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Supplement

Medieval overexploitation triggers large-scale drowning and permanent land loss in coastal North Frisia (Wadden Sea region, Germany)

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Supplementary Materials: The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Table S1: Core background data; Table S2: Stratigraphic units of the Rungholt study area; Table S3: Radiocarbon dating results; Table S4: Dendrochronological dating results.

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Table S1. Core background data.

Core No.	Location	Height	Coring depth	PEP			Dating	Facies pattern	Archaeological context	Publication
		m NHN	m	Sediment	Geochemistry	Microfauna	(14C)	(cf. Fig. 3)		
RUN 2A	E 483446.716 N 6037157.716	-0.66	1.25	x	x	x	x	II	Drainage ditch	[69,110]
RUN 3A	E 483454.012 N 6037183.811	-0.84	1	x	x	-	x	II	Drainage ditch	[69]
RUN 6A	E 481995.224 N 6035492.928	+2.27	8	x	x	-	x	VI	Cultivated land (‘Hufe’)	[18,69]
RUN 17A	E 482081.801 N 6035143.187	+1.80	6	x	x	x	x	VI	Cultivated land (‘Hufe’)	[18]
RUN 18A	E 482066.313 N 6035124.205	+1.51	7	x	x	x	x	VI	Cultivated land (‘Hufe’)	[18]
RUN 26A	E 481273.058 N 6034660.102	-0.69	4	x	x	-	x	Ia	Dike	[18,53]
RUN 27A	E 481362.040 N 6034630.784	-0.61	4	-	x	-	-	Ia	Terp	[18,53]
RUN 33A	E 482492.655 N 6037063.912	-0.78	3	x	x	-	-	Ia	Path	this study
RUN 35A	E 482462.806 N 6037058.202	-0.79	2	x	x	x	-	Ia	Cultivated land (‚Hufe‘)	this study
RUN 36A	E 482467.435 N 6036955.259	-0.69	3	x	x	-	-	Ia	Terp	this study
RUN 37A	E 482460.690 N 6036973.362	-0.76	3	x	x	-	-	Ia	Terp	this study

RUN 40A	E 482246.913 N 6035011.685	+1.83	16	x	x	-	-	VI	Cultivated land (‘Hufe’)	this study
RUN 41A	E 482578.365 N 6036957.376	-0.54	3	-	x	-	-	II	Cistern	this study
RUN 42A	E 482557.302 N 6036992.322	-0.54	2	-	x	-	-	Ia	Terp	this study
RUN 44A	E 482581.420 N 6036989.692	-0.54	2	x	x	-	-	Ia	Terp	this study
RUN 46A	E 482526.998 N 6037038.414	-0.57	2	x	x	-	-	III	Cultivated land (‘Hufe’)	this study
RUN 48A	E 482538.046 N 6036949.388	-0.57	2	x	x	-	-	II	Ditch surrounding terp	this study
RUN 53A	E 482611.000 N 6036969.800	-0.60	2	x	x	-	-	Ia	Terp	this study
RUN 54A	E 482678.150 N 6037003.020	-0.62	2	x	x	-	-	Ia	Terp	this study
RUN 55A	E 482644.280 N 6036989.260	-0.61	2	-	x	x	-	Ia	Terp	this study
RUN 58A	E 482637.500 N 6036938.600	-0.60	2	x	x	-	-	II	Ditch surrounding terp	this study
RUN 59A	E 483969.071 N 6037116.279	-0.91	2	x	x	x	-	Ib	Terp	this study
RUN 60	E 483973.289 N 6037101.128	-0.90	1	-	-	-	-	Ia	Terp	this study
RUN 61A	E 483963.558 N 6037132.544	-0.92	1	x	x	-	-	II	Cistern	this study
RUN 62A	E 483972.757 N 6037119.957	-0.92	2	x	-	-	-	Ib	Terp	this study
RUN 68A	E 483991.766 N 6037141.461	-0.98	2	x	-	-	-	Ia	Cultivated land (‘Hufe’)	this study
RUN 71A	E 482937.126 N 6035975.258	+0.08	3	x	x	x	x	Ib	Terp	[54]

RUN 72A	E 482898.914 N 6035946.490	+0.05	1	x	x	-	x	Ib	Church foundation	[54]
RUN 95A	E 482914.068 N 6035942.093	+0.06	3	x	x	-	x	Ib	Church foundation	this study
P2	E 483922.091 N 6037062.935	-0.92	1	-	-	-	x	II	Ditch surrounding terp	this study
TRE 1A	E 488585.153 N 6036085.996	+0.82	14	x	x	x	x	Vb	Irregular field (with tidal creeks and drainage ditches)	[33]
TRE 2A	E 488610.739 N 6036085.567	+1.17	5	x	x	-	x	Va	Dike	[33]
TRE 16A	E 487122.245 N 6035928.304	+0.31	4	x	x	x	x	IV	Terp	[65,66]
TRE 19A	E 487232.558 N 6035836.551	-0.08	3	x	x	-		III	Presumably irregular field (with tidal creeks and drainage ditches)	[65]
TRE 24A	E 486965.814 N 6035301.238	-0.23	2	x	x	-	-	III	Presumably irregular field (with tidal creeks and drainage ditches)	[65]
TRE 25A	E 488021.049 N 6036108.726	+0.67	4	x	x	-	-	IV	Irregular field (with tidal creeks and drainage ditches)	this study
TRE 26A	E 488288.829 N 6036130.784	+0.86	4	x	x	-	-	IV	Irregular fields (with tidal creeks and drainage ditches)	this study
TRE 33A	E 486977.684 N 6035067.576	-0.50	3	x	x	x	x	Va	Dike	[65]
TRE 34A	E 486965.392 N 6035099.777	-0.57	3	x	x	-	-	III	Presumably irregular field (with tidal creeks and drainage ditches)	[65]
TRE 37B	E 487684.495 N 6035974.451	+0.82	3	x	x	-	-	IV	Irregular field (with tidal creeks and drainage ditches)	this study
TRE 38A	E 487834.654 N 6036022.135	+0.73	3	x	x	-	-	IV	Irregular field (with tidal creeks and drainage ditches)	this study
TRE 39A	E 488446.978 N 6036115.265	+0.83	3	x	x	-	-	Vb	Irregular field (with tidal creeks and drainage ditches)	this study
TRE 46A	E 487131.819 N 6035943.529	+0.21	3	x	x	x	x	II	Ditch surrounding terp	[65]

TRE 47A	E 487140.802 N 6035919.527	+0.27	3	x	x	x	x	II	Ditch surrounding terp	[65]
TRE 48A	E 487136.484 N 6035890.070	+0.33	3	x	x	x	x	Ib	Terp	[65]
TRE 49	E 488486.712 N 6036790.672	+0.58	3	-	-	-	x	Vb	Irregular field (with tidal creeks and drainage ditches)	this study
TRE 52	E 488539.447 N 6035387.424	+0.84	3	-	-	-	x	Vb	Irregular field (with tidal creeks and drainage ditches)	this study

Table S2. Stratigraphic units of the Rungholt study area. Unit characteristics are summarized after [18,33,54,65,69] and results of this study. All average characteristics, that may slightly vary between coring sites.

Unit	Depositional Environment	Sedimentary characteristics	Geochemical characteristics	Microfaunal characteristics
A	**back-barrier shallow water**	Soft, dark grey to grey (very) poorly sorted sandy mud. Gradual upper contact. Locally with abundant thin layers of sand or fine shell debris. Contains few plant remains and few individuals of *Peringia ulvae*.	The content of organic matter (LOI) varies with both depth and locations. Magnetic susceptibility (MS) values are low. Fluctuations in the Zr/Rb ratio indicate short-term changes of energetic conditions and reflects thin sandy layers. Proxies like the Ti and Ca content indicate negligible effects of weathering.	Hyaline species typical of tidal flat or estuarine environments like *Haynesina germanica*, *Ammonia beccarii*, *Elphidium* spp. dominate the foraminiferal assemblage. Ostracods occur at varying abundance, mostly comprising species commonly associated with shallow water, lagoonal to open sea environments, like *Leptocythere* spp. or, less common, *Cytherois* spp., *Semicytherura sella*, *Palmoconcha laevata*, *Pontocythere elongata.* Towards the top, these species are locally replaced by *Cyprideis torosa* and *Loxoconcha elliptica*, both typical for brackish lagoonal conditions.
B	**shallow water to pioneer zone**	Soft, light grey poorly sorted silty mud with a distinct blackish mottling at the upper boundary, indicating the microbial reduction of sea water sulphides and development of a characteristic monosulphide and disulphide zonation. Homogeneous, no bedding structures. Thick roots vertically penetrate the deposit through well visible oxidized root canals. Distinct but gradual lower and upper contact.	LOI varies, but locally increases towards the top of the unit as does the sulfur (S) content. MS values are rather low but show a highly variable pattern from low to strongly increased values in the upper part. Zr/Rb values decrease upwards, reflecting quiescent sedimentation. Ca and Ti indicate no effects of weathering.	*H. germanica* dominate the foraminiferal assemblage at low to medium abundance, with minor occurrences of *A. beccarii* and *Elphidium* spp. All species decrease towards the top. Outer estuarine species dominate the ostracod assemblage with locally varying proportions and dominance. Species comprise *Leptocythere* spp., *S. sella, P. laevata, P. elongata, Cytherois* spp., *C. torosa and L. elliptica.* Ostracods are missing in the pioneer zone and entirely disappear upwards, indicating a significant environmental shift within the unit.
C1	**fossil salt marsh (pre 800 BC)**	In the lower part light grey, towards the top stiff bluish grey and slightly marbled, poorly	LOI slightly varies in a rather low spectrum, while MS values are significantly increased. Low	Sediments comprise (very) few foraminifera but mostly species characteristic of (high) salt marsh environments, like *Entzia macrescens*,

		sorted mud with high avg. clay content (> 50 %) and locally crumbly structure. Lower part quite homogeneous, upper part locally preserved with constantly increasing content of *Phragmites* sp. remains. Gradual lower and either distinct but gradual upper contact towards unit D or erosive contact. Thick roots vertically penetrate the unit.	Zr/Rb ratios point to quiescent sedimentation conditions and contents of Ca, Ti and S point to initial marsh-associated soil formation processes (aeration, decay of organic matter, oxidation of sulphides).	*Trochammina inflata, Haplophragmoides* spp., or, less frequent, *Balticammina pseudomacrescens*, *Triloculina oblonga* and *Miliammina fusca*. Their distribution within the unit reflects the typical development from lower to high salt marsh conditions. Ostracods are nearly absent as marsh siltation raises the ground surface to some decimetres below MHW, inducing environmental stress by high fluctuations in salinity and temperature during tides and/or seasons.
C2	**Salt marsh, fossil (Nordstrander Klei)**	Where unit C2 is preserved as recent ground surface it occurs as stiff, greyish brown to rust-coloured, poorly sorted silty mud with horizontal sand intercalations (storm deposits). Typical characteristics of wet soils such as reduction and oxidation (WRB: gleysol). Iron oxide coatings along roots. In the lower part quite similar to unit C1.	Topsoil LOI enriched due to vegetation cover (grassland), below rather low values. MS are at medium levels. Ca, Ti and S values point to weathering.	Foraminifera increase with depth, likely as an effect of intense weathering close to the surface and comprise the hyaline tidal flat to low marsh species like *H. germanica* and *A. beccarii, Elphidium* spp. and, less frequent, the agglutinated marsh species *E. macrescens*, *T. inflata and B. pseudomacrescens*. Ostracods are few and mostly comprise *Leptocythere* spp.
C3	**salt marsh, fossil**	Compact, greenish grey clayey mud with strong features of both oxidation and reduction.	LOI decreases towards the top while MS values slightly increase. A low Zr/Rb ratio indicates quiescent sedimentation conditions. Ca, Ti and S values point to intense weathering.	Foraminifera are few and comprise hyaline species of tidal flat to low marsh environments (*H. germanica, A. beccarii* and *Elphidium spp.)* but also agglutinated middle and high marsh species (*E. macrescens*, *T. inflata*). The latter increase upwards. Sediments are void of ostracods. Plant macro-remains like roots and *Juncus* sp. seeds indicate wet but terrestrial conditions.

C4	**salt marsh, recent**	Dark grey locally rust-coloured, sandy mud with several layers of fine sand in the upper part. Sediments show typical features of hydromorphic soils such as reduction and oxidation.	LOI decreases towards the top, MS values medium to high.	Foraminifera occur in high numbers and are dominated by hyaline species of tidal flat to low marsh environments (*H. germanica, A. beccarii, Elphidium* spp.). Ostracods mainly comprise *P. elongata, Leptocythere* spp. and *S. sella.*
D1	**peat (Phragmites sp.)**	Very compact, dark to reddish brown *Phragmites* sp. peat. Lower part with abundant macroscopic plant remains (esp. leaves and rhizomes of *Phragmites* sp.), upper part locally with remains of birch wood. Decomposition increases upward. Distinct, but gradual lower contact and erosive upper contact.	Lowest MS and highest LOI values. Exceptionally high EC.	No foraminifera and ostracods.
D2	**peat (Sphagnum sp.)**	Very compact, orange-brown peat dominated by *Sphagnum* sp., accompanied by other (undetermined) plant remains (small roots, branches etc.).	Lowest MS and highest LOI values. Exceptionally high electrical conductivity (EC).	No foraminifera and ostracods.
E1	**natural infill (from sedimentation)**	Dark grey to bluish silty clay to clayey silt.	LOI is increased, while MS shows medium values. S is slightly increased.	Foraminifera comprise *H. germanica, A. beccarii* and *E. macrescens.* Ostracods are dominated by the occurrence and high abundance of the fresh- or brackish species *Sarscypridopsis aculeata*.
E2	**artificial backfill (man-made)**	Mixture of reworked bluish-grey silty to clayey marsh sediment, black peat debris and sand.	LOI is increased, while MS shows medium values. S is slightly increased.	Foraminifera comprise *H. germanica, A. beccarii* and *E. macrescens.* Ostracods are dominated by the occurrence and high abundance of the fresh- or brackish species *Sarscypridopsis aculeata*.

F	**tidal flat, fossil**	Very poorly sorted grey, sandy mud with a distinct blackish mottling at the top. Sharp (erosive) contact towards underlying unit C1 but gradual transition to overlying unit C3.	LOI and MS values are rather low. High Zr/Rb values indicate increased energetic conditions. Ca and Ti reflect marine conditions and no effects of weathering. At the lower contact, sediments contain abundant calcium sulphate minerals (gypsum, anhydrite), known to precipitate where calcareous seawater is mixed with sulphuric acid.	Foraminifera mainly comprise tidal flat species (*H. germanica*, *A. beccarii*, *Elphidium* spp.). In the lower part, ostracods are dominated by *Leptocythere* spp. but upwards replaced by a monospecific occurrence of the euryhaline *C. torosa*. The macrofauna includes typical (outer) tidal mud flat species like *Cerastoderma* sp. (cockle) and *Scrobicularia plana* (peppery furrow clam), individuals of *Peringia ulvae* (mud snail) and *Retusa obtusa* (Arctic barrel-bubble) as well as jaws of *Hediste* sp. (ragworm).
G	**flooding event**	Blackish to dark grey, (very) poorly sorted layers of either with shell debris, shell debris in a sandy matrix or predominantly sand. Distinct upper and lower contacts.	LOI and MS show low values, while high Zr/Rb values reflect increased energetic conditions.	Foraminifera mostly comprise tidal flat species (*H. germanica*, *A. beccarii*, *Elphidium* spp.). The ostracod assemblage mostly comprises *Leptocythere* spp., accompanied by *P. elongata*, *P. laevata* or *S. sella*. Macrofauna comprises fragments and single valves of *Cerastoderma* sp. and *Mytilus edule* as well as *Peringia ulvae*.
H	**tidal flat, recent**	Grey, (very) poorly sorted sandy mud to muddy sand with thin intercalations of organic matter, fine shell debris and *P. ulvae*. Locally with coarsening upward.	LOI shows mean contents, while MS is rather low. Ca and Ti are increased, while S upward. The Zr/Rb ratio increases with increasing grains size.	Typical tidal flat foraminifera occur in high abundance, dominated by *H. germanica*, *A. beccarii* and *Elphidium* spp. with few individuals of *E. macrescens*, *Lagena sp.* and *Ammoscalaria runiana*. Ostracod abundance is rather low and typical for recent tidal flat, *Leptocythere* spp. the dominant genus. Single individuals also occur of *C. torosa*, *L. elliptica*, *P. laevata*, *P. elongata* and *Semicytherura* spp.

Table S3. Radiocarbon dating results. The calibration is based on the Calib 8.2 software with calibration curves IntCal20 (**a**) and Marine20(**b**) using a local reservoir correction factor of R = -85±17 ^{14}C years [102]. Remarks: Lab. no.: laboratory number; b.s.: below surface; 2σ max; min (cal BC/AD): calibrated ages, 2 σ range.

Lab. no	Sample	Material	Depth (m b.s.)	^{14}C age	^{13}C	Calibration curve	2σ max: min (cal BC/AD)	Publication (original)
MAMS 19780	RUN 2A/3 M2	*Cerastoderma edule*, articulated	0.81	926 ± 18	-1.4	b	1393 - 1640 cal AD	[69]*
MAMS 19781	RUN 3A/4 PR	Plant remain	0.77-0.81	2063 ± 22	-33.4	a	155 BC; 7 cal AD	[69]*
MAMS 19782	RUN 3A/5 PR	Plant remain	0.85-0.87	724 ± 18	-34.9	a	1269 - 1295 cal AD	[69]*
MAMS 20619	RUN SPLINT 1	Wood	surface	799 ± 15	-29.6	a	1222 - 1268 cal AD	[69]*
MAMS 19683	RUN 7A/10 PR	Plant remain	1.04	231 ± 18	-36.4	a	1641; 1950 cal AD	[69]*
MAMS 41273	RUN 17A M	*Cerastoderma edule*, articulated	2.12	914 ± 21	-0.1	b	1403 - 1645 cal AD	[18]*
MAMS 41274	RUN 17A PR	Plant remains (bulk sample)	2.20	3257 ± 22	-26.9	a	1609; 1451 cal BC	[18]*
MAMS 41275	RUN 18A/10 M	*Scrobicularia plana*, articulated	2.11	1209 ± 21	-2.2	b	1142 - 1399 cal AD	[18]*
MAMS 41277	RUN 26A/4+ PR	Reed root, vertical	0.71	3245 ± 25	-29.7	a	1532; 1458 cal BC	[18]*
MAMS 41278	RUN 26A/5 PR	Reed root, vertical	0.75	2556 ± 24	-29.0	a	794; 599 cal BC	[18]*
MAMS 41280	RUN 33A/2+ PR	Reed root, vertical	0.38	2521 ± 22	-29.7	a	779; 546 cal BC	this study
MAMS 41281	RUN 35A/2+ PR	Reed root, vertical	0.43	289 6± 21	-25.0	a	1195; 1008 cal BC	this study
MAMS 41282	RUN 36A/3+ PR	Reed root, vertical	0.46	2530 ± 22	-26.7	a	788; 549 cal BC	this study
MAMS 41283	RUN 37A/4+ PR	Reed root, vertical	0.47	2494 ± 21	-27.9	a	771; 543 cal BC	this study
MAMS 59843	RUN 41A PR2	Plant remain (seed)	2.61	910 ± 33	-27.4	a	1040; 1215 cal AD	this study

MAMS 59844	RUN 48A/3 PR	Plant remain/ wood	0.55	668 ± 16	-25.1	a	1282; 1387 cal AD	this study
MAMS 59845	RUN 48A/4+ PR/Wurzel	Plant remain	0.68	2368 ± 18	-24.5	a	513; 393 cal BC	this study
MAMS 59846	RUN 53A/3+ PR	Plant remain	0.37	2405 ± 18	-24.5	a	659; 404 cal BC	this study
MAMS 59847	RUN 54A/3+ PR	Plant remain	0.59	2483 ± 22	-28.4	a	770; 518 cal BC	this study
MAMS 59848	RUN 55A/3 PR	Plant remain	0.50-0.52	2650 ± 18	-23.8	a	829 - 793 cal BC	this study
MAMS 59849	RUN 59A/0+ HR	Wood	-0.02	1830 ± 17	-23.6	a	131; 307 cal AD	this study
MAMS 59850	RUN 59A/0+ PR	Reed peat	0.41	2283 ± 19	-27.8	a	398; 232 cal BC	this study
MAMS 59851	RUN 59A/0+ PR2	Plant remain	0.42-0.43	2385 ± 18	-24.8	a	536; 399 cal BC	this study
MAMS 59852	RUN 59A/1+PR1	Plant remain	0.53-0.55	2446 ± 18	-24.5	a	748; 413 cal BC	this study
MAMS 59853	RUN 59A/1+ PR2	Plant remain	0.56	2585 ± 19	-26.6	a	803 - 413 cal BC	this study
MAMS 59854	RUN 61A/0+ PR/HR	Plant remain/ wood	-0.05	862 ± 17	-31.1	a	1164 - 1221 cal AD	this study
MAMS 59855	RUN 61A/1 PR	Plant remain	0.08-0.09	1117 ± 17	-26.7	a	891 - 990 cal AD	this study
MAMS 59856	RUN 61A/4+ PR	Plant remain	0.75-0.76	1039 ± 17	-27.3	a	992 - 1026 cal AD	this study
MAMS 59857	RUN 61A/5 PR	Plant remain	0.79-0.80	1588 ± 17	-24.6	a	428 - 541 cal AD	this study
MAMS 59859	RUN Profil 2 PR	Plant remain	0.70	866 ± 17	-26.0	a	1163 - 1220 cal AD	this study
MAMS 59860	RUN Baumwurzel	Wood (tree root)	surface	1852 ± 17	-26.3	a	129; 236 cal AD	this study

MAMS 65629	RUN 71A/3+ PR1	Plant remain (peat)	0.35	1704 ± 17	-31.4	a	259; 409 cal AD	[54]
MAMS 65630	RUN 71A/3+ PR1	Plant remain (peat)	0.40	1755 ± 17	-33.7	a	242; 360 cal BC	[54]
MAMS 65632	RUN 71A/6+ PR	Plant remain (*Phragmites* sp.)	1.15	2652 ± 19	-26.8	a	890; 793 cal BC	[54]
MAMS 71047	RUN 72A/9+ PR	Peat	0.78-0.79	1071 ± 13	-27.3	a	899; 1021 cal AD	this study
MAMS 71043	RUN 95A/1 PR	Peat	0.82	1269 ± 14	-26.3	a	676; 774 cal AD	this study
MAMS 71044	RUN 95A/2 PR	Peat	1.21	1547 ± 14	-26.0	a	437; 576 cal AD	this study
MAMS 71045	RUN 95A/3 PR	Peat	1.22	1541 ± 14	-27.5	a	439; 585 cal AD	this study
MAMS 71046	RUN 95A/4 PR	Peat	1.73	2713 ± 14	-27.5	a	900 - 817 cal BC	this study
KIA 33183	LA 54/1518	Wood (handhewn)	surface	615 ± 20	-24.2	a	1301; 1397 cal AD	[60]*
KIA 4327	LA 42/1518	Wood (from millstone)	surface	590 ± 35	-28.8	a	1301; 1414 cal AD	[60]*
KIA 3958	LA39/1518	Wood (from tidal gate)	surface	862 ± 33	-26.7	a	1049; 1256 cal AD	[61]*
MAMS 41284	TRE 1A/6+ Torf1	Peat	1.58	1795 ± 20	-27.4	a	216; 328 cal AD	[33]
MAMS 41285	TRE 1A/6+ Torf4	Peat	1.79	2612 ± 21	-26.6	a	808 - 779 cal BC	[33]
MAMS 41286	TRE 2A/9 PR	Plant remain	1.57	840 ± 19	-28.5	a	1167; 1261 cal AD	[33]
MAMS 41287	TRE 2A/10 PR	Plant remain	1.83	889 ± 22	-30.5	a	1048; 1220 cal AD	[33]
MAMS 49324	TRE 16A/7 PR	Plant remain	1.62	1460 ± 37	-37.7	a	556 - 651 cal AD	[65,66]

MAMS 49325	TRE 16A/8+ PR	Plant remain	1.82	2158 ± 21	-28.3	a	351; 105 cal BC	[65,66]
MAMS 49326	TRE 16A/11+ PR	Plant remain	2.32	2590 ± 22	-25.0	a	805 - 773 cal BC	[65,66]
MAMS 59870	TRE 33A/7 PR2	Plant remain	1.22-1.24	1823 ± 18	-39.2	a	132; 318 cal AD	[65]
MAMS 59871	TRE 33A/7+ PR1	Peat	1.26-1.27	2147 ± 16	-27.3	a	346; 104 cal BC	[65]
MAMS 59872	TRE 33A/7+ PR2	Peat	1.45-1.46	2660 ± 16	-21.1	a	891; 797 cal BC	[65]
MAMS 59873	TRE 37B/8 PR2	Plant remain	1.31-1.34	2027 ± 17	-35.4	a	87 cal BC; 56 cal AD	this study
MAMS 59874	TRE 39A/8+ PR1	Peat	1.30-1.31	1778 ± 16	-28.3	a	237; 333 cal AD	this study
MAMS 59875	TRE 39A/8+ PR4	Peat	1.41-1.42	2653 ± 16	-27.8	a	829 - 795 cal BC	this study
MAMS 59879	TRE 46A/10 PR	Plant remain	1.61-1.62	2574 ± 16	-27.9	a	799 - 770 cal BC	[65]
MAMS 59880	TRE 46A/13 PR	Plant remain	2.14-2.15	1891 ± 16	-26.3	a	85; 212 cal AD	[65]
MAMS 59881	TRE 46A/14 PR2	Plant remain	2.24	842 ± 15	-27.8	a	1167; 1260 cal AD	[65]
MAMS 59882	TRE 46A/16 PR2	Plant remain	2.54	2458 ± 16	-25.9	a	751; 421 cal BC	[65]
MAMS 59883	TRE 47A/2 PR	Plant remain	1.88	513 ± 15	-27.4	a	1407 - 1434 cal AD	[65]
MAMS 59884	TRE 47A/4 PR2	Plant remain	2.59	1401 ± 18	-24.2	a	605; 661 cal AD	[65]
MAMS 59885	TRE 48A/8+ PR1	Peat	1.71	2421 ± 16	-24.2	a	719; 408 cal BC	[65]
MAMS 59887	TRE 48A/8+ PR2	Peat	1.73	2507 ± 16	-26.5	a	773 - 741 cal BC	[65]

MAMS 59888	TRE 49/1 PR	Peat	1.28	2485 ± 16	-26.6	a	762; 542 cal BC	this study
MAMS 59889	TRE 49/2 PR	Peat	1.33	1855 ± 16	-22.7	a	129; 234 cal AD	this study
MAMS 59890	TRE 52/1 PR	Peat	1.50	2119 ± 16	-22.6	a	197; 53 cal BC	this study
MAMS 59891	TRE 52/2 PR	Peat	1.62	2391 ± 16	-27.5	a	537; 401 cal BC	this study

* Published radiocarbon ages have been recalibrated.

Table S4. Dendrochronological dating results.

Lab. No.	**Sample**	**Wood species**	**No. of tree rings**	**Growth** (beginning)	(end)	**Date of felling**	**Comment**	**Publication (original)**
DAI Berlin 97118	09/2018	*Quercus* sp.	64	1101 AD	1164 AD	1184 AD	20 yrs added for missing sapwood	this study
DAI Berlin 97118	09/2017	*Fagus* sp.	98	1126 AD	1126 AD	1129 AD	3 more rings visible along outer margin	this study
DAI Berlin 81579	Wooden beam C	n.a.	63	1269 AD	1331 AD	1351 AD	20 yrs added for missing sapwood	[61]