8.90	1.53	7.33	0.0000007205000

The ditch on the side of the reave provided the material that was used to form the reave, incorporating redeposited colluvial and palaeosol material into the reave bank structure.

2.15.6. *Sample 11 summary*

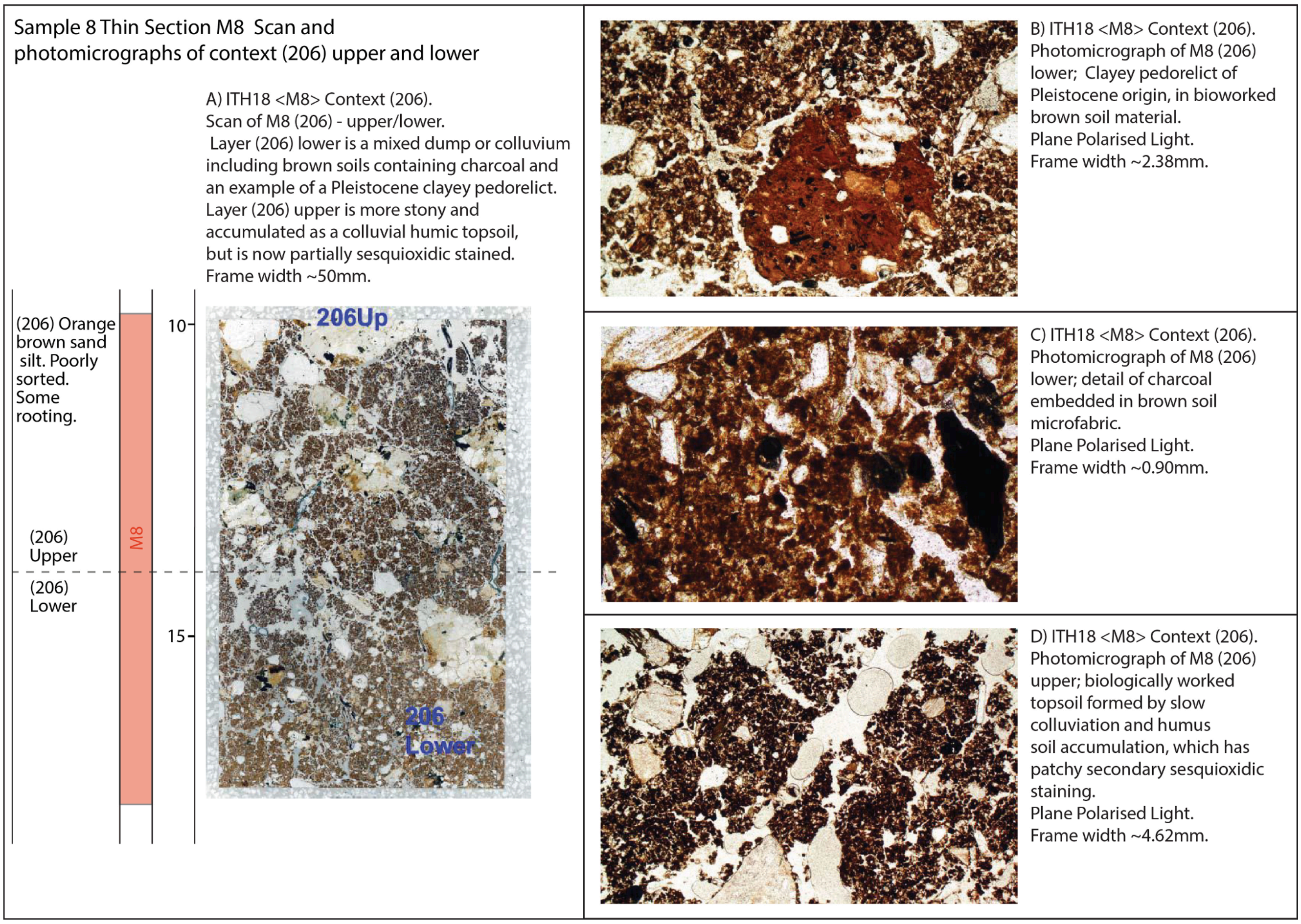
This sample records a palaeosol (316), dominated by medium and coarse silt fractions defining a loessic origin, with the presence of an interpreted illuvial Bt horizon at *c.* 38 cm, indicating waterlogging and the start of translocation of fine sediment fractions indicating podzolisation. The presence of the cut features [312] and [314] demonstrate the potential of palaeosols on Dartmoor to contain early features, preserved in palaeosols underneath later deposits and structures. Above this is another colluvial deposit (391), again defining localised soil erosion and attesting to human impacts on the acid brown earth soils upslope, with definable episodes of inwashing. The date of deposition of (391) can only be defined as post-dating the cut features [312] and [314] in the late Mesolithic. The reave bank (304) also has episodic peaks in the sand fractions, although the > 2 mm clasts reduce; it is interpreted that the bank was constructed from a mix of redeposited colluvium and a palaeosol, with a cut visible on the east side of reave 2.

2.16. *Discussion*

The Mesolithic features beneath reave 1, cut the palaeosol and are buried under the colluvial soil, demonstrating the soil type in the Late Mesolithic was an acid brown earth. The palaeosol (191) beneath the suspected recumbant 'standing stone' at Holwell also defines an acid brown earth, a soil type synonymous with deciduous woodland environments (Roberts, 2014; Walker & Bell, 2005). Pollen analysis of the earlier Holocene prehistoric Dartmoor landscape has provided evidence for a largely wooded environment preceding the Neolithic (e.g. Smith et al., 1981), in common with other upland landscapes in the southwest peninsula, such as Bodmin Moor (Gearey 2000; Maltby and Caseldine, 1982) and Exmoor (Fyfe, 2012; Merryfield and Moore, 1974). In palaeosol (191), charcoal provided evidence of earlier human activity, possibly woodland burning and/or clearance predating the deposition of the suspected recumbent 'standing stone' (121). A similar example was recorded at Carn Brea, Cornwall, where there was evidence for Neolithic scrub woodland clearance prior to the construction of the outermost rampart of the tor enclosure (Macphail, 1990). Although the brown earth soil beneath the suspected recumbent 'standing stone' at Holwell provides similar evidence for possible woodland burning/clearance, at Holwell there is no evidence for podzol development or colluvial deposition pre-deposition of the stone.

The lack of any colluvium above palaeosol (191), under the recumbent 'standing stone', confirms it pre-dates the roundhouse built over it, i.e. it was not moved into position during construction of the roundhouse, but was already lying on the landsurface. It is possible the stone was placed here during the Neolithic or Early Bronze Age, with standing stones postulated as dating to the Neolithic and/or Early Bronze Age across the southwest peninsula, although the dating of such sites and monuments has proved problematic. There is only one absolutely dated stone row at Cut Hill, Dartmoor, dating to between 3700 and 3500 cal BC (stone 1) and 3400 – 3200 cal BC (stone 9) (Fyfe and Greeves, 2010), with the Holwell stone (121) being of similar dimensions to the recumbent stones at Cut Hill.

The siting of the roundhouse over the recumbent 'standing stone' is interpreted as a deliberate and significant act creating a forceful connection between the roundhouse and an older prehistoric monument. Earlier excavations on Dartmoor have recorded a similar phenomenon of a standing stone being incorporated into a roundhouse at Watern Oke (house 45; Amery et al., 1906) and a roundhouse having a menhir (standing stone) against its outer wall (Grimspound house XVIII; Baring-Gould et al., 1894). These mark an association between what has been classically interpreted as more agriculture and domestic landscapes of the Middle Bronze Age and the more ceremonially focused landscapes



Sample 8 Thin Section M8 Scan and photomicrographs of context (206) upper and lower

A) ITH18 <M8> Context (206). Scan of M8 (206) - upper/lower. Layer (206) lower is a mixed dump or colluvium including brown soils containing charcoal and an example of a Pleistocene clayey pedorelict. Layer (206) upper is more stony and accumulated as a colluvial humic topsoil, but is now partially sesquioxidic stained. Frame width ~50mm.

B) ITH18 <M8> Context (206). Photomicrograph of M8 (206) lower; Clayey pedorelict of Pleistocene origin, in bioworked brown soil material. Plane Polarised Light. Frame width ~2.38mm.

C) ITH18 <M8> Context (206). Photomicrograph of M8 (206) lower; detail of charcoal embedded in brown soil microfabric. Plane Polarised Light. Frame width ~0.90mm.

D) ITH18 <M8> Context (206). Photomicrograph of M8 (206) upper; biologically worked topsoil formed by slow colluviation and humus soil accumulation, which has patchy secondary sesquioxidic staining. Plane Polarised Light. Frame width ~4.62mm.

Fig. 12. Sample < 8 > soil micromorphology data.

Table 10
Sample < 8>, thin section M8 soil micromorphology counts.

Thin section	Relative depth	Layer	MFT	SMT	Voids	Gravel	Soil clasts	Roots	Charcoal	Fungal sclerotia	Arbusc mychor	Embedded Gr/ (LinkCap)
M8	100–140 mm	(206) upper	F2	2b,2c(1a)	45 %	fff	*	aa	a*			a
M8	140–175 mm	(206) lower	G1	2d-3a(1a)	40 %	fff	*	aa	a			

Thin section	Relative depth	Poss-Matrix intercal	Organo sesq.	Secondary Fe	Thin burrows	Broad burrows	Extr. Thin org. excr	V. thin org. excr.	Thin org. excr.	V. thin O-M excr.	Thin O-M excr.	Broad O-M excr.
M8	100–140 mm			a	aaaaa	aaa		aaaaa	aaa			
M8	140–175 mm		aaaaa	a	aaa	aaaa				aaaaa	aaa	aaa

* - very few 0–5 %, f - few 5–15 %, ff - frequent 15–30 %, fff - common 30–50 %, ffff - dominant 50–70 %, fffff - very dominant > 70 %; a - rare < 2 % (a*1%; a-1, single occurrence), aa - occasional 2–5 %, aaa - many 5–10 %, aaaa - abundant 10–20 %, aaaaa - very abundant > 20 %.

of the later Neolithic/Early Bronze Age, although connections between Middle Bronze Age field systems and older monuments and landscape features have been well documented across southern Britain (Field, 2001; Fleming, 2008; Bradley, 2007, 188). As the Holwell roundhouse aptly demonstrates, the location of structures in the Middle Bronze Age not only paid attention to the earlier monuments, but in this case repurposed them within the construction of the roundhouse. At Holwell this could represent the legitimisation of a location or an association with certain forces or ancestry within this landscape.

Palaeosols were also identified beneath the roundhouse ((125)/(lower 111)) and the two reaves ((207 and (316)), which were similar in sediment composition to palaeosol (191), dominated by medium to coarse silts, demonstrating incorporation of loessic parent material (Catt, 1978). These early Holocene soils at Holwell were subsequently incrementally added to by colluvium that post dates the positioning of the recumbent ‘standing stone’ (121); consequently, the A horizon of the original soil was not quickly or completely buried, creating a diffuse boundary at the top of the palaeosol, as the depth of the soil profile

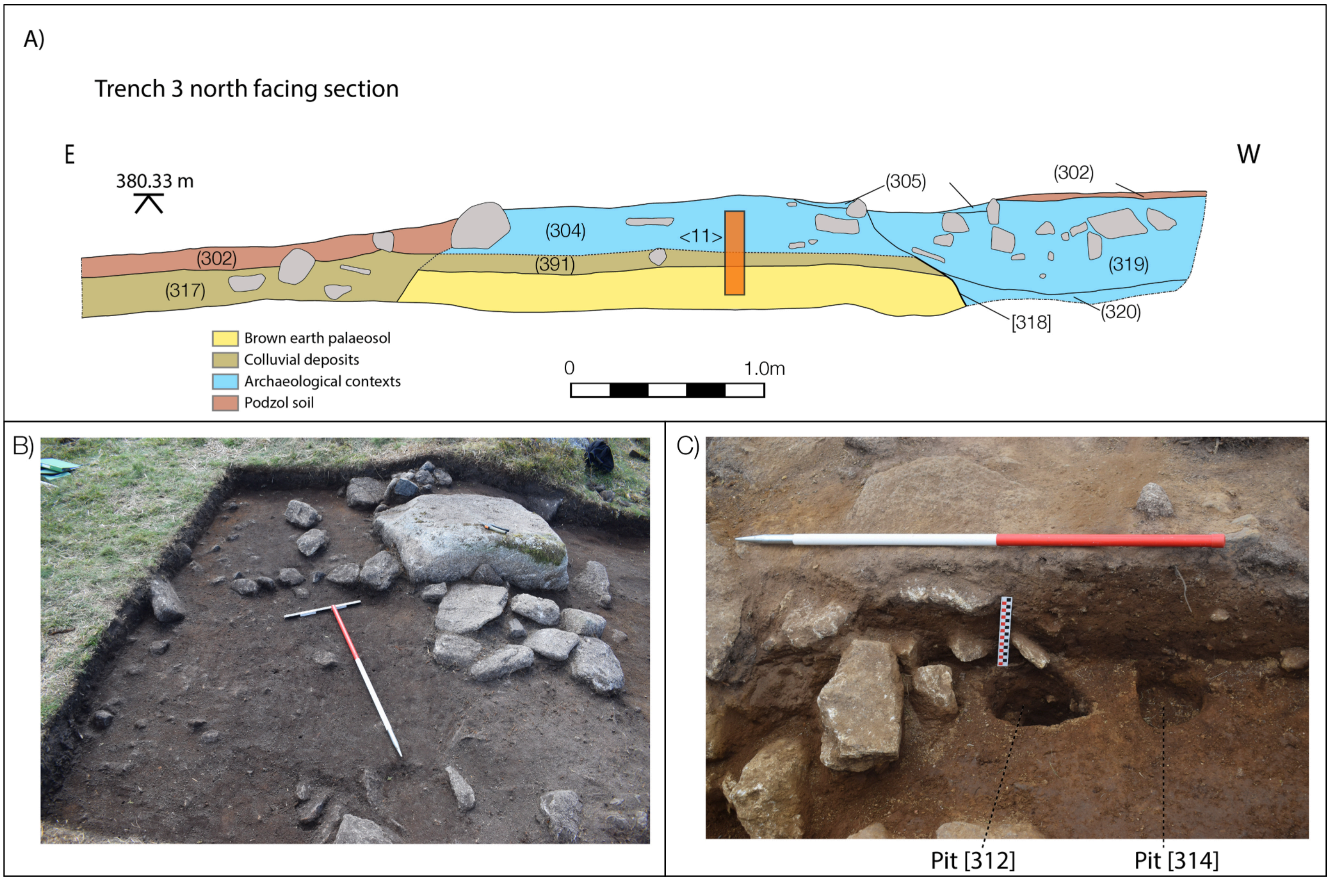


Fig. 13. The details of sample < 11 > showing: 13A) trench 3 north facing section and the position of sample < 11>, and 13B) a photograph of reave 1 exposed before excavation showing its stone topping and earth bank, view looking south and 13C) a photograph of trench 3 showing cuts [312] and [314] and the trench 3 sediment sequence, view looking south.

incrementally increased. Bell (1983) also recorded a diffuse boundary between a palaeosol and overlying colluvium (Trench B, layers 4 and 5) at Charlton, Hampshire, and it was suggested that cultivation of a colluvial soil had blurred this original junction; it is possible that a similar process occurred at Holwell, although there was no evidence for typical features associated with cultivation visible in the thin section analyses from the samples under the roundhouse or either reave (e.g. micro-laminar dusty clay coatings in the base of the A/top of the B, juxtaposed fabrics or dusty clay infilling the voids in the Bw).

However, such textural pedofeatures are most common in cultivated soils depauperated in organic matter, a process more typical of early cultivated English soils where manuring had not been carried out or in modern arable soils which suffer from major organic matter loss through cropping and bare ground oxidation; such features were noted early on by Jongerius (1970). Soils on Dartmoor are inherently moderately humic, and have more in common with cultivated soils from Scotland and the Isles, and plaggen soils of Holland, for example, where manured cultivation is accompanied by over-thickened Ap horizons, increased levels of biological activity and the formation of stable soil peds, and where textural pedofeatures are less likely and much less well-preserved (Conry, 1970; Pape, 1970; Davidson and Carter, 1998; Mücher et al., 1990). Alternatively, the lack of definable soil horizon boundaries within the colluvial soil at Howell could simply be due to mixing by soil fauna.

At Holwell, the duration of colluvial deposition is undefined, partly a result of the absence of artefacts within the excavation (no pottery was recovered for example), although the limited colluvial additions to the palaeosol under the roundhouse date to pre-1660–1526 cal BC (95.4 %; SUERC 87580). The radiocarbon date at the base of the palaeosol (207) in the very Late Mesolithic – Early Neolithic (4234–4191 cal BC (24.4 %); 4172–4043 cal BC (68.3 %); 4012–3990 cal BC (2.8 %) (95.4 %, SUERC 101361)) is likely to demonstrate an old wood effect and it potentially represents an Early Neolithic woodland disturbance/clearance. The deposition of the colluvium in (291) occurred after this date and pre-reave construction and is interpreted as anthropogenically driven, following a long period of soil stability at this locale in the Early Holocene. Colluvium (291) and (391) demonstrated evidence of pedogenesis, defining a colluvial soil as much as a sediment deposit *per se*. The colluvium was heterogeneous, containing charcoal and brown earth subsoil material, and is dominated by the silt and sand fractions. The silt rich brown earth soils upslope of the roundhouse and reaves were clearly susceptible to erosion through surface run-off, following vegetation disturbance and/or clearance, with soil erosion having occurred prior to construction of the reaves and the roundhouse.

The particle size distribution of the colluvium coupled with the soil micromorphology indicates the source of this colluvial material is mainly localised topsoil (A, upper B horizon), with the erosion of a potentially cultivated soil incorporated in the colluvium (291) beneath reave 2. Colluvium from Bronze Age cultivation was also identified at Chysauster, where tillage increased the susceptibility of soil to erosion and the ‘washing-out’ of clay from cultivated topsoil (Macphail, 1987). What is apparent from the analysis of the reave 2 deposit sequences, is that the process of localised soil erosion that caused colluviation was occurring pre-reave construction (291) and this deposition continued after reave construction (206). This sediment deposition occurring both pre- and post-reave construction, describes some form of continuity in the use of this locale over the time period of reave construction.

It is tempting to consider that the colluvium under the reave relates

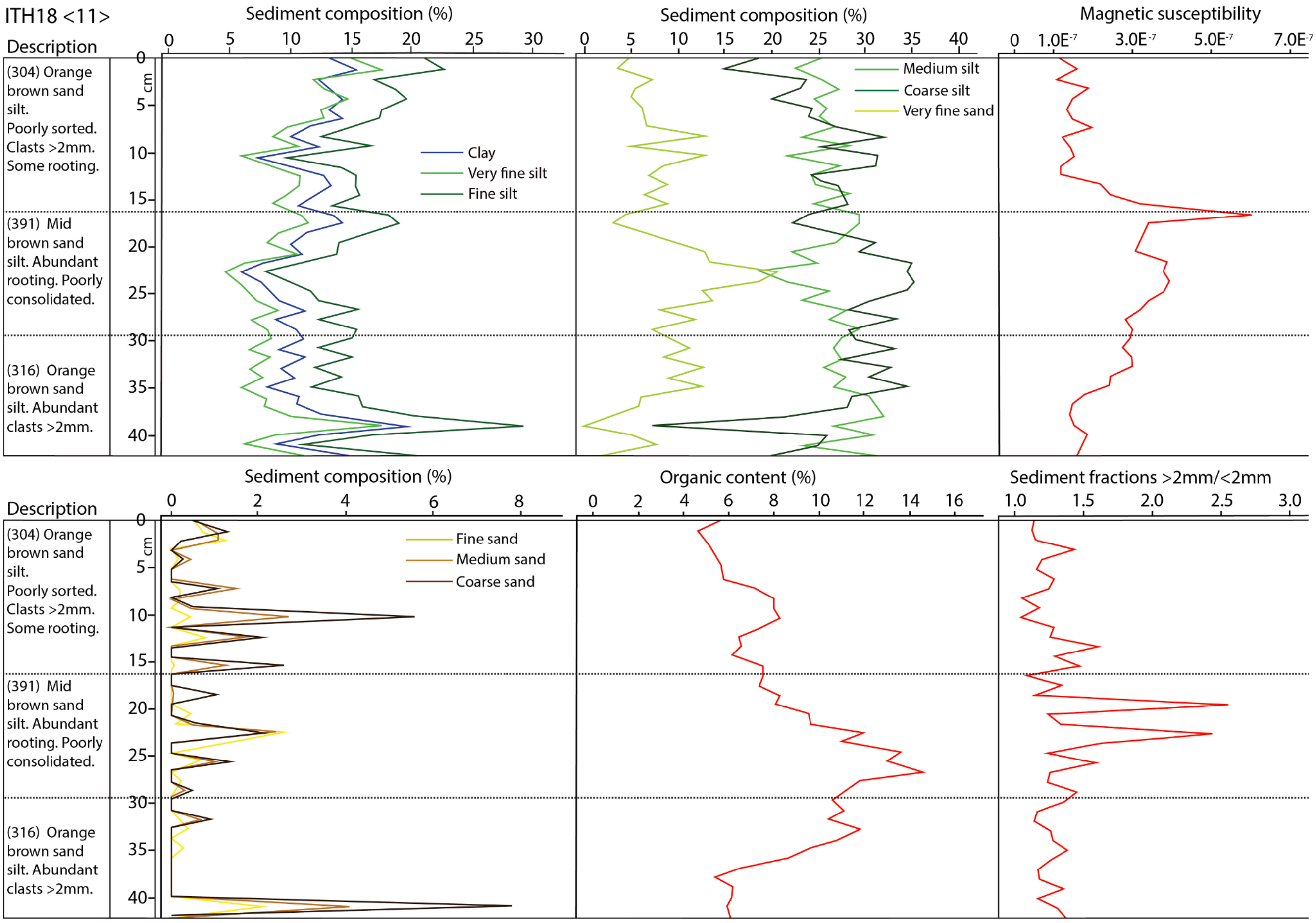


Fig. 14. Sample < 11 > sediment data.

Table 11
ITH18 sample < 11 > sediment data.

Context		Clay (%)	Very fine silt (%)	Fine silt (%)	Medium silt (%)	Coarse silt (%)	Very fine sand (%)	Fine sand (%)	Medium sand (%)	Coarse sand (%)	Very coarse sand (%)	Organic matter (%)	>2mm/ <2mm fraction	Magnetic susceptibility
(304)	Mean	12.31	11.31	16.35	25.37	25.20	7.26	0.30	0.68	0.87	0.35	6.46	1.25	0.00000016406
	Minimum	7.42	6.08	9.76	21.62	14.88	3.67	0	0	0	0	4.69	1.04	0.0000001080
	Maximum	15.36	17.49	22.48	28.38	32.13	12.99	1.29	2.68	5.53	2.29	8.27	1.61	0.0000003220
(391)	Mean	9.97	8.04	13.67	25.76	30.21	11.02	0.43	0.32	0.42	0.15	10.56	1.50	0.00000036031
	Minimum	5.98	4.70	8.06	18.93	22.13	3.37	0	0	0	0	7.38	1.09	0.0000002830
	Maximum	14.36	11.66	19.06	29.41	35.16	20.65	2.55	2.35	2.06	1.11	14.57	2.55	0.0000006030
(316)	Mean	11.50	8.76	16.12	28.32	26.50	7.24	0.25	0.36	0.66	0.30	8.40	1.26	0.00000021492
	Minimum	8.13	6.09	11.05	23.57	7.24	0.06	0	0	0	0	5.35	1.14	0.0000001390
	Maximum	19.44	17.73	29.17	32.16	34.29	12.79	2.08	4.02	7.72	3.72	11.7927	1.38	0.0000002980

to soil erosion from woodland clearance and the colluvium against the reave relates to landscape use (e.g. soil erosion from arding). However, the form of the colluvial soil does not drastically change across (291) and the lower part of (206), suggesting the same or similar activities were occurring within this locale throughout (with the caveat that pedogenesis would have homogenised (291) and (206) to some extent). Therefore, land division was occurring within a continuity of use at this locale; rather than representing a juxtaposition of landscape use before and after reave construction.

Colluvial soils have also been defined underneath prehistoric field divisions in North Wales at Cwn Cilio, where excavation identified a buried humic colluvial soil. This colluvial soil was a plough eroded brown earth, which provided a date of 1910–1740 cal BC at 95 % probability, although the charcoal was possibly associated with a clearance phase, and the cultivation could have been later, potentially Late Bronze Age (Smith et al., 2018). Likewise, the aforementioned colluvium at Chysauster was associated with tillage during the Bronze Age (Macphail, 1987). Simmonds and Champness (2015) also identified colluvium against the Great Western Reave, Dartmoor, and although this sediment is undated, its stratigraphic position at the base of profile against the reave corroborates similar processes were occurring shortly after reave construction on other areas of Dartmoor, similar to Holwell. At Farley Water, Exmoor, colluvium was identified underneath a burnt mound dating to pre-2577–2456 cal BC (95.4 %; SUERC 52978), prior to podzolisation (Carey et al., 2021). At Brean Down, Somerset, Beaker/Early Bronze Age colluvium and possible ard marks are recorded, prior to Middle Bronze Age occupation of the site (Bell 1990). Furthermore, Bell's (1983) seminal research demonstrated post Beaker, Bronze Age colluvium in Sussex and Hampshire, England, above chalk bedrocks, which was associated with woodland clearance and subsequent cultivation. These examples all demonstrate phases of localised human impact on landscapes during prehistory, with most of them pre-dating the classic Middle Bronze Age date of land division in southern Britain.

The remarkable preservation of both Early and Middle Bronze Age land surfaces at Gwithian, Cornwall, also identified continuity in the use of the same locale across the Bronze Age (Nowakowski et al., 2007). At Gwithian, an Early Bronze Age house associated with Trevisker Ware (a localised SW Britain Early Bronze Age pottery style) was set within a series of terraces and fields, with palaeosols from these fields demonstrating ard marks, manuring and *Hordeum spp*. (barley) seeds. Burial by the aeolian coastal dunes preserved this land surface, before this locale was reused in the Middle Bronze Age (1500–1200 cal BC) with further development of the field system and a prolonged period of arable cultivation. A similar continuity of locale use both pre and post enclosures was demonstrated at West Northwood Farm, Bodmin Moor, Cornwall. At West Northwood, a pre-enclosure bank with abundant evidence for anthropogenic use and additions over a prolonged period occurred prior to construction of the enclosure. Whilst the date of construction of the enclosure bank was not ascertained, on morphological grounds it was interpreted as Middle Bronze Age (Carey et al., 2022).

Taken together, these examples define phases of landscape use and impact occurring prior to the Middle Bronze Age in site specific analyses, i.e. locales were being used in the same/similar ways both pre-land division and after land division. In areas of exceptional preservation (depositional environments, such as under aeolian dune formations or accreting podzolic soils), it is apparent that the use of these locales and construction of land divisions are a process that started in the Early Bronze Age and continued into the Middle Bronze Age. Thus, rather than Middle Bronze Age land divisions representing either A) a complete change in landscape use, or B) a change in the intensity of use of these locales, it can now be seen that landscape impacts occurred across the Early – Middle Bronze Age.

If similar processes of landscape use were occurring across the Early – Middle Bronze Age, how is the construction of Middle Bronze Age land divisions to be explained? Interpretations of reave construction on Dartmoor and Middle Bronze Age land division across Britain more generally, have equated land division with fields and food production, primarily pastoral in the case of Dartmoor (Smith et al., 1981; Fyfe,et al., 2008; Fleming, 2008). It is clear that extensive land division in the Middle Bronze Age is not a prerequisite for farming and domesticate food production (elements of farming practices had been present in Britain since the Early Neolithic). The construction of large-scale land divisions and coaxial fields had previously been interpreted as relating to agricultural intensification during the Middle Bronze Age, but as Brück (2019, 187-200) eloquently describes, equating Middle Bronze Age field systems to agricultural intensification and proto-capitalist models of exploitation are not supported by the archaeological evidence; what Holwell clearly demonstrates is some form of connection between older monuments, older land use practices and the subsequent construction of the reaves.

It is also important to recognise the relationship between hard lithologies, such as granite, and non-replenishment of soils after erosion, due to a low ability of ploughing/arding to break up the bedrock interface and facilitate soil replenishment (Brown and Walsh, 2017). Alongside soil erosion, soil acidity increased at Holwell, due to woodland clearance and the removal of Ah horizons exposing lower soil horizons with greater susceptibility to weathering and erosion, leading to decreased earthworm activity and eventual replacement by acid tolerant soil fauna, characterised by the abundant narrow burrows. This led to the cessation of soil mixing and a build-up of organic matter and plant acids. These changes often result in the leaching of clay and sesquioxides into the subsoil forming an illuvial layer enriched in clay and iron/aluminium oxides (Fe_2O_3/Al_2O_3). This is evident in the palaeosol (316) in trench 3, where there is a peak in clay, very fine silt and fine silt at *c*.38 cm indicating the presence of an illuvial (Bt) horizon within the acid brown earth palaeosol, and also within (206) post dating reave 2. The Bt horizon at Holwell demonstrates that the soil was deteriorating prior to construction of reave 1, with the leaching of clay, and fine silt fractions, which are vital for maintaining soil structure, stability and fertility (Goldberg et al., 2022).

At Holwell, the analyses also recognised subsoil material affected by podzolisation incorporated into reave 2 demonstrating that some podzol development had already occurred, presumably close to reave 2. However, unlike Shaugh Moor where a podzol was preserved beneath the reave (Balaam et al., 1982), the colluvial soils at Holwell under the reaves were not podzolised. These analyses describe a mosaic landscape where soils are eroding through human activity, potentially pastoralism/horticulture (colluvium (291), (391) and (111)), deteriorating (Bt illuviation (316)), with evidence of podzolisation nearby (209), yet, reaves are being built and a roundhouse constructed. This suggests a proactive response of people at this location to encroaching podzolisation and soil degradation. This poses significant questions about where and why reaves were being constructed. Was this an incremental setting out rather than a wholesale landscape division? Was it that the reaves deliberately traversed not only terrain types, but also soil types and by extrapolation different landscape zones? And were past societies who enclosed land through reave construction, as soils were degrading and changing, driving these changes?

Previously, it has been interpreted that there is little evidence of significant land pressure on the southwest uplands prior to, and during, reave construction (Wickstead, 2007, 60), with only limited examples of sub division of fields (Brück 2019, 187-200). Fleming (2008) proposed that reaves were constructed over a short period of time, and could represent the formalisation of earlier territories, with reaves being necessary due to increased pressure on grazing land. Johnston (2005, 3) suggests the reaves were constructed through the ‘working of individual agencies within the material conditions of an existing socialised landscape and the ideational structure of land enclosure and division’. Within this Johnston (2005) argues that the construction of reaves takes place over an elongated period of time, with reaves demonstrating long and complex biographies, defining incremental enclosure, emerging from longer traditions of tenure and land use. It is clearly necessary to look beyond tenure and food production as an explanatory force for Middle Bronze Age land division and consider the construction of such divided landscapes, as monumental landscapes. The construction of stone walled reaves over such large areas of landscape represents a significant societal undertaking, producing monuments on a landscape scale.

Whilst the chronology of construction of these land divisions is far from resolved, it is clear some of these reaves divided land, e.g. contour reaves separating higher ground and lower ground, whilst some of these land divisions enclose land, e.g. co-axial fields, but also the reaves join together landscapes and structures. In the case of Holwell, reave 1 connects to the roundhouse at Holwell, but it also terminates at the roundhouse. Rather than dividing land, it is equally a connection, tying an unenclosed roundhouse into a wider network.

Although the data from Holwell is localised in extent, it can allow us to consider interpretations of land division in the Middle Bronze Age. We suggest that land divisions could be a product of ‘societal relationships to each other and the landscapes they inhabit’. In other words, the reaves were constructed to formalise the conceptual relationships of peoples and landscapes. For example, the reave systems can be considered to divide ecotonal areas, showing awareness of different resources and processes, e.g. areas of funerary monuments and higher ground are divided from the Middle Bronze Age settlement at Holne Moor; this is a conceptual division of land, but it is also one based on peoples uses and perceptions of that locale. Likewise, the reaves connect roundhouses (people) and areas of landscape. Therefore, the relationship of people and their conceptualisation of their landscape, is formalised in the construction of these stone monuments.

Linked to this idea, it is possible that reave construction was partially a response to soil erosion and encroaching podzolisation. Potentially areas of land were subdivided (contained) due to encroachment of podzol soils. Such ideas would fit comfortably within a model of Middle Bronze Age land divisions representing conceptualisation of relationships between people and landscapes, rather than through models of agricultural change and intensification. Of course, reasons for construction of the reave systems and Middle Bronze Age land divisions more generally do not need to be singular, but can be interpreted through a variety of factors and perceptions, relating to societal interaction with the landscapes they inhabited. Such ideas can explain the nuance of land division at local scales, relating to local factors, ecologies and topographies but can be nested within wider models of land division that occurred over much larger areas. The process of creating monuments of land division (and linkage) were shared by societies over wide areas, but these ideas were read, adapted and enacted at local scales, dictated by the uniqueness, resources and subtlety of the landscapes that was being monumentalised.

3. Conclusion

These analyses demonstrate, that at Holwell, prior to reave construction, there had been human driven landscape changes, leading to soil degradation and erosion, before reave construction. These same processes continued after reave construction. Whilst models of wider landscape degradation, abandonment and podzolisation have been discussed for the Bronze Age in the uplands, there has been little synthesis of human landscape impacts linked to archaeological sequences. Holwell unequivocally demonstrates human impacts through use of this upland landscape prior to the creation of reaves. As such it substantially adds to the reasons for, and models of, reave construction. Furthermore, this study defines continuity, such as between earlier landscape features and the roundhouse location, and practices that preceded the reaves that were continued after reave construction. The data produced from this study is suggestive of some localised cultivation in the study area, upslope of the reaves and roundhouse. This question of small scale arable/ vegetable cultivation requires further exploration, to fully explain the lifeways of Early and Middle Bronze Age communities in upland environments. This can be achieved through more site-specific studies, integrating sediment analysis data with palaeoecological data. Likewise, the impacts of human societies on these environments requires further investigation. Whilst deterministic models of societal collapse are headline grabbing, nuanced models of human impacts and human/ environmental interactions can substantially add to our understanding of Middle Bronze Age societies and their perception of their world. Dartmoor is arguably the best preserved Bronze Age landscape in Europe and as such has considerable potential to illuminate our understanding of past societal relationships with the landscapes they inhabited. Such research can significantly add to the narratives produced through studying monumental architectures, and as such provide alternative data driven models of societal changes, or continuity.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.jasrep.2024.104506.

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