A Late Bronze Age timber trackway in the intertidal zone at Coopers Beach, Mersea Island, Essex

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Mersea Island, Essex, TM 057131
Coastal and Intertidal Zone Archaeological Network (CITiZAN)

Abstract

In 2016 a group of planked timbers were observed resting beneath thick sediments 700m offshore at –1.52mOD, directly south of Coopers Beach Caravan Park, Mersea Island, Essex. Reported to the CITiZAN project by local oysterman Daniel French, an initial survey identified the remains of an apparently in-situ section of timber trackway made up of three large timbers laid edge to edge, with two outlying timbers of similar dimensions found nearby. The timbers In February of 2017 CITiZAN archaeologists, supported by a local Mersea volunteer team and specialists from Historic England and Colchester Council, rapidly cleaned, recorded and rescued the timbers for scientific dating and conservation. Dendrochronology dated the in-situ timbers with a terminus post quem of 952BC. The structure is unique to the southeast of England both in form and scale. Made of radially cleft oak planks supported below by a brushwood raft of hazel and oak, the trackway was built to traverse a wetland environment that was infrequently flooded by the highest tides. It likely provided access to resource rich islands amongst the marshes, possibly terminating by a natural embayment or water course that provided access to deeper waters, possibly for onward travel by boat.

The timbers were crafted with considerable skill, radially cleft from oak logs up to 0.8m in diameter. Square sockets were axe cut into the ends of all timbers with tool marks clearly visible around each socket. The holes were used for locating stakes to pin the structure to the brushwood raft below. If the observed remains were consistent in size with the original structure with the locating sockets c.1.8m apart, the trackway would have been wide enough to allow the passage of carts or even chariots, certainly large numbers of livestock or heavy cargos across the marshes.

The timbers were generously conserved by Historic England and a local fund-raising initiative by the Mersea Island Museum has seen the timbers returned to the island. They are on permanent display at the local museum.

Introduction

Mersea Island, Essex is situated at the mouth of the Blackwater and Colne estuaries *(Fig. 1)* 12 miles south of Colchester. The Coopers Beach site is located at TM057131 and accessed via a public beach from the Coopers Beach caravan park by advance request, or by the coastal path from Cudmore Grove Country Park. Access to the site is possible year-round, weather permitting, but a low tide of at least 0.4mOD is recommended. The site is 700m offshore and extensive mudflats must be crossed to reach it, they include hard, compacted clays and areas of deep soft mud. A local guide is recommended.

The foreshore to the south of Mersea Island has been subject to significant coastal erosion since the early 20th century, with up to 1.5m of saltmarsh and sediment eroded by the late 1950's (Frost 1979). Where once a lush saltmarsh reached all the way to the low water line there are now mudflats broken by relict channels and embayment's. The sedimentary architecture reflects that of a former wetland in the main, at least where limited auger survey has been undertaken. Shifting sand dunes are present and shingle spits have a propensity to move with large storms and tides. Such dramatic change is the main reason why so many archaeological features are exposed on the expansive mudflats (*c.8km²)* to the south of the island where they stretch from Mersea Stone in the east all the way to the Monkey beach at the SW tip of Mersea Island.

The archaeology of the Coopers Beach site is situated in a particularly active area of the foreshore. Local oysterman Daniel French observed the ends of three larger, planked timbers protruding from soft mud after a channel had naturally expended, draining the mudflats on the ebb tide. It was an area of the foreshore that had changed significantly and rapidly even for a relatively regular visitor. He contacted CITiZAN via registered volunteers on Mersea Island and an initial survey visit was conducted in 2016. Based on that survey, a decision was made by Historic England in 2017 to support CITiZAN in lifting the timbers for conservation. The decision was based on the high level of preservation and the significance of the feature, it being structurally unique to the Southeast of England.

Post ex analysis of the timbers was conducted at MOLA's offices in London by the volunteer team who helped lift them and accompanied by MOLA specialists. Environmental analysis was kindly conducted by Dr. Zoe Hazel and Gill Cambell and dendrochronological dating by Peter Marshall and Ian Tyers, all from Historic England. Conservation of the timbers was conducted under agreement between Historic England and CITiZAN and managed expertly Angela Middleton.

The site survey was produced using Leica Zeno Mobile and a GG04 antenna RTK survey kit. The aerial survey was conducted using a DJI Mavic II and the orthomosaic produced using Agisoft Photoscan.

Background

CITiZAN were alerted to the Coopers Beach site by oysterman Daniel French and volunteer James Pullen in the winter of 2016. Mr French described what he believed to be the remains of a boat under soft, thick mud, but on closer inspection believed the timbers to be of some antiquity. An initial recce was conducted in January of 2017 with support from ASE, Colchester Council and MOLA with an initial report made to Historic England. Based on this report a decision was made to rescue the timbers and Historic England supported CITiZAN to do so in February 2017.

A further five surveys were made between 2017 and 2021 during which a limited auger survey was conducted and monitoring of the rates of erosion around the brushwood raft. Since lifting, the site has been monitored twice annually by volunteers and CITiZAN archaeologists. The channel that originally exposed the timbers, combined with five years of natural and storm driven erosion, has destroyed an estimated 75% of the features that were not removed from the site. This includes the brushwood raft on which the timbers were laid, a second, heavily eroded section of the trackway and the remains of numerous submerged trees.

Description of the features

The principle remains observed fall into four groups identified on the site plan *(fig. 2)*; 1) three oak timbers in situ resting on a brushwood raft, 2) a fourth timber located to the northeast of group 1, 3) a fifth timber located northwest of group 2, 4) a heavily eroded section of trackway consisting of parallel runner beams and a heavily eroded planked timber to the southwest of group 1.

Feature 1: Three oak timbers in situ (fig 3 and 4) -1.52m OD

A row of three planked oak timbers laid sw-ne, edge to edge forming a solid trackway surface up to 2.5m wide. The dimensions;

Timber 1: 2m x 0.2m x 80mm
Timber 2: 2.4m x 0.26m x 80mm
Timber 3: 2.56m x 0.29m x 55mm

All three timbers had square axe cut sockets at each end measuring 60mm x 60mm with evidence of axe marks clearly visible around the edges of the sockets. The marks measured 5mm in width. The timbers were supported below by a raft of brushwood poles consisting of oak and hazel. The raft covered a total area of c.8m^2 and on average was 0.25m deep. Two upright stakes were observed in gaps between timbers 1 and 2 (fig. 4). Small patches of brushwood were observed resting above timber 3 and sampled. All three timbers were then lifted and samples of brushwood taken from beneath.

Feature 2: Timber 4

A single oak timber dimensions 2.02 x 0.18 x 0.06m laid se – nw. A single socket cut at the western tip as observed prior to lifting. It is not known if the timber was found in situ given its location within a flowing channel, however it was directly above a thick blue grey clay suggesting possible redeposition.

Feature 3: Timber 5

A single timber dimensions 2.35 x 0.14 x 0.05m laid se – nw. A single complete socket with evidence of a possible socket at the opposite end but since broken off. Positioned directly above grey blue clay and submerged in a shallow flowing channel.

Feature 4: A heavily eroded section of trackway

A single, heavily eroded plank measuring 1.8 x 0.4 x 0.02m laid across and directly above two parallel, circular section runner beams at –1.60m OD. The plank was laid in a sw – ne alignment similar to feature 1. The runners were set directly above some evidence of small brushwood. The feature abutted an area of raised peats with evidence of a root bowl directly to the sw. The feature was not sampled.

Timber analysis

Damian Goodburn of MOLA examined all five timbers before they were sawn for dendrochronological dating. A summary of his analysis follows;

All the planks are radially cleft. Timber 3 is a 1/32nd section the others all 1/16ths. The ends of all five planks were axe cut, as are the roughly square holes for the stakes. The oak trees they came from varied, from very narrow ringed, slow growth examples nearly 200 years old, to faster growing examples not much more than 100 years old. The largest diameter logs used were about 0.8m (2'4") diameter to the outside of the bark. The two patterns of rings suggest that two separate areas of woodland were probably used.

Scientific dating

Samples were taken from all five timbers for dendrochronological and carbon dating kindly provided by Ian Tyers and Peter Marshal respectively, both of Historic England. Reports can be found in Appendix A and B of this report. Timbers 1 – 3 were dendrochronologically dated with a *terminus post quem* of 952BC, the Bronze Age.

Timber 4 was dated using wiggle matching given that it was the only one of the five timbers that had sapwood present. The estimate for the date of felling is 947 – 890 cal BC (95% probability) and therefore it is assumed that timber 4 is likely contemporary in its use with timbers 1 – 3.

Brushwood analysis

Samples of the brushwood recovered from on top of timber 1 and below timber 3 were analysed by Aitkin and Hazel (2017). Only two wood types were identified, both of which are hardwoods: *Coylus* (hazel) and *Quercus* (oak). In the British Isles, the only native hazel is *C. avellana* (hazel) and the only native oaks are *Q. petraea* (sessile oak) and *Q.robur* (pedunculate oak) (Gale and Cutler, 2000: 204).

Interpretation of features and discussion

Timbers 1 – 5 are the remnants of a relatively broad-gauge timber trackway that was built to cross an area of boggy ground. If we are to assume timbers 1 – 4 were likely part of a structure over 80m long and wide enough for carts and livestock to travel on. If we are to further assume that timber 5 and feature 4 are also contemporary with timbers 1 – 4 then the structure extends to over 150m in length, albeit with a change in direction between timber 4 and 5, not an unlikely prospect given that one intended terminus point for the structure was likely firmer ground on the mainland.

However, it is not possible to say with any degree of certainty that timbers 4 and 5 were found in situ, resting as they were directly above harder clay and submerged in a channel. Both also have sockets cut at one end, implying that there were at one point staked to the ground. If they are contemporaneous with timbers 1 – 3 then a similar construction style may be expected i.e. laid and pegged above a supportive brushwood raft. It is feasible that the timbers were pinned directly into harder sediments, perhaps at the edge of the bog or channel which they were originally intended to span where the structure moved from solid to brushwood foundations. Given their slightly maligned positions relative to timbers 1 – 3 and the rate of erosion at the site waterborne redeposition is a possibility where sections of the trackway have been weakened by the channel, this might also explain the lack of brushwood beneath them.

Feature 4 appears to be a further section of a trackway, although it was not sampled when initially observed and had subsequently eroded out entirely on future trips leaving no trace. Its orientation and alignment indicate that it could have been part of the same structure, perhaps even indicating the end of the trackway and the route moved onto terrafirma. This would support the idea that the trackway was being used to access resource rich areas of the once sprawling wetland it was built to cross. Aerial survey of the wider trackway area suggests that feature 4 is situated next to a relict embayment or the meandering banks of a relict watercourse. Evidence of a possible riverbank was observed further to west (fig 5) where root bowls and tree trunks appeared to follow a meandering course of softer sediments in a shallow channel. The trackway may have been constructed as a means of accessing such a bay or channel, providing a natural harbour for travel beyond Mersea and potentially across a bronze age Blackwater channel.

Recommendations and further fieldwork

Given the speed and scale of erosion, the destruction of most of the features associated with the trackway, it is recommended that any further focus be directed westwards of Feature 4 to record in detail the remains of the submerged woodland exposed along the shores of the relict embayment and possible river channel. There is anecdotal evidence of timber planks set into the peat shelf with similar dimensions to those recorded in this report, but that these are at risk of erosion or are already heavily eroded. The raised peat beds would make ideal candidates for extensive environmental sampling and possible scientific dating to establish the age of the woodland currently exposed.

Figures

Figure 1: Location of Coopers Beach site

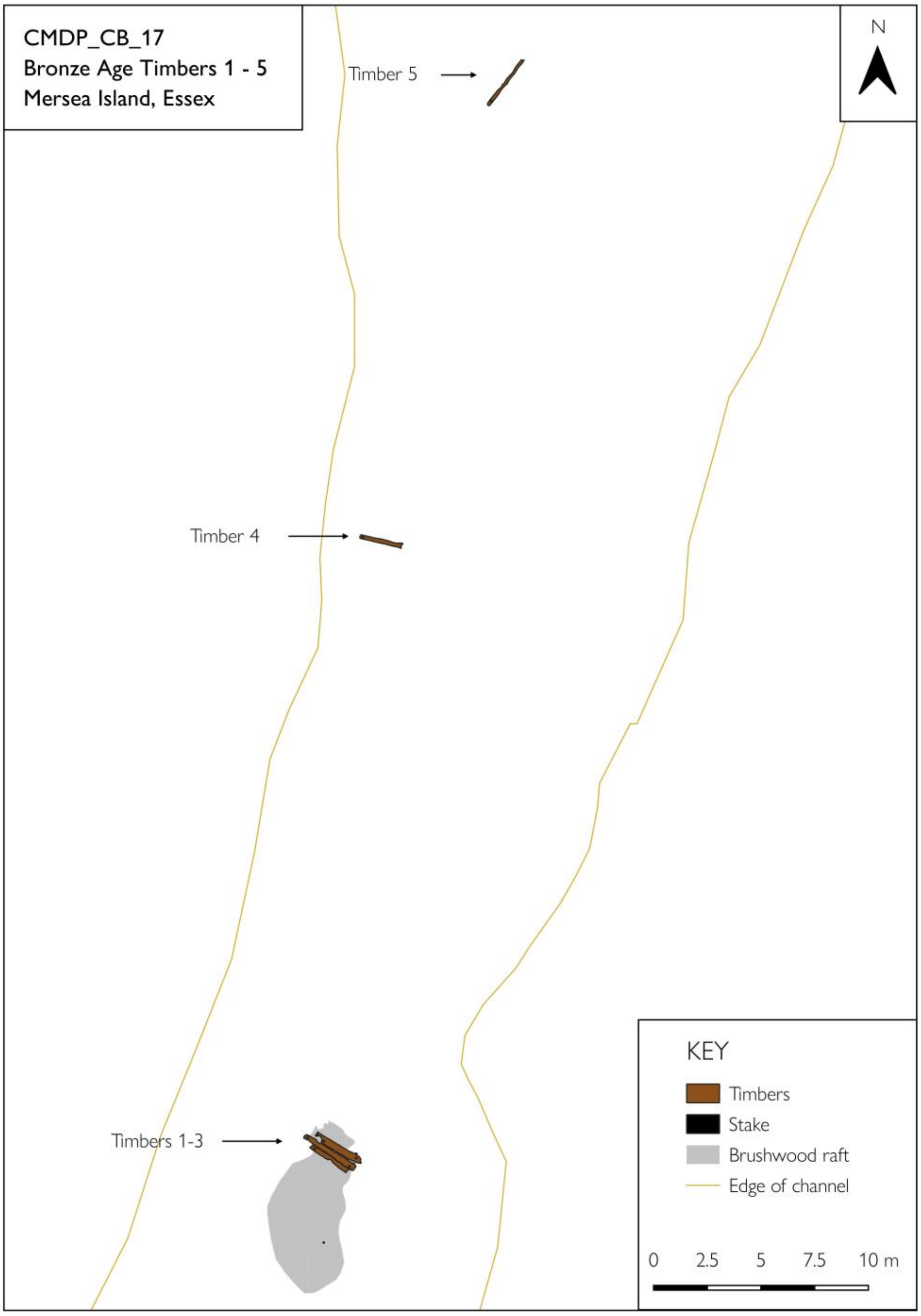

Figure 2: Plan of timbers 1 – 5

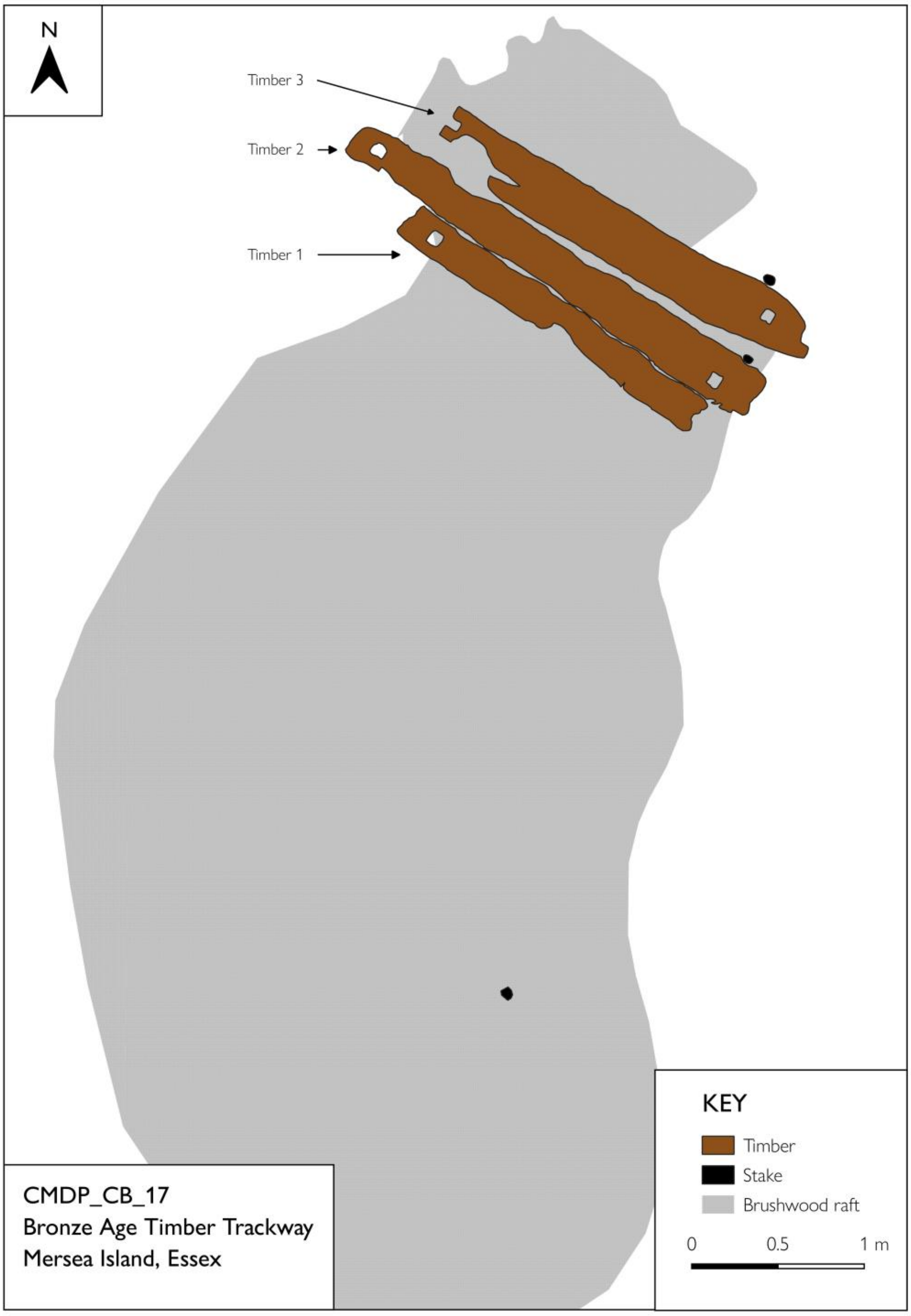

Figure 3: Plan of timbers 1 – 3

Figure 4: Timbers 1 – 3 after cleaning and recording

APPENDIX A

Coopers Beach, East Mersea: Radiocarbon Dating and Chronological Modelling

Peter Marshall, Irka Hajdas, Sanne Palstra, and Ian Tyers

Radiocarbon methods

Thirteen radiocarbon results have been obtained from samples of waterlogged wood from Coopers Beach. Details of the dated samples, radiocarbon ages, and associated stable isotopic measurements are provided in Table 1. The radiocarbon results are conventional radiocarbon ages (Stuiver and Polach 1977), corrected for fractionation using $\delta^{13}C$ values measured by Accelerator Mass Spectrometry (AMS).

Five samples were dated at the Centre for Isotope Research, University of Groningen, the Netherlands in 2019. Two samples (Timber 4: rings 41–50 and rings 121–130) were converted to α-cellulose using an intensified aqueous pretreatment, one (Peg 1) was pretreated using an acid-base-acid protocol (4% HCl, 1% NaOH, <1% HCl) followed by bleaching and two (Sample 2: fragment 6 and Sample 4: fragment 4) were divided and were both converted to α-cellulose using an intensified aqueous pretreatment, and pretreated using an acid-base-acid protocol (4% HCl, 1% NaOH, <1% HCl) followed by bleaching (Dee *et al.* 2019). The two different pretreatment methods used on Sample 2: fragment 6 and Sample 4: fragment 4 were undertaken to investigate the effect of the different methods on the resulting radiocarbon measurements. Following pretreatment all samples were combusted in an elemental analyser (IsotopeCube NCS), coupled to an Isotope Ratio Mass Spectrometer (Isoprime 100) and the resultant CO_2 was graphitised by hydrogen reduction in the presence of an iron catalyst (Dee *et al.* 2019). The graphite was then pressed into aluminium cathodes and dated by AMS (Synal *et al.* 2007; Salehpour *et al.* 2016).

Six samples were dated at ETH Zürich, Switzerland in 2019. They were pretreated using the acid-base-acid protocol described by Hajdas (2008), combusted and graphitised as outlined in Wacker *et al.* (2010a), and dated by AMS (Synal *et al.* 2007; Wacker *et al.* 2010b).

Data reduction was undertaken at both laboratories as described by Wacker *et al.* (2010c). Both facilities maintain continual programmes of quality assurance procedures, in addition to participation in international inter-comparison exercises (Scott *et al.* 2017). Details of quality assurance data and error calculation at Groningen are provided by Aerts-Bijma *et al.* (in prep), and similar details for ETH are provided in (Synal and Wacker 2010). Replicate radiocarbon measurements are available on two samples, both of which are statistically consistent at the 5% significance level (Ward and Wilson 1978; Table 1), suggesting that different pretreatments are effective. One of the pairs of $\delta^{13}C$ values (Sample 4: fragment 4) measured by Isotope Ratio Mass Spectrometry (IRMS), is statistically consistent at the 5% significance level, and the other pair (Sample 2: fragment 6) is statistically consistent at the 1% significance level

Bayesian modelling

The chronological modelling described below has been undertaken using OxCal 4.3 (Bronk Ramsey 1995; 2009a; 2009b), and the internationally agreed calibration curve for terrestrial samples from the northern hemisphere (IntCal20; Reimer *et al.* 2020). The models are defined by the OxCal CQL2 keywords and by the brackets on the left-hand side of Figures 1 and 3. In the diagrams, calibrated radiocarbon dates are shown in outline and the posterior density estimates produced by the chronological modelling are shown in solid black. The Highest Posterior Density intervals which describe the posterior distributions are given in italics.

Timber CCB4: Wiggle matching

Following the tree-ring analysis, four of the five sampled timbers from the trackway remained undated, although a pair of timbers (CCB4 and CCB5) were cross-matched to each other (*t* value 9.03) but could not to be dated conclusively when compared to reference sequences. One of these two cross-matched, but undated, timbers (CCB4) is the only timber in the assemblage with some sapwood present and as it is also the longest tree-ring sequence from the undated sequence it was selected for radiocarbon dating and wiggle-matching.

Wiggle-matching is the process of matching a series of calibrated radiocarbon dates which are separated by a known number of years to the shape of the radiocarbon calibration curve. At its simplest, this can be done visually, although statistical methods are usually employed. Floating tree-ring sequences are particularly suited to this approach as the calendar age separation of tree-rings submitted for dating is known precisely by counting the rings in the timber. A review of the method is described in Galimberti *et al.* (2004).

Figure 1 illustrates the chronological model for timber CCB4. This model incorporates the gaps between each dated block of 10 rings from tree-ring dating (eg that the carbon in rings 1–10 of the measured tree-ring series (ETH-96040) was laid down 40 years before the carbon in ring 41–50 of the series (GrM-17203), with the radiocarbon measurements (Table 1) calibrated using the internationally agreed radiocarbon calibration data for the northern hemisphere, IntCal20 (Reimer *et al* 2020).

The model has good overall agreement (Acomb: 123.0, An: 31.6, n: 5), and all five dates have good individual agreement (A: > 60.0). The Acomb statistic shows how closely the assemblage of calibrated radiocarbon dates as a whole agree with the relative dating provided by the tree-ring analysis that has been incorporated in the model; an acceptable threshold is reached when it is equal to or greater than An (a value based on the number of dates in the model). The A statistic shows how closely an individual calibrated radiocarbon date agrees its position in the sequence (most values in a model should be equal to or greater than 60). It suggests that the final ring of timber CCB4 formed in *951–909 cal BC (95% probability; CCB4_ring_184*; Fig 1), probably in *934–914 cal BC (68% probability).*

As timber CCB4 retains 27 sapwood rings we can estimate its felling dates by adding the probability distribution of the expected number of sapwood rings in ancient oak timbers from England (Arnold *et al.* 2019, fig 9) truncated to allow for the surviving sapwood rings (Bayliss and Tyers 2004, 960–1)to the estimated date of its last surviving ring. The resulting distribution is shown in Figure 2 and estimates the felling of CCB4 occurred in *947–890 cal BC (95% probability; CCB4_felling*; Fig 2), probably in *929–906 cal BC (68% probability).*

Chronological model for the Coopers Beach trackway sequence

The chronological model for activity associated with the Coopers Beach trackway is shown in Figure 3. The model includes radiocarbon dates and a tree-ring date on samples from stratigraphically-related deposits. As described below our modelling also incorporates relationships between deposits based on our understanding of the structural sequences documented.

Two samples (Sample 4: fragment 4 and Sample 4: fragment 5), were dated from the large brushwood raft beneath timber CCB3 that extended to the east and west of the trackway timbers and is presumed to be the base on which the they were originally laid. The two measurements on Sample 4: fragment 4 (GrM-17205 and GrM-17785), from sub-samples that went through different pretreatment protocols, alpha cellulose and ABA-bleach respectively (see above), are statistically consistent at the 5% significance level (Table 1) and a weighted mean (Sample 4: fragment 4; 2847±15 BP) has therefore been taken as the best estimate for the age of the complete *Quercus* roundwood sample. The two radiocarbon measurements on samples from the brushwood raft (Sample 4: fragment 4; 2847±15 BP and ETH-96039; 2815±23 BP) are statistically consistent at the 5% significance level and could be of the same actual age ($T'=1.4$ $T'(5\%)=3.8$, $\nu=1$).

In addition to the estimated felling date for timber CCB4 derived from the wiggle-match described above dendrochronology provided a *terminus post quem* date for the felling of timber CCB1, part of the trackway formed by CCB1–3, of 952 BC. Given therefore that timber CCB4 is likely to be part of the same trackway as timbers CCB1–3 we have constrained it to be later than the two dated samples from the brushwood raft in the model shown in Figure 3.

Two samples (Sample 2: fragment 6 and Sample 2: fragment 7) were also dated from the brushwood layer that was on top of timber CCB1. The two measurements on Sample 2: fragment 6 (GrM-18840 and GrM-17787), from sub-samples that went through different pretreatment protocols, alpha cellulose and ABA-bleach respectively (see above), are statistically consistent at the 5% significance level (Table 1) and a weighted mean (Sample 2: fragment 6; 2841±19 BP) has therefore been taken as the best estimate for the age of the incomplete *Quercus* roundwood sample. The two radiocarbon measurements on samples from the brushwood above timber CCB1 (Sample 2: fragment 6; 2841±19 BP and ETH-96038; 2813±23 BP) are statistically consistent at the 5% significance level and could be of the same actual age ($T'=0.9$ $T'(5\%)=3.8$, $\nu=1$).

Radiocarbon determinations on the two pegs found between timbers CCB2 and CCB3 (peg 1) and south of the main group of timbers driven through the brushwood raft (peg 2) are statistically consistent at the 5% significance level and could be of the same actual age ($T'=1.2$ $T'(5\%)=3.8$, $\nu=1$). They are though clearly much later than the trackway timbers and brushwood raft and have therefore been excluded from the model for activity associated with the trackway.

The model incorporating the scientific dates and stratigraphic relationships has good overall agreement (Amodel: 89; Fig 3) and provides an estimate for the construction of the trackway of *945–860 cal BC* (*95% probability*; *build_trackway*; Fig 4) probably *939–917 cal BC* (*68% probability*). The pegs were driven through the trackway and brushwood raft a millennium and a half later (*1405–1437 years* (*5% probability*; *trackway-pegs*; Fig 5) or *1443–1535 years* (*90% probability*), probably *1468–1511 years* (*68% probability*)), in *cal AD 478–500* (*4% probability*; *last_pegs*; Fig 6) or *cal AD 509–517* (*1% probability*) or *cal AD 530–602* (*90% probability*), and probably *cal AD 542–578* (*68% probability*).

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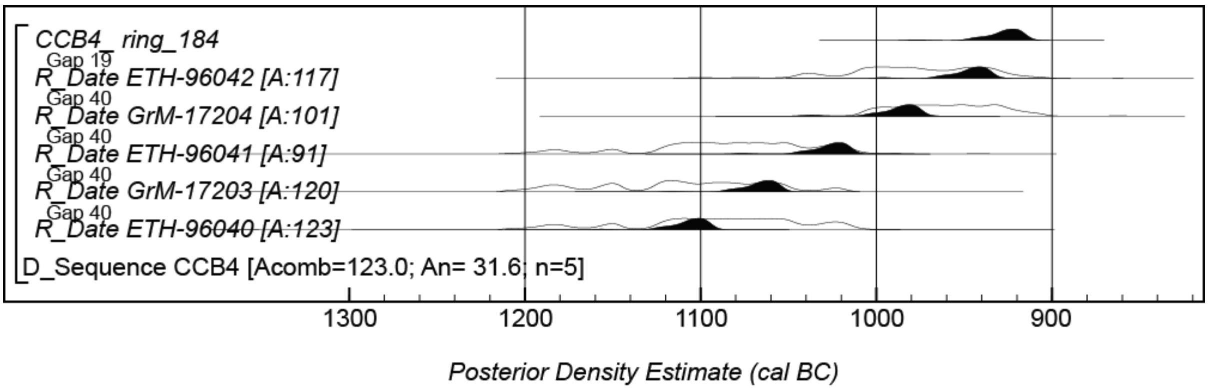

Figure 1: Probability distributions of dates from timber CCB4. Each distribution represents the relative probability that an event occurs at a particular time. For each of the dates two distributions have been plotted: one in outline, which is the simple radiocarbon calibration, and a solid one, based on the wiggle-match sequence. Distributions other than those relating to particular samples correspond to aspects of the model. For example, the distribution '*CCB4_ring_184*' is the estimated date for the last ring, 184, of timber CCB4. The large square brackets down the left-hand side along with the OxCal keywords and the description of the sapwood estimates in the text defines the overall model exactly

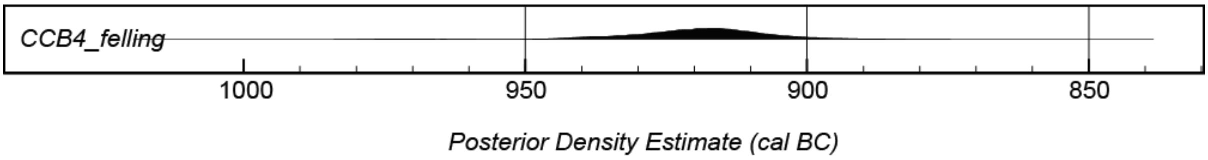

Figure 2: Probability distribution for the estimated felling date of timber CCB4

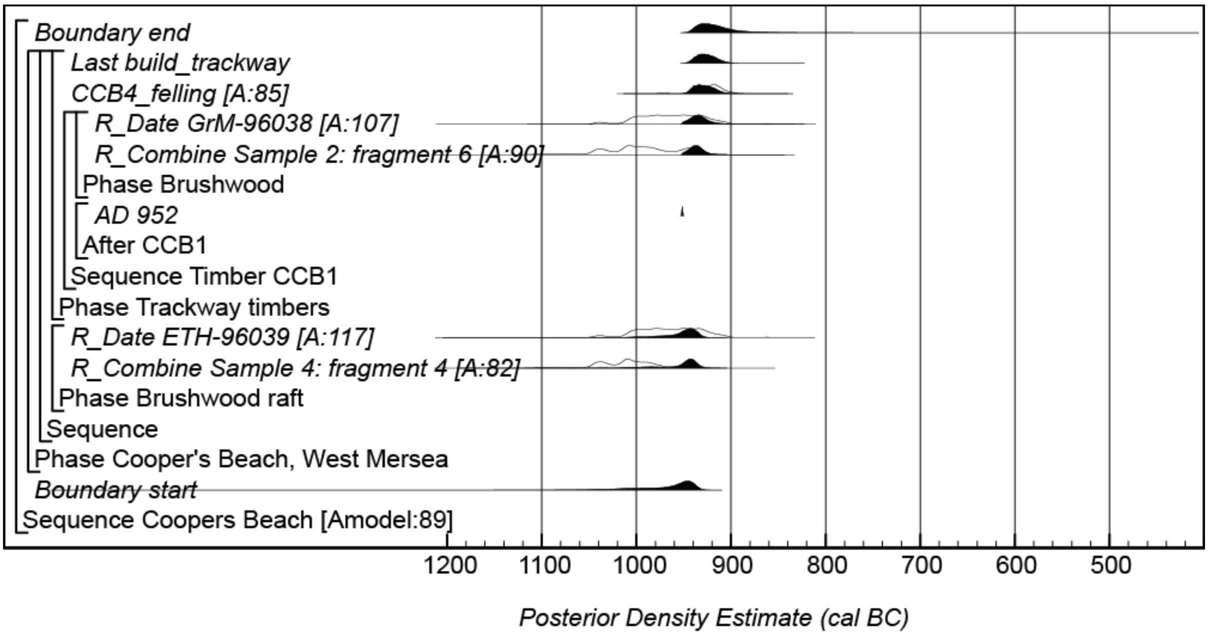

Figure 3: Probability distributions of dates from Coopers Beach. The format is as described in Figure 1

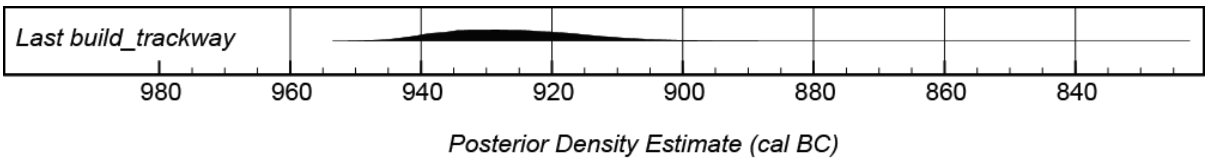

Figure 4: Probability distribution for the date of construction of the Coopers Beach trackway. The estimate is derived from the model defined in Figure 3

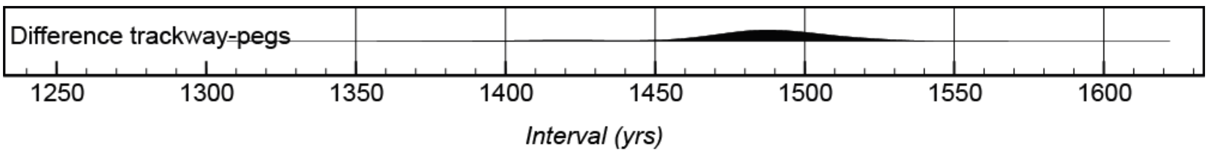

Figure 5: Probability distribution of the number of years between the construction of the Coopers Beach trackway and the insertion of the later pegs

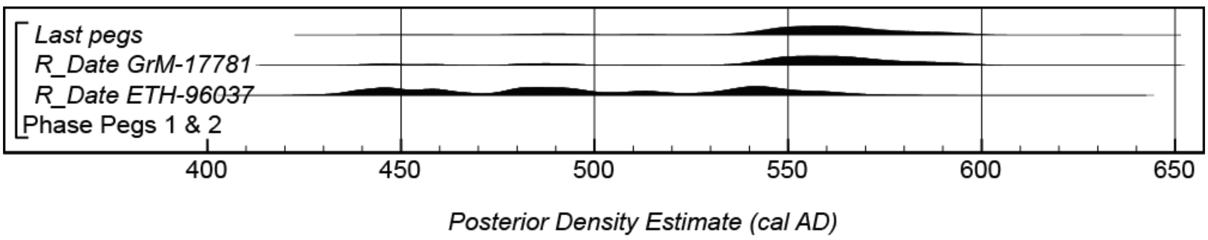

Figure 6: Probability distributions of the dates of the pegs inserted between the trackway and through the brushwood raft

Table 1: Cooper Beach, East Mersea radiocarbon and stable isotope results. Replicate measurements have been tested for statistical consistency and combined by taking a weighted mean before calibration as described by Ward and Wilson (1978).

Laboratory Code	Sample, material & depth	$\delta^{13}C_{IRMS}$ (‰)	$\delta^{13}C_{AMS}$ (‰)	Radiocarbon Age (BP)
Trackway timber 4				
ETH-96040	Timber 4: rings 1–10 Waterlogged wood, *Quercus* sp. heartwood rings 1–10 (I Tyers) part of 184 ring undated chronology CCB17 (including 27 sapwood rings)		−26.8±1.0	2903±23
GrM-17203	Timber 4: rings 41–50 Waterlogged wood, *Quercus* sp. heartwood rings 41–50 (I Tyers) part of 184 ring undated chronology CCB17 (including 27 sapwood rings)	−25.2±0.15		2916±18
ETH-96041	Timber 4: rings 81–90 Waterlogged wood, *Quercus* sp. heartwood rings 81–90 (I Tyers) part of 184 ring undated chronology CCB17 (including 27 sapwood rings)		−26.1±1.0	2897±23
GrM-17204	Timber 4: rings 121–130 Waterlogged wood, *Quercus* sp. heartwood rings 121–130 (I Tyers) part of 184 ring	−24.5±0.15		2810±18

	undated chronology CCB17 (including 27 sapwood rings)			
ETH-96042	Timber 4: rings 161–170 Waterlogged wood, *Quercus* sp. heartwood rings 81–90 (I Tyers) part of 184 ring undated chronology CCB17 (including 27 sapwood rings)		−27.6±1.0	2828±23
Brushwood below trackway timber 3				
ETH-96039	Sample 4: fragment 5 Waterlogged wood, *Quercus*, complete small diameter roundwood, 8 growth rings and outer xylem edge (Z Hazell) from brushwood under trackway timber 3		−25.1±1.0	2815±23
GrM-17205	Sample 4: fragment 4 Waterlogged wood, *Quercus*, complete small diameter roundwood, 8 growth rings and outer xylem edge (Z Hazell) from brushwood under trackway timber 3	−26.0±0.15		2861±19
GrM-17785	Replicate of GrM-17205	−25.7±0.15		2826±15
Sample 4: fragment 4	^{14}C: 2847±15 BP; T'=1.4;: δ^{13}C: −25.85±0.1 T'=2.0			
Brushwood above timber 1				
ETH-96038	Sample 2: fragment 6 Waterlogged wood, *Caprinus*, 6 growth rings, outer edge degraded, missing most of one side		−27.7±1.0	2813±23

	lengthways, radius 8.8mm (Z Hazell), from brushwood on top of trackway timber 1			
GrM-18840	Waterlogged wood, *Quercus*, incomplete roundwood, 5 growth rings, pith present: outer edge is degraded (Z Hazell), from brushwood on top of trackway timber 1	−25.4±0.19		2860±30
GrM-17787	Replicate of GrM-18840	−26.0±0.15		2829±15
Sample 2: fragment 6	^{14}C: 2841±19 BP; T'=1.4;: δ^{13}C: −25.8±0.1 T'=6.1			
Pegs				
GrM-17781	Peg 1 Waterlogged wood, *Corylus* sp. bark, from peg found between trackway timber 2 & 3	−26.1±0.15		1529±15
ETH-96037	Peg 2 Waterlogged wood, *Corylus* sp. bark, from peg found between trackway timber 2 & 3		−27.9±1.0	1561±23

APPENDIX B

Wood identifications from Coopers Beach (CCB17), Mersea Island, Essex

Emma Aitken (Cotswold Archaeology) and Zoë Hazell (Historic England), May 2017

Project background

In late 2016 a group of three worked timbers ('planks') with associated brushwood remains, was identified in the intertidal zone along the southern edge of Mersea Island, Essex. Due to the threat of loss through erosion, the timbers and additional samples were recovered in January 2017 (in works led by the Coastal and Intertidal Zone Archaeological Network (CITiZAN)) and then kept in cold storage at Historic England, Fort Cumberland, Portsmouth. Subsequent analyses has included wood identifications of small diameter roundwood fragments (reported here) and dendrochronological investigations (by I. Tyers).

Sample summary

In total, five fragments were identified:

- three fragments from Sample 2 (above Timber 1)
- two fragments from Sample 4 (below Timber 3)

Wood identifications of the artefacts were carried out at Fort Cumberland, Portsmouth. Samples were taken for thin-section by hand using a double-edged razor blade. Thin sections were taken from the three planes of wood required for secure identifications; the transverse section (TS), radial section (RS) and the transverse longitudinal section (TLS), and then examined under high power magnification (x100 to x400) using a Leica DM2500.

Identifications were made using a combination of the texts and keys by Schweingruber (1982) and Gale and Cutler (2000) and the reference material from Historic England's *Wood and Charcoal Reference Collection* (held at Fort Cumberland, Portsmouth, England).

Results and discussion

All the fragments came from small diameter roundwood. None had bark attached, but the outer edges looked to be the real outer edge of the xylem. All had at least eight growth rings; four had eight rings, and one (Fragment 5) was too degraded around the outer edge to be able to thin section well. All the fragments are deemed be suitable for radiocarbon dating.

Only two wood types were identified, both of which are hardwoods: *Coylus* (hazel) and *Quercus* (oak). In the British Isles, the only native hazel is *C. avellana* (hazel) and the only native oaks are *Q. petraea* (sessile oak) and *Q.robur* (pedunculate oak) (Gale and Cutler, 2000: 204).

The maximum average ring width for the assemblage ranged between 0.93 to 1.72mm.

Table 1. Wood identification results of the small diameter ‘brushwood’ samples from the Coopers Beach site. * = incomplete diameter due to the eroding outer edge of the fragment. ARW = Average ring width (calculated, to 2dp).

Sample	Fragment	Wood type	Notes	Diameter (mm)
2	1	*Corylus*	Pith present. No bark but looks like outer xylem edge where not eroding. 8 growth rings. ARW = 1.18mm	18.8x15.3*
	2	*Corylus*	Pith present; no bark but looks like outer xylem edge. 8 growth rings. Complete small diameter roundwood. ARW = 1.26mm	20.2x18.3
	3	*Quercus*	6 growth rings. Innermost ring is the widest; outer rings are much narrower. ARW = 0.93mm	14.9 x12.0*
4	4	*Quercus*	Pith present. No bark but looks like outer xylem edge. Complete small-diameter roundwood. 8 growth rings. Only a single row of earlywood large vessels in the outermost ring (ie felled early in the	25.0x24.0

			growth season). ARW = 1.56mm	
	5	*Quercus*	Pith present; no bark but looks like outer xylem edge. ≥ 8 growth rings. Fragment disintegrates. Generally wide rings. ARW = 1.72mm	27.5x18.5*

References

Gale, R. and Cutler, D. 2000 *Plants in archaeology: identification manual of artefacts of plant origin from Europe and the Mediterranean*. Otley: Westbury Publishing.

Schweingruber, F 1982 *Microscopic Wood Anatomy: structural variability of stems and twigs in recent and subfossil woods from central Europe*. Birmensdorf: Swiss Federal Institute of Forestry Research.

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