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Analysis of ^{13}C and ^{15}N isotopes from Eurasian Quaternary fossils: Insights in diet, climate and ecology

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Supplementary Information

Table SI Chapter 3.1

Results of the isotopic data and woolly mammoth sample information in chronological order.

Lab code ¹	Locality ²	¹⁴ C age (yr BP)	Sigma	% C	$\delta^{13}\text{C}$ (‰)	% N	$\delta^{15}\text{N}$ (‰)	C:N	Material ³	% coll	Source ⁴
GrA-43037	New Siberian Arch.	> 45000		46.5	-21.5	18.4	+7.51	3.0	b	7.4	1
GrA-60422	New Siberian Arch.	> 45000		44.9	-22.0	16.2	+8.63	3.2	b	16.2	1
Site 1 M. pr. 20	New Siberian Arch.	> 45000		40.0	-21.7	15.6	+7.60	3.0	b/t	14.1	2
Site 1 M. pr. 21	New Siberian Arch.	> 45000		42.6	-22.3	16.0	+9.30	3.1	b/t	16.1	2
95600	New Siberian Arch.	> 45000		43.2	-22.2	15.8	+9.20	3.2	b		3
UCIAMS38674	Sanga-Yuriakh	> 45000		35.9	-22.6	12.6	+10.90	3.3	b	18.6	4,5
UCIAMS38676	Ari Mas	> 45000		41.1	-21.8	15.2	+10.50	3.2	b	7.6	4,5
UCIAMS38677	Arilakh	> 45000		38.2	-22.0	13.4	+10.00	3.3	b	22.4	4,5
UCIAMS39109	Arilakh	> 45000		39.8	-23.2	12.8	+7.80	3.6	b	15.2	4,5
UCIAMS39111	Popigay	> 45000		32.0	-22.0	11.1	+7.50	3.4	b	23.4	4,5
UCIAMS39881	Arilakh	> 45000		38.8	-22.0	14.5	+11.40	3.1	b	24.0	4,5
Site 1 M. pr. 19	New Siberian Arch.	43600	1000	40.7	-23.2	14.6	+8.70	3.2	b/t	15.4	2
GrA-25856	Novaya R.	42040	830	45.9	-22.5	17.1	+8.46	3.1	b	16.0	1
GrA-57720	New Siberian Arch.	41650	+600/ -500	43.5	-22.5	15.0	+10.02	3.4	t	0.9	1
GrA-17439	Novaya R.	41580	1190	43.3	-21.8	16.2	+9.94	3.1	b	6.0	1
UCIAMS39110	Taimyr Peninsula	41000	1400	35.0	-22.1	12.2	+8.10	3.3	b	22.3	4,5
20/415	Taymyr	40800	200	40.6	-22.2	13.7	+6.50	3.5	b	16.7	6
GrA-38905	Lena R.	40800	+650/ -550	43.5	-21.3	15.0	+9.06	3.4	b	12.0	1
19/58	Sviatoy Site 1	40200	1800	44.2	-21.6	15.6	+11.20	3.3	b	19.2	6
Site 1 M. pr. 18	New Siberian Arch.	40200	900	42.2	-22.3	16.0	+9.60	3.1	b/t	16.8	2
UCIAMS38678	Baikura-Turku	40150	990	38.4	-21.7	13.6	+8.90	3.3	b	20.1	4,5
20/407	Taymyr	39800	600	42.6	-21.4	14.6	+8.20	3.4	b	23.1	6

20/412	Taymyr	39800	500	42.2	−21.4	14.2	+8.40	3.5	b	20.4	6
Site 1 M. pr. 17	New Siberian Arch.	39600	1000	41.6	−22.5	15.8	+9.40	3.1	b/t	10.2	2
GrA-62205	New Siberian Arch.	39460	+300/−320	46.7	−22.6	17.1	+11.28	3.2	t	7.5	1
Site 1 M. pr. 16	New Siberian Arch.	37800	900	42.7	−21.9	15.5	+8.80	3.2	b/t	16.8	2
GrA-57021	Unspecified	37710	+430/−370	42.9	−21.1	17.4	+10.25	2.9	t	2.2	1
GrA-57652	Wrangel Isl.	35870	+320/−290	43.7	−21.6	16.1	+11.94	3.2	t	8.0	1
GrA-19528	Toll's Bay	35760	+280/−370	39.8	−20.05				t	0.9	1
UCIAMS38680	Baikura-Turku	35380	550	35.4	−21.4	12.5	+8.70	3.3	b	14.7	4,5
GrA-19284	Oskar Pen.	34680	+350/−340	39.2	−21.3				t	0.4	1
Site 2 M. pr. 23	Lena Delta	34600		42.1	−22.2	15.6	+9.10	3.1	b/t	10.7	2
GrA-53289	Yana-Indigirka lowl.	34300	+260/−240	46.7	−22.85	15.9	+12.01	3.4	b	22.7	1
Site 2 M. pr. 15	Lena Delta	34000	500	39.6	−22.0	15.2	+8.60	3.0	b/t	16.1	2
Site 1 M. pr. A	New Siberian Arch.	32500	500	39.2	−22.6	15.9	+9.20	2.9	b/t	17.7	2
GrA-19523	Sabler C.	32180	+210/−200	42.2	−22.35	16.2	+9.14	3.0	t	7.1	1
Site2-14	Lena Delta	31500	650	38.3	−21.7	14.9	+8.90	3.0	b/t	13.8	2
Site2-13	Lena Delta	30200	400	41.8	−22.1	15.3	+9.10	3.2	b/t	5.8	2
19/52	Sviatoy Site 1	30100	550	42.8	−22.1	14.8	+9.10	3.3	b	18.8	2
GrA-57019	Unspecified	29150	+190/−180	38.1	−22.2	15.2	+9.10	2.9	t	12.1	1
UCIAMS39885	Lake Taymyr	28700	310	36.6	−21.9	12.9	+9.70	3.3	b	17.2	4,5
GrA-60044	New Siberian Arch.	28660	160	47.4	−22.0	17.3	+10.22	3.2	b	13.6	1
GrA-19275	Oskar Pen.	28370	200	40.5	−21.3	13.4	+10.78	3.5	t	1.3	1
GrA-19271	Oskar Pen.	28350	200	39.0	−21.8	15.6	+11.90	2.9	t	2.6	1
Beta-148643	Lake Taymyr	28260	170	40.5	−21.4	15.0	+9.40	3.2	b	12.2	4,5
Beta-148662	Arilakh	28210	210	39.1	−21.7	14.5	+10.70	3.1	b	14.7	4,5
Site 1 M. pr. 12	New Siberian Arch.	28000	180	40.7	−21.6	15.7	+9.00	3.0	b/t	14.4	2
Beta-210777	Baikura-Turku	27740	220	36.7	−21.9	13.6	+10.00	3.1	b	26.2	4,5
Site2-11	Lena Delta	27400	800	38.6	−21.9	15.8	+9.10	2.8	b/t	14.5	2
Site2-10	Lena Delta	25900	600	39.0	−22.5	14.8	+8.90	3.1	b/t	16.1	2
GrA-19311	Upper Taymyra R.	24990	150	42.3	−22.2	15.2	+10.08	3.3	b	8.3	1

GrA-19526	Upper Taimyra R.	24980	130	41.2	-22.3	13.8	+11.14	3.5	t	2.9	1
GrA-38941	Nordwik C.	24870	+130/ -120	45.0	-21.8	16.6	+9.45	3.2	?	1.6	1
GrA-19273	Upper Taimyra R.	24740	150	40.0	-21.8	13.8	+9.66	3.4	b	3.0	1
GrA-19238	Upper Taimyra R.	24460	200	37.7	-21.6	14.2	+10.35	3.1	b	0.2	1
Site2-9	Lena Delta	24300	200	42.6	-22.3	16.1	+7.30	3.1	b/t	21.8	2
Site 1 M. pr. 8	New Siberian Arch.	22100	1000	41.8	-21.3	14.8	+8.30	3.3	b/t	19.8	2
GrA-17604	Taimyr Lake	20950	190	44.4	-22.3	16.0	+8.60	3.2	b	18.4	1
Site2-7	Lena Delta	20800	600	40.7	-21.7	15.2	+8.30	3.1	b/t	20.7	2
GrA-17347	Upper Taimyra R.	20500	90	45.7	-21.3	15.9	+11.21	3.3	b	14.1	1
UCIAMS39886	Sabler C.	20080	110	37.3	-20.8	13.1	+9.10	3.3	b	25.2	4,5
GrA-38930	Yana-Indigirka lowl.	19300	80	44.6	-21.9	16.3	+8.56	3.2	t	11.6	1
GrA-62207	New Siberian Arch.	19160	90	47.0	-21.8	17.1	+8.64	3.2	t	4.4	1
UCIAMS38679	Lake Taimyr	17300	60	39.0	-21.0	14.2	+10.70	3.3	b	20.0	4,5
Beta-148642	Sabler C.	15390	50	37.1	-21.0	13.7	+10.60	3.2	b	16.3	4,5
GrA-19264	Sabler C.	13919	70	38.6	-22.3				b	16.5	1
GrA-57617	Wrangel Isl.	13450	+60/ -50	44.0	-21.5	15.6	+10.62	3.3	t	11.4	1
GrA-65681	New Siberian Arch.	13340	60	43.2	-21.9	15.0	+12.14	3.4	t	6.8	1
Site2-3	Lena Delta	13100	500	39.9	-22.7	15.4	+5.60	3.0	b/t	22.2	2
GrA-65517	New Siberian Arch.	13040	60	42.7	-21.1	14.3	+11.64	3.5	d	0.3	1
GrA-65689	New Siberian Arch.	13030	60	43.3	-22.2	15.4	+11.12	3.3	t	0.4	1
GrA-60423	Selliach R.	12470	50	41.7	-21.9	15.0	+8.78	3.2	b	14.4	1
UCIAMS38671	Berelekh	12350	35	37.8	-22.2	13.5	+9.40	3.3	b	18.2	4,5
GrA-65687	New Siberian Arch.	12330	60	46.6	-21.5	15.2	+9.82	3.6	t	2.3	1
UCIAMS38672	Berelekh	12295	40	37.8	-22.0	13.2	+9.40	3.3	b	23.4	4,5
UCIAMS38670	Berelekh	12125	30	43.7	-21.5	15.0	+9.20	3.4	b	11.9	4,5
Site 1 M. pr. 1	New Siberian Arch.	12030	60	41.3	-21.6	16.1	+5.70	3.0	b/t	22.4	2
Beta-148663	Arilakh	11900	40	38.2	-22.5	14.2	+9.10	3.1	b	10.7	4,5
GrA-65512	New Siberian Arch.	11250	50	50.1	-22.5	16.7	+8.81	3.5	b	2.6	1
20/411	Taymyr	11140		46.0	-22.4	15.4	+8.10	3.5	b	18.7	6

GrA-65686	New Siberian Arch.	10920	50	44.5	-22.6	15.2	+8.28	3.4	t	0.7	1
GrA-65685	New Siberian Arch.	10330	50	47.0	-22.5	15.9	+10.18	3.4	t	7.1	1
GrA-19231	Upper Taimyra R.	10230	60	39.4	-22.0	13.4	+9.50	3.4	t	10.3	1
GrA-17350	Bikada R.	9920	60	42.3	-22.8	14.9	+8.62	3.3	b	7.5	1
GrA-65680	New Siberian Arch.	9445	50	44.5	-22.1	15.8	+10.5	3.3	t	5.7	1
GrA-57648	Wrangel Isl.	8395	45	45.2	-22.5	16.5	+9.71	3.2	t	13.2	1
GrA-57649	Wrangel Isl.	8000	40	43.8	-21.8	15.9	+8.90	3.2	t	13.5	1
GrA-57645	Wrangel Isl.	7505	40	44.7	-22.45	16.3	+11.20	3.2	t	12.5	1
GrA-57711	Wrangel Isl.	7300	35	?	-22.6	16.8	+8.47		t	13.5	1
GrA-57647	Wrangel Isl.	7175	40	43.1	-22.5	15.7	+10.32	3.2	t	5.3	1
GrA-57622	Wrangel Isl.	7030	40	46.5	-22.23	16.8	+9.55	3.2	t	6.3	1
GrA-57650	Wrangel Isl.	6455	40	46.3	-21.82	16.9	+9.50	3.2	t	7.6	1
GrA-57725	Wrangel Isl.	6180	35	39.3	-22.55	14.3	+9.12	3.2	d	4.9	1
GrA-57623	Wrangel Isl.	6000	40	48.0	-22.06	17.3			t	15.8	1
GrA-57646	Wrangel Isl.	5615	35	43.8	-21.73	16.0	+8.77	3.2	t	7.3	1
GrA-57726	Wrangel Isl.	5400	40	45.5	-21.94	16.3	+8.68	3.3	t	12.3	1
GrA-57731	Wrangel Isl.	4955	35	48.1	-21.80	17.2	+8.16	3.3	t	14.3	1
GrA-57729	Wrangel Isl.	4870	35	47.6	-21.85	17.5	+9.38	3.2	t	8.1	1
GrA-57709	Wrangel Isl.	4770	35	42.7	-21.71	15.4	+10.08	3.2	t	14.7	1
GrA-57621	Wrangel Isl.	4535	35	47.8	-21.80	17.2	+9.71	3.2	t	13.9	1
GrA-57741	Wrangel Isl.	4495	35	45.3	-22.28	16.5	+9.80	3.2	t	14.2	1
UCIAMS38673	Wrangel Isl.	4420	15	37.9	-22.20	13.6	+8.60	3.3	b	15.5	4,5
GrA-57742	Wrangel Isl.	4410	35	47.5	-21.47	17.3	+9.03	3.2	d	8.9	1
GrA-57727	Wrangel Isl.	4155	35	43.9	-21.91	15.9	+9.73	3.2	t	8.7	1
GrA-57712	Wrangel Isl.	4115	30	41.4	-22.18	15.0	+9.11	3.2	t	5.4	1
GrA-57796	Wrangel Isl.	4030	35	40.1	-22.25	15.2	+10.56	3.1	t	7.2	1
GrA-57619	Wrangel Isl.	4020	35	48.4	-22.18	17.2	+9.10	3.3	t	9.3	1
GrA-57654	Wrangel Isl.	3960	35	46.7	-21.97	17.0	+9.25	3.2	t	12.2	1
GrA-57710	Wrangel Isl.	3955	30	46.7	-22.00	17.3	+8.70	3.1	t	5.7	1

¹Used abbreviations: GrA = Groningen University, Groningen, NL, Beta = Beta Analytic, Miami, USA, UCIAMS = University of California, Irvine, USA. In cases that the lab code is unknown, we mention the sample ID as referred to in the original publication.

²Used abbreviations: Arch = archipel, Isl = island, R = River, C = cave, Lowl = lowland, Pen = Peninsula.

³Used abbreviations: b = bone, t = tusk, d = dentine, ? = unspecified.

⁴Used data sources: 1 = current study, 2 = lacumin *et al.*, 2010, 3 = Bocherens *et al.*, 1996, 4 = Szpak *et al.*, 2010 (stable isotopes), 5 = Debruyne *et al.*, 2008 (¹⁴C dates), 6 = lacumin *et al.*, 2000.

Table SI Chapter 3.2

Isotopic data and sample information from woolly mammoth samples used to define the ranges for 'Alaska' in Fig. 3.4.

Lab code ⁱⁱⁱ	Locality ⁱ	¹⁴ C age, yr BP	±	δ ¹³ C (‰)	δ ¹⁵ N (‰)	C:N	Source ⁱⁱ
AA14939	Ester Cr.	> 45000		−20.5	+5.0	3.2	1,2
AA14855	Cripple Cr.	26022	640	−20.8	+6.4	3.5	1,2
AA14904	Cleary Cr.	43239	1878	−20.8	+4.4	3.5	1,2
AA17538	Eldorado Cr.	30000	1000	−20.7	+7.8	3.2	1,2
AA17535	Dawson	37920	2700	−20.6	+7.9	3.4	1,2
UCIAMS-41486	Paron's L.	> 45000		−21.3	+5.8	3.4	1,2
UCIAMS-39883	Dawson	> 45000		−20.4	+8.7	3.3	1,2
UCIAMS-39884	Dawson	> 45000		−20.3	+6.9	3.3	1,2
UCIAMS-39891	Quartz Cr.	36690	810	−20.5	+6.6	3.3	1,2
UCIAMS-38675	Whitman G.	32140	370	−20.7	+8.1	3.1	1,2
UCIAMS-39116	Sulphur Cr.	> 45000		−20.8	+7.5	3.3	1,2
UCIAMS-39892	Whitman G.	39899	1200	−20.5	+7.3	3.3	1,2
UCIAMS-39112	Finning	29030	310	−20.5	+7.2	3.3	1,2
UCIAMS-39113	Finning	> 45000		−20.6	+6.4	3.4	1,2
UCIAMS-39114	Finning	29170	320	−20.9	+7.1	3.3	1,2
UCIAMS-39887	Finning	44700	2200	−20.6	+5.7	3.3	1,2
UCIAMS-39115	Finning	28960	310	−20.6	+6.8	3.3	1,2
UCIAMS-39889	Hunker Cr.	32470	480	−20.6	+6.9	3.1	1,2
UCIAMS-39888	Hunker Cr.	> 45000		−20.7	+9.0	3.3	1,2
UCIAMS-39890	Indian R.	30630	870	−20.9	+6.4	3.2	1,2
UCIAMS-41490	VGFN Foot	> 45000		−21.2	+9.3	3.1	1,2
AA14935	Cleary Cr.	18379	124	−21.0	+7.0	3.2	1,2
AA17574	Tanana	23150	460	−21.0	+9.7	3.1	1,2
UCIAMS-41487	Hunker Cr.	22430	140	−21.0	+9.4	3.3	1,2
AA14888	Sullivan Cr.	12677	142	−20.8	+5.9	3.3	1,2
UCIAMS-149817	St. Paul Isl.	4750	20	−20.5	+8.1	3.2	3
UCIAMS-148202	St. Paul Isl.	5050	20	−20.7	+7.3	3.4	3
UCIAMS-148200	St. Paul Isl.	5095	20	−20.3	+6.3	3.2	3
UCIAMS-149816	St. Paul Isl.	5200	20	−20.3	+7.6	3.3	3
UCIAMS-149818	St. Paul Isl.	5405	20	−19.7	+7.1	3.2	3

UCIAMS-119831	St. Paul Isl.	5715	30	−19.5	+8.3	3.3	3
UCIAMS-149815	St. Paul Isl.	5960	20	−19.2	+7.2	3.2	3
UCIAMS-148201	St. Paul Isl.	6490	20	−19.2	+7.8	3.3	3
UCIAMS-148199	St. Paul Isl.	7145	25	−20.2	+6.8	3.2	3
UCIAMS-149811	St. Paul Isl.	7610	20	−19.1	+4.4	3.3	2
UCIAMS-149812	St. Paul Isl.	7785	25	−20.7	+3.5	3.3	3
UCIAMS-119830	St. Paul Isl.	8210	35	−20.9	+4.2	3.3	3
UCIAMS-149814	St. Paul Isl.	8370	20	−19.0	+7.6	3.2	3
UCIAMS-149813	St. Paul Isl.	8350	25	−19.1	+6.7	3.2	3

ⁱ Used abbreviations: Cr = Creek, G = Gulch, Isl = island, L = Lake, R = River.

ⁱⁱ Used data sources: 1 = Szpak *et al.*, 2010 [stable isotopes], 2 = Debruyne *et al.*, 2008 [14C dates], 3 = Graham *et al.*, 2016.

ⁱⁱⁱ Used abbreviations: AA = University of Arizona AMS, USA, UCIAMS = University of California, Irvine, USA.

Table SI Chapter 4

Results of the isotopic data and sample information arranged per species.

lab code	locality	age (¹⁴ C yr BP)	±	C%	δ ¹³ C (‰)	N%	δ ¹⁵ N (‰)	C/N ratio	species	skeletal element
GrA-54021	Zuid-Holland, Zandmotor	31140	200	32.3	-21.3				<i>Lepus species</i>	mandible
GrA-30722	Brown Bank	8910	50	45.1	-21.1	16.5	4.8	3.2	<i>Castor fiber</i>	femur
GrA-22183	Eurogully	>45000		43.4	-19.4	15.4	7.7	3.3	<i>Canis lupus</i>	femur
GrA-24209	Eurogully	8780	50	47.7	-25.6	16.7	10.2	3.3	<i>Canis species</i>	cranium
GrA-69520	Zuid-Holland, Zandmotor	29900	550	34.3	-20.7	12.5	8.5	3.2	<i>Alopex lagopus</i>	unknown
GrA-50465	Brown Bank	>45000		43	-20.3	14.3	7.7	3.5	<i>Ursus arctos</i>	mandible
GrA-25816	Eurogully	>45000		35.9	-22.3	14.2	3.5	3	<i>Ursus species</i>	unknown
GrA-11643	Brown Bank	40660	350	39.3	-20.1				<i>Crocuta c. spelaea</i>	ulna
GrA-23151	Eurogully	>45000		39.9	-19.2	15.7	8.7	3	<i>Panthera spelaea</i>	ulna
GrA-31471	North Sea	39970	360	41.5	-19.4	13.9	8.2	3.5	<i>Panthera spelaea</i>	scapula
GrA-34644	Brown Bank	10730	60	33.9	-21.2				<i>Gulo gulo</i>	mandible
GrA-52432	Eurogully	8825	45	39.4	-24.8				<i>Lutra lutra</i>	cranium
GrA-52433	Zuid-Holland, Maasvlakte 2	8300	40	32	-26.2	13.3	8.6	2.8	<i>Lutra lutra</i>	mandible
GrA-22178	Eurogully	>45000		45.6	-12.5	14.6	11.5	3.6	<i>Odobenus rosmarus</i>	cranium
GrN-28548	Southern Bight	>45000		41.9	-14.1				<i>Odobenus rosmarus</i>	femur
GrA-59468	Eurogully	>45000		42.2	-13.3	15.5	11.2	3.2	<i>Odobenus rosmarus</i>	mandible
GrA-64644	Denmark, Holmgren	40360	240	39.1	-13.9	15.3	12	3	<i>Odobenus rosmarus</i>	atlas
GrA-57505	Eurogully	2070	30	43.7	-12.9	16.9	13.6	3	<i>Odobenus rosmarus</i>	tooth
GrA-65933	Zuid-Holland, Maasvlakte 2	25130	130	26.2	-15.5	9.3	14.5	3.3	<i>Halichoerus grypus</i>	unknown
GrN-28551	Southern Bight	7180	60	38.7	-11.7				<i>Halichoerus grypus</i>	bone
GrN-28546	Southern Bight	>45000		43.9	-15.8				<i>Pagophilus groenlandica</i>	humerus

GrN-28547	Southern Bight	43500	40.1	-15				<i>Pagophilus groenlandica</i>	humerus
GrA-59476	Brown Bank	>45000	42.7	-21.4	15.4	7.8	3.2	<i>Mammuthus primigenius</i>	tusk
GrA-50851	Eurogully	>45000	47.9	-22.3	15.9	6.1	3.5	<i>Mammuthus primigenius</i>	tibia
GrA-50847	Eurogully	>45000	46.9	-22.1	15.8	6.2	3.5	<i>Mammuthus primigenius</i>	tibia
GrA-50854	Brown Bank	>45000	40	-21.7	14.8	7.2	3.1	<i>Mammuthus primigenius</i>	tooth
GrA-50860	Brown Bank	>45000	41.3	-21.5	14.3	9	3.4	<i>Mammuthus primigenius</i>	tooth
GrA-50848	North Sea	>45000	43.2	-22.2	13.4	8.3	3.7	<i>Mammuthus primigenius</i>	tooth
GrA-52416	Brown Bank	>45000	46	-21.6	15.9	9.1	3.4	<i>Mammuthus primigenius</i>	tooth
GrA-50846	Brown Bank	>45000	40.3	-22.4	15.2	8	3.1	<i>Mammuthus primigenius</i>	tooth
GrA-50843	Brown Bank	>45000	45.1	-22.4	14.1	8.4	3.7	<i>Mammuthus primigenius</i>	tooth
GrA-11640	Brown Bank	>45000	47.9	-22.4				<i>Mammuthus primigenius</i>	epistropheus
GrA-56656	Brown Bank	>45000	40.3	-21.9	14.9	5.9	3.2	<i>Mammuthus primigenius</i>	unknown
GrA-56660	Eurogully	>45000	39.6	-21.9	14.6	5.6	3.2	<i>Mammuthus primigenius</i>	humerus
GrA-56661	Eurogully	>45000	41.4	-21.8	15.1	5.7	3.2	<i>Mammuthus primigenius</i>	humerus
GrA-56675	Zuid-Holland, Maasvlakte	>45000	41.8	-21.6	15.4	5	3.2	<i>Mammuthus primigenius</i>	femur
GrA-56662	Eurogully	43910	550	-21.8	15.9	6.5	3.2	<i>Mammuthus primigenius</i>	ulna
GrA-20134	Eurogully	43800	600	-22.4				<i>Mammuthus primigenius</i>	fibula
GrA-50866	Brown Bank	42690	550	-21.4	14.8	6.6	3.1	<i>Mammuthus primigenius</i>	tooth
GrA-50858	Brown Bank	41450	490	-22.4	13.7	8.8	3.8	<i>Mammuthus primigenius</i>	tooth
GrA-56655	North Sea	41090	400	-22.1	13.3	6.1	3.2	<i>Mammuthus primigenius</i>	unknown
GrA-50864	North Sea	39970	440	-21.7	13.3	7.9	3.1	<i>Mammuthus primigenius</i>	tooth
GrA-56658	Brown Bank	39860	350	-21.5	15.1	7.2	3.2	<i>Mammuthus primigenius</i>	femur
GrA-50852	Eurogully	38960	400	-22.4	13.8	7.3	3.3	<i>Mammuthus primigenius</i>	vertebra
GrN-27410	Eurogully	37580	810	-21.7				<i>Mammuthus primigenius</i>	cranium
GrA-39962	Great Yarmouth	37240	280	-22.6				<i>Mammuthus primigenius</i>	vertebra
GrA-30740	Zeeland, Westerschelde	>45000	46.9	-20.7	17.5	7.5	3.1	<i>Palaeoloxodon antiquus</i>	unknown

GrA-30590	Zeeland, Westerschelde	>45000	48.7	-21.2	17.3	8.1	3.3	<i>Palaeoloxodon antiquus</i>	unknown
GrA-30591	Zeeland, Westerschelde	>45000	45.5	-20.6	15.7	10.1	3.4	<i>Palaeoloxodon antiquus</i>	unknown
GrA-30592	Zeeland, Westerschelde	>45000	41.6	-20.6	13.7	11.2	3.5	<i>Palaeoloxodon antiquus</i>	unknown
GrA-56664	Zuid-Holland, Maasvlakte	>45000	39.1	-20.2	14.1	9.8	3.2	<i>Palaeoloxodon antiquus</i>	cranium
GrA-52410	Eurogully	>45000	35.3	-20.8	16.4	11.6	2.5	<i>Palaeoloxodon antiquus</i>	molar root
GrA-40013	Zeeland, Westerschelde	42400	1100	36.6	-20.5	13.1	11.1	<i>Palaeoloxodon antiquus</i>	mandible
GrA-56674	Zuid-Holland, Maasvlakte	>45000	40	-21.3	14.8	3	3.2	<i>Equus species</i>	tibia
GrA-42704	Southern Bight	>45000	36.4	-21.4	12.7	6.4	3.3	<i>Equus species</i>	metacarpal
GrA-23582	Brown Bank	44780	1635	40.7	-21.4	14.4	5.4	<i>Equus caballus</i>	tibia
GrA-22585	Eurogully	43550	1200	44.5	-22	16.5	2.3	<i>Equus species</i>	ulna
GrA-39964	Great Yarmouth	42960	500	38.2	-21.4	14.1	4.1	<i>Equus species</i>	metacarpal
GrA-37558	Stekels	37860	355	41.9	-19.9	16.3	4.8	<i>Equus caballus</i>	metacarpal
GrN-32392	Eurogully	>45000	44.4	-20.7			3		unknown
GrA-39965	Great Yarmouth	>45000	42	-20.6	4.8	4.5	3.3	<i>Coelodonta antiquitatis</i>	mandible
GrN-27411	Eurogully	39910	1070	45.8	-20.8			<i>Coelodonta antiquitatis</i>	pelvis
GrA-66408	Yerseke	2190	30	39.4	-16.7	13.4	9.3	<i>Balaenidae</i>	bullae
GrA-34338	Southern Bight	>45000	40.9	-14.8	12.7	14.3	3.3	<i>Balaena mysticetus</i>	radius
GrA-37034	Southern Bight	>45000	46	-12.6				<i>Balaenoptera physalus</i>	thoracic vertebra
GrA-22182	Eurogully	>45000	42.2	-14.4	14.8	13.3	3.3	<i>Eschrichtius robustus</i>	vertebra
GrA-34348	Zuid-Holland, Scheveningen	>45000	44.3	-14.8	16.6	12.9	3.1	<i>Eschrichtius robustus</i>	vertebra
GrA-34381	Southern Bight	>45000	42.1	-13.3	16.2	14.8	3	<i>Eschrichtius robustus</i>	axis
GrN-28549	Southern Bight	42800	4100	42.3	-15.4			<i>Eschrichtius robustus</i>	vertebra
GrA-34349	Eurogully	39100	360	1.6	-14	13.3	12.2	<i>Eschrichtius robustus</i>	atlas
GrA-34378	North Sea	4815	40	40.4	-14	16.2	13.9	<i>Eschrichtius robustus</i>	cranium
GrA-34380	Southern Bight	4230	35	46.8	-15	14.6	14.5	<i>Eschrichtius robustus</i>	vertebra
GrN-31093	Noord-Holland, Andijk	4130	40	39.1	-14.1			<i>Eschrichtius robustus</i>	unknown

GrA-34761	Southern Bight	4055	35	46.7	-14.6	13.8	16	3.4	<i>Eschrichtius robustus</i>	unknown
GrA-34379	North Sea	3925	35	42.2	-13.1	16.6	14	3	<i>Eschrichtius robustus</i>	cranium
GrA-34385	Southern Bight	3650	35	47.2	-13.4	17.4	14.6	3.2	<i>Eschrichtius robustus</i>	vertebra
GrA-34383	Southern Bight	2270	35	45	-14.6	16.1	12.5	3.3	<i>Eschrichtius robustus</i>	axis
GrA-34369	White Bank	1870	35	43.6	-15.1	17	16.1	3	<i>Eschrichtius robustus</i>	mandible
GrA-34368	North Sea	1865	30	42.8	-14.9	15.6	15.9	3.2	<i>Eschrichtius robustus</i>	vertebra
GrA-25852	Southern Bight	3120	40	39.8	-12	14.7	15.6	3.2	<i>Lagenorhynchus albirostris</i>	mandible
GrA-37555	Stekels	2505	35	43.2	-12.4	15	16.2	3.4	<i>Lagenorhynchus albirostris</i>	vertebra
GrA-34342	Wadden Sea (G)	4550	35	45.2	-12.3	17.1	15.4	3.1	<i>Orcinus orca</i>	maxilla
GrA-25820	Southern Bight	3900	45	38.7	-11.6	14.4	17.4	3.1	<i>Orcinus orca</i>	unknown
GrA-25851	Southern Bight	8135	45	40	-11.4	15.6	15.9	3	<i>Tursiops truncatus</i>	mandible
GrA-25850	Southern Bight	7390	50	43.5	-12.4	16	14.9	3.2	<i>Tursiops truncatus</i>	mandible
GrN-28544	Southern Bight	>45000		40.5	-16.5				<i>Delphinapterus leucas</i>	vertebra
GrA-22179	Eurogully	>45000		40.9	-14.8	12.8	13.9	3.7	<i>Delphinapterus leucas</i>	axis
GrA-25849	Borkumrif	>45000		44.6	-14.4	17.3	16.5	3	<i>Delphinapterus leucas</i>	vertebra
GrA-34337	Zeeland, Yerseke	40550	400	40.5	-16.4	14.7	15.1	3.1	<i>Delphinapterus leucas</i>	mandible
GrA-34339	Southern Bight	8860	40	39.1	-21.9				<i>Sus scrofa</i>	mandible
GrA-32600	Eurogully	8710	45	41.7	-21.2	15.1	4	3.2	<i>Sus scrofa</i>	humerus
GrA-30721	Eurogully	7780	50	31.9	-21.9	13.4	6.2	2.8	<i>Sus scrofa</i>	atlas
GrA-38353	Eurogully	>45000		43	-20.6	15.2	6.6	3.3	<i>Megaloceros giganteus</i>	cranium
GrA-32601	Eurogully	>45000		45.7	-19.5	14.9	2.5	3.6	<i>Megaloceros giganteus</i>	antler
GrA-32685	Eurogully	>45000		40.5	-19.8				<i>Megaloceros giganteus</i>	unknown
GrA-32599	Eurogully	40750	440	38.7	-20.1	14.2	5.5	3.2	<i>Megaloceros giganteus</i>	antler
GrA-36110	Brown Bank	10000	50	44.4	-21.1	14.8	3.7	3.5	<i>Cervus elaphus</i>	antler
GrA-37796	Stekels	9815	40	42.9	-21.2	15.1	3.5	3.3	<i>Cervus elaphus</i>	antler
GrA-37795	Stekels	9675	40	43.7	-20.8	16.5	4.1	3.1	<i>Cervus elaphus</i>	antler

GrA-25514	North Sea	9500	180	41.5	-21.5			<i>Cervus elaphus</i>	antler
GrA-30732	Brown Bank	9070	50	40.6	-21.9	14.5	5	<i>Cervus elaphus</i>	tibia
GrA-40524	Eurogully	9070	45	38.1	-21.6	13.7	3.2	<i>Cervus elaphus</i>	antler
GrA-29204	Brown Bank	8870	50	42.4	-22.2			<i>Cervus elaphus</i>	antler
GrA-37561	Stekels	8830	40	44.2	-21.7	15.2	2.5	<i>Cervus elaphus</i>	antler
GrA-36113	Brown Bank	8710	50	39.7	-22.5	13.4	2.2	<i>Cervus elaphus</i>	antler
GrA-25568	Southern Bight	8600	50	36.6	-21.8	13.9	2.1	<i>Cervus elaphus</i>	antler
GrA-22999	Eurogully	8070	50	38.5	-20.4	16	3.4	<i>Cervus elaphus</i>	antler
GrA-20280	Zeeland, Roompot	4030	60	32.2	-22.6			<i>Cervus elaphus</i>	antler
GrA-50510	North Sea	3540	40	42.5	-22.6	14.6	5.1	<i>Cervus elaphus</i>	antler
*	Zeeland, Roompot	1352	34	37.1	-20.9			<i>Cervus elaphus</i>	antler
GrA-23581	Brown Bank	44560	1665	43.9	-20.4	15.3	4.7	<i>Alces alces</i>	antler
GrA-27206	Brown Bank	9910	50	39.9	-20.9	16.6	1.7	<i>Alces alces</i>	antler
GrA-37004	Brown Bank	9520	50	39.7	-21.7	14.1	3.4	<i>Alces alces</i>	antler
GrA-68250	Zuid-Holland	9510	50	44.3	-20.6	16.2	2.2	<i>Alces alces</i>	antler
GrA-30731	Brown Bank	8240	50	45.8	-21.2	16.4	4.2	<i>Alces alces</i>	antler
GrA-20475	Brown Bank	>45000		32.4	-19.6			<i>Rangifer tarandus</i>	bone
GrA-20303	Brown Bank	>45000		39.7	-19.6			<i>Rangifer tarandus</i>	metacarpal
GrA-20475	Brown Bank	>45000		32.4	-19.6	15.2	2.9	<i>Rangifer tarandus</i>	unknown
GrA-32597	Eurogully	45150	650	36.6	-19.1	15.1	2.9	<i>Rangifer tarandus</i>	metatarsal
GrA-20259	Brown Bank	42300	1000	36.3	-18.9	13.8	3.2	<i>Rangifer tarandus</i>	astragalus
*	Brown Bank	41604	645	39.8	-19.1	14.4	5.1	<i>Rangifer tarandus</i>	radius
*	Eurogully/Brown Bank	41832	612	41.1	-19.2			<i>Rangifer tarandus</i>	calcaneum
*	Brown Bank	39210	665	42.2	-19.1	14.7	4.4	<i>Rangifer tarandus</i>	metacarpal
GrA-20257	Eurogully	39200	700	35.9	-21.2	13.7	6.8	<i>Rangifer tarandus</i>	phalanx
GrA-20261	Brown Bank	39000	700	39	-19.2	14.1	4.3	<i>Rangifer tarandus</i>	epistropheus

GrA-31284	Brown Bank	38960	355	35.1	-19.8	13.2	3.6	3.1	<i>Rangifer tarandus</i>	antler
GrA-25570	Brown Bank	35160	315	36	-19.3	12.6	2.2	3.3	<i>Rangifer tarandus</i>	antler
GrA-39966	Great Yarmouth	31460	160	42.8	-19.5	14.4	2.5	3.5	<i>Rangifer tarandus</i>	antler
GrA-20294	Eurogully/Brown Bank	29460	250	38.5	-19.4	15.7	4.1	2.9	<i>Rangifer tarandus</i>	astragalus
GrA-20256	Brown Bank	8820	60	40.6	-22.7	16.8	4	2.8	<i>Rangifer tarandus</i>	phalanx
GrA-20353	Brown Bank	8350	50	30.6	-23.3				<i>Rangifer tarandus</i>	phalanx
GrA-31283	Brown Bank	8880	40	38.9	-22.2	12.8	2.4	3.6	<i>Capreolus capreolus</i>	tibia
GrA-33949	Eurogully	8405	45	36.8	-21.4	12.5	3	3.4	<i>Capreolus capreolus</i>	antler
GrA-37797	Stekels	>45000		45.9	-20.4	17.9	4.3	3	<i>Bos primigenius</i>	femur
GrA-51668	North Sea	8900	40	44.3	-22.4	15.6	5.2	3.3	<i>Bos primigenius</i>	unknown
GrA-25569	Brown Bank	8800	50	38.2	-22.3	14.7	5.2	3	<i>Bos primigenius</i>	metapodal
GrA-22998	Brown Bank	8780	60	36.2	-22.6	15.5	5.5	2.7	<i>Bos primigenius</i>	metacarpal
GrA-51786	Eurogully	8175	40	42.8	-22.8	16.6	6.1	3	<i>Bos primigenius</i>	horn pit
GrN-28261	Eurogully	>45000		50.7	-19.6				<i>Bison priscus</i>	lendal vertebra
GrA-39518	Great Yarmouth	39900	850	35.6	-20.9				<i>Bison species</i>	metacarpale
GrA-28364	Brown Bank	11560	50	37.9	-20.6	14.5	3.9	3.1	<i>Bison species</i>	metatarsus
GrA-34524	Brown Bank	>45000		37.5	-21.9	13.2	6.1	3.3	<i>Bovidae</i>	unknown
GrA-34531	Brown Bank	>45000		39.2	-21.7	14.3	5.4	3.2	<i>Bovidae</i>	unknown
GrA-34533	Brown Bank	>45000		42.1	-21.9	15.1	6.7	3.2	<i>Bovidae</i>	unknown
GrA-51667	North Sea	9220	40	38.6	-22.7	14.7	4.9	3.1	<i>Bovidae</i>	metacarpal
GrA-34526	Brown Bank	110	50	45.2	-21.8	15.9	5.1	3.3	<i>Bovidae</i>	unknown
GrA-11641	Brown Bank	36740	230	42.5	-20.1				<i>Ovibos moschatus</i>	metacarpal
*	Brown Bank	15183	36	37	-19.2	14.1	7.5	3	<i>Caprinae</i>	unknown
GrA-58271	Zuid-Holland, Maasvlakte	11050	45	41.6	-20.6	14.9	9.7	3.3	<i>Homo sapiens</i>	bone
GrA-42700	Southern Bight	10070	50	36	-24.7	13.3	11.2	3.2	<i>Homo sapiens</i>	cranium
GrA-42702	Southern Bight	9440	50	41.5	-24.2	15.6	13.6	3.1	<i>Homo sapiens</i>	cranium

GrA-57506	Eurogully/Brown Bank	9440	45	40.3	-24.4	15.1	12.2	3.1	<i>Homo sapiens</i>	femur
GrA-50459	Eurogully	9220	60	35.4	-22.8	13.1	10	3.2	<i>Homo sapiens</i>	femur
GrA-62470	Zuid-Holland, Maasvlakte	9180	50	42.7	-23	16.2	10.3	3.1	<i>Homo sapiens</i>	cranium
GrA-49638	North Sea	9150	50	44.5	-22.7	16.3	4.5	3.2	<i>Homo sapiens</i>	bone
GrA-27188	Brown Bank	9140	50	36.4	-23.1	15.4	10.2	2.8	<i>Homo sapiens</i>	humerus
GrA-30733	Brown Bank	9080	50	42.6	-22	15.3	11.6	3.2	<i>Homo sapiens</i>	bone
GrA-31287	Brown Bank	9035	40	33.2	-23.4	12.3	11.4	3.2	<i>Homo sapiens</i>	bone
GrA-35949	Brown Bank	9005	45	40.7	-23.3	14.1	10.8	3.4	<i>Homo sapiens</i>	humerus
GrA-62225	Eurogully	8945	45	40.4	-13.4	15	14.1	3.1	<i>Homo sapiens</i>	humerus
GrA-51669	North Sea	8910	40	43.7	-22.1	15.7	9.4	3.2	<i>Homo sapiens</i>	bone
GrA-49637	North Sea	8820	50	44.1	-22.5	13.9	9.3	3.7	<i>Homo sapiens</i>	bone
GrA-67124	Zuid-Holland, Zandmotor	8680	45	44	-23.6	16.1	12.4	3.2	<i>Homo sapiens</i>	cranium
GrA-45801	Brown Bank	8665	45	43.6	-16.5	15.3	15.7	3.3	<i>Homo sapiens</i>	femur
GrA-54735	North Sea	8660	50	43.1	-16.7	15.6	13.8	3.2	<i>Homo sapiens</i>	femur
M-21188	Zuid-Holland, Hoek van Holland	8630	25	51.3	-23.4	18	14.1	3.3	<i>Homo sapiens</i>	tooth
GrA-57501	Zuid-Holland, Maasvlakte	8565	45	37.3	-23.5	14	12.7	3.1	<i>Homo sapiens</i>	cranium
*	Eurogully	8610	36	43	-24.1	15.4	12.4	3.3	<i>Homo sapiens</i>	femur
GrA-65508	Slijtgeul	8560	50	30.5	-19.8	11.2	12.9	3.2	<i>Homo sapiens</i>	maxilla
GrA-56366	Zuid-Holland, Hoek van Holland	8425	40	37.4	-21.3	14.2	14.9	3.1	<i>Homo sapiens</i>	tooth
GrA-63432	Zuid-Holland, Hoek van Holland	8375	45	34	-23.1	12.8	12.5	3.1	<i>Homo sapiens</i>	cranium
GrA-11642	North Sea	8370	50	39	-15.6	14.3	15.7	3.2	<i>Homo sapiens</i>	mandible
GrA-56352	Zeeland, Burgh Haamstede	8290	40	42	-19.9	15.7	15	3.1	<i>Homo sapiens</i>	tooth
GrA-27205	Brown Bank	8180	45	40.6	-22.6	17.7	15.1	2.7	<i>Homo sapiens</i>	femur
GrA-65943	Zuid-Holland, Zandmotor	8140	45	39.1	-22.5	14	15.9	3.3	<i>Homo sapiens</i>	cranium
GrM-10211	Noord-Holland, Castricum	8000	45	43.2	-16.9	15.5	17.4	3.2	<i>Homo sapiens</i>	bone
GrA-51670	North Sea	7955	40	43.3	-21.5	15.6	14.6	3.2	<i>Homo sapiens</i>	bone

GrA-68069	North Sea	7950	45	43	-17.6	15.7	16.2	3.2	<i>Homo sapiens</i>	tooth
GrA-63431	Zuid-Holland, Monster	7885	45	38.4	-21.3	15	14.1	3	<i>Homo sapiens</i>	cranium
GrA-63799	Zuid-Holland, Maasvlakte	7870	45	40.8	-23.7	15	12.9	3.2	<i>Homo sapiens</i>	cranium
GrA-67123	Zuid-Holland, Zandmotor	7810	45	41.5	-20.9	15.1	15.6	3.2	<i>Homo sapiens</i>	cranium
GrA-65507	Zuid-Holland, Zandmotor	7760	45	36.3	-21.6	13.1	16.4	3.2	<i>Homo sapiens</i>	femur
GrA-68591	Zuid-Holland, Den Haag	7725	45	44.8	-23.2	16.3	13.9	3.2	<i>Homo sapiens</i>	cranium
GrM-10161	Wadden Sea, Texel	5020	25	45.8	-21	16.7	9.6	3.2	<i>Homo sapiens</i>	cranium
GrM-10748	Noord-Holland, Bloemendaal	3130	20	44.9	-20.2	16.4	13.4	3.2	<i>Homo sapiens</i>	vertebra
GrM-10746	Noord-Holland, Noordwijk	2985	20	46.3	-20.2	16.9	8	3.2	<i>Homo sapiens</i>	femur
GrM-12352	Noord-Holland, Noordwijk	2842	16	44	-20.2	16	9.5	3.2	<i>Homo sapiens</i>	humerus
GrA-65511	Wadden Sea, Terschelling	2740	35	40.5	-20.4	14.1	10.2	3.3	<i>Homo sapiens</i>	vertebra
GrM-13967	North Sea	2518	16	42.3	-20.3	15.3	8.5	3.2	<i>Homo sapiens</i>	phalanx
GrM-12977	Katwijk/Wassenaar	2515	16	44.7	-19.8	15.9	10.2	3.3	<i>Homo sapiens</i>	mandible
GrA-67067	North Sea	2285	30	42.3	-20.4	15.5	11.3	3.2	<i>Homo sapiens</i>	vertebra
GrA-68058	Zuid-Holland, Den Haag	2190	30	38	-19.6	13.9	12.2	3.2	<i>Homo sapiens</i>	tooth
GrM-12817	Wadden Sea, Texel	2156	15	44	-19.4	15.9	11.7	3.2	<i>Homo sapiens</i>	cranium
GrA-69134	Zuid-Holland, Katwijk	1995	30	45.2	-20.2	16.4	10.4	3.2	<i>Homo sapiens</i>	scapula
GrM-12923	Scheveningen	1838	15	47.3	-19.9	17.2	10	3.2	<i>Homo sapiens</i>	femur
GrA-63619	Wadden Sea, Terschelling	1830	30	44.2	-19.9	16.6	9.9	3.1	<i>Homo sapiens</i>	bone
GrM-12944	Noordwijk	1808	15	46.2	-19.7	16.9	12.1	3.2	<i>Homo sapiens</i>	vertebra
GrA-64747	Noord-Holland, Zandam	1805	30	46.4	-20.2	16.9	9.9	3.2	<i>Homo sapiens</i>	femur
GrM-13316	Cadzand	1799	15	42.9	-18.7	15.7	9.8	3.2	<i>Homo sapiens</i>	mandible
GrA-64726	Zeeland, Borsele	1335	30	41.9	-19.4	15.2	12	3.2	<i>Homo sapiens</i>	tooth
GrA-50511	Southern Bight	1260	40	43.3	-20.3	12.7	8.8	4	<i>Homo sapiens</i>	bone
GrM-10157	Wadden Sea, Texel	1225	20	45.4	-20.1	16.6	9.6	3.2	<i>Homo sapiens</i>	cranium
GrM-10158	Wadden Sea, Texel	1205	20	45.5	-20	16.7	9.7	3.2	<i>Homo sapiens</i>	cranium

GrM-12819	Wadden Sea, Texel	1212	15	43.3	-19.8	15.7	10.8	3.2	<i>Homo sapiens</i>	cranium
GrA-31286	Zeeland, Westerschelde	1200	25	49.6	-19.5	17.1	12	3.4	<i>Homo sapiens</i>	bone
GrA-65510	Zuid-Holland, Maasvlakte	1175	30	47	-20.6	16	10.8	3.4	<i>Homo sapiens</i>	cranium
GrM-12519	Zeeland	1141	13	46.5	-20	17	12.3	3.2	<i>Homo sapiens</i>	vertebra
GrM-10814	Zeeland	1115	12	42.5	-19.5	15.6	11.9	3.2	<i>Homo sapiens</i>	mandible
GrM-12518	Zeeland	1035	14	47.5	-20	17.4	9.4	3.2	<i>Homo sapiens</i>	cranium
GrA-66669	Zuid-Holland, Den Haag	1015	30	46.2	-19.7	16.7	10.9	3.2	<i>Homo sapiens</i>	vertebra
GrM-12512	Zeeland	986	14	46.7	-19.9	17.2	10.6	3.2	<i>Homo sapiens</i>	mandible
GrM-12513	Zeeland	975	13	45.8	-19.7	16.7	10	3.2	<i>Homo sapiens</i>	vertebra
GrM-12594	Zeeland	951	13	46.4	-20.3	16.8	12.2	3.2	<i>Homo sapiens</i>	cranium
GrM-10150	Wadden Sea, Texel	905	20	43.9	-18	16	13.6	3.2	<i>Homo sapiens</i>	humerus
GrA-67125	Zuid-Holland, Den Haag	875	30	44.4	-19.1	16.1	11.3	3.2	<i>Homo sapiens</i>	humerus
GrM-10156	Wadden Sea, Texel	840	20	43.8	-19.7	15.9	14	3.2	<i>Homo sapiens</i>	mandible
GrM-10172	North Sea	791	17	40.5	-19.4	14.6	12.4	3.2	<i>Homo sapiens</i>	bone
GrM-10162	Wadden Sea, Texel	730	20	43	-19.2	15.7	10.7	3.2	<i>Homo sapiens</i>	femur
GrA-68787	Zuid-Holland, Monster	730	30	45.4	-19.4	16.6	12.5	3.2	<i>Homo sapiens</i>	mandible
GrM-10163	Wadden Sea, Texel	695	20	43.5	-19.8	15.8	12.9	3.2	<i>Homo sapiens</i>	femur
GrM-12511	Zeeland	654	13	46.7	-19.6	17.2	11.8	3.2	<i>Homo sapiens</i>	cranium
GrM-10160	Wadden Sea, Texel	630	20	42.5	-20	15.4	12.7	3.2	<i>Homo sapiens</i>	cranium
GrA-69069	Noord-Holland, Noordwijk	585	30	42.8	-18.3	15.5	14.6	3.2	<i>Homo sapiens</i>	scapula
GrA-68049	North Sea	540	30	42.5	-19.9	15.4	11.5	3.2	<i>Homo sapiens</i>	mandible
GrA-61784	Noord-Holland, Wijk aan Zee	485	35	43.4	-18.5	15.5	13.7	3.3	<i>Homo sapiens</i>	mandible
GrM-12592	Wadden Sea, Griend	477	13	46	-17.2	16.8	15.2	3.2	<i>Homo sapiens</i>	pelvis
GrA-62687	Zuid-Holland, Biesbosch	470	30	13.3	-19.9	4.5	13.5	3.5	<i>Homo sapiens</i>	cranium
GrA-67126	Zuid-Holland, Den Haag	450	30	41.7	-18.9	15.1	13.4	3.2	<i>Homo sapiens</i>	femur
GrM-11117	Wadden Sea	374	17	35.7	-20.1	13	12.2	3.2	<i>Homo sapiens</i>	tooth

GrM-12514	Zeeland	356	13	47.9	-19.4	17.6	14.1	3.2	<i>Homo sapiens</i>	cranium
GrA-66670	Zuid-Holland, Den Haag	355	30	47.3	-20.1	17.1	11.4	3.2	<i>Homo sapiens</i>	vertebra
GrM-10351	Schiermonnikoog	340	15	43.8	-18.5	16.3	13.1	3.1	<i>Homo sapiens</i>	bone
GrM12013	North Sea	338	11	45.9	-20.5	16.3	10.7	3.3	<i>Homo sapiens</i>	bone
GrA-69720	Wadden Sea, Texel	335	35	41.9	-19.9	15.2	12.9	3.2	<i>Homo sapiens</i>	vertebra
GrM-12590	Zeeland, Domburg	334	13	46.8	-18.5	17.1	11.6	3.2	<i>Homo sapiens</i>	femur
GrM-10152	Wadden Sea, Texel	310	25	42.6	-21.6				<i>Homo sapiens</i>	femur
GrA-69722	Wadden Sea, Texel	300	35	43.4	-20.1	15.9	13.6	3.2	<i>Homo sapiens</i>	vertebra
GrA-37072	Eurogully	280	35	40.9	-18.2	13.5	12.2	3.5	<i>Homo sapiens</i>	humerus
GrA-68584	Zeeland, Vlissingen	250	30	41	-19.5	14.8	13.5	3.2	<i>Homo sapiens</i>	cranium
GrA-68309	North Sea	248	28	44.8	-19.9	16.2	12.3	3.2	<i>Homo sapiens</i>	mandible
GrM-10159	Wadden Sea, Texel	235	20	46.2	-19.5	16.9	11.3	3.2	<i>Homo sapiens</i>	cranium
GrA-64893	North Sea	225	30	44.1	-17	15.5	15.1	3.3	<i>Homo sapiens</i>	tibia
GrA-67581	Zeeland, Oostkapelle	225	30	44.9	-18	16.3	11.2	3.2	<i>Homo sapiens</i>	cranium
GrM-12348	Wadden Sea, Terschelling	223	14	45.6	-13.4	16.5	13.4	3.2	<i>Homo sapiens</i>	tibia
GrM-10149	Wadden Sea, Texel	220	20	43.1	-18.4	15.5	12.8	3.2	<i>Homo sapiens</i>	humerus
GrA-67523	Wadden Sea, Holwerd	210	30	46.9	-18.1	17	11.8	3.2	<i>Homo sapiens</i>	tibia
GrM-10200	North Sea	207	13	45.3	-19.7	16.4	11.6	3.2	<i>Homo sapiens</i>	bone
GrA-63668	North Sea	205	30	46.8	-17.2	17.3	11.1	3.2	<i>Homo sapiens</i>	bone
GrA-64239	North Sea	200	30	47	-19.6	17	11.9	3.2	<i>Homo sapiens</i>	bone
GrA-64895	North Sea	195	30	44.6	-19.2	15.1	11.3	3.5	<i>Homo sapiens</i>	tibia
GrM-10173	North Sea	191	16	42.9	-19.2	15.5	13.4	3.2	<i>Homo sapiens</i>	bone
GrA-68059	North Sea	191	30	39.8	-18.6	14.4	10.6	3.2	<i>Homo sapiens</i>	cranium
GrA-68655	Zuid-Holland, Wassenaar	190	30	45.6	-17.7	16.7	12.1	3.2	<i>Homo sapiens</i>	vertebra
GrM-10168	Wadden Sea, Texel	190	20	45	-17.8	16.3	11.8	3.2	<i>Homo sapiens</i>	femur
GrM-12516	Zeeland	178	13	46.9	-18.5	17.2	12.1	3.2	<i>Homo sapiens</i>	fibula

GrA-68310	North Sea	175	30	45.1	-19.5	16.3	11.8	3.2	<i>Homo sapiens</i>	mandible
GrA-69018	Zeeland, Sluis	170	30	47.5	-19.5	17	12.6	3.3	<i>Homo sapiens</i>	humerus
GrA-65315	Noord-Holland, Bergen aan Zee	165	30	41.6	-17.4	14.5	11.6	3.3	<i>Homo sapiens</i>	humerus
GrA-69724	Wadden Sea, Texel	165	30	45.2	-19.3	16.6	10.9	3.2	<i>Homo sapiens</i>	femur
GrA-69020	Zeeland, Sluis	160	30	43.8	-19.9	15.6	12.6	3.3	<i>Homo sapiens</i>	pelvis
GrM-10151	Wadden Sea, Texel	160	20	45.3	-19.6	16.4	10.1	3.2	<i>Homo sapiens</i>	humerus
GrM-10164	Wadden Sea, Texel	160	20	39.8	-19.9	14.6	12.6	3.2	<i>Homo sapiens</i>	femur
GrM-12346	Wadden Sea, Schiermonnikoog	159	14	44.6	-19.2	16.1	13.6	3.2	<i>Homo sapiens</i>	tibia
GrA-69723	Wadden Sea, Texel	155	35	45.1	-18.5	16.5	12.1	3.2	<i>Homo sapiens</i>	femur
GrM-12589	Zeeland, Domburg	144	12	46.9	-19.3	17.2	11.8	3.2	<i>Homo sapiens</i>	mandible
GrA-69019	Zeeland, Sluis	140	30	47.4	-19.6	17	12.6	3.3	<i>Homo sapiens</i>	cranium
GrM-10199	North Sea	130	14	45.8	-20	16.7	11.6	3.2	<i>Homo sapiens</i>	bone
GrA-64894	North Sea	120	30	40.8	-18.2	14.4	11.7	3.3	<i>Homo sapiens</i>	tibia
GrA-64891	Wadden Sea	115	30	43.8	-19.9	15.7	11.2	3.2	<i>Homo sapiens</i>	cranium
GrA-64892	Wadden Sea	75	30	45.3	-19.6	16.2	12.3	3.3	<i>Homo sapiens</i>	cranium
GrA-69016	North Sea	0	25	48.8	-19.6	17	12.4	3.4	<i>Homo sapiens</i>	cranium
GrA-69725	Zuid-Holland	0	25	44.2	-19.8	16.1	12.2	3.2	<i>Homo sapiens</i>	humerus
GrA-64453	Zuid-Holland, Hoek van Holland	43290	380	39.9	-14.9	14.5	17.6	3.2	<i>Pinguinus impennis</i>	humerus
GrA-64384	Zuid-Holland, Zandmotor	6480	40	35.5	-14.3	12.9	17.7	3.2	<i>Pinguinus impennis</i>	humerus
GrA-65546	Zuid-Holland, Zandmotor	3505	35	39.4	-14.2	13.8	16	3.3	<i>Pinguinus impennis</i>	unknown
GrA-43620	Stekels	>45000		36.6	-23	13.7	4.6	3.1	<i>unknown</i>	unknown
GrA-40522	Brown Bank, SW	>45000		38.9	-20.6	14.4	5.2	3.2	<i>unknown</i>	cf tibia
GrA-43612	Stekels	8945	45	34.8	-22.8	13.9	5.4	2.9	<i>unknown</i>	bone
GrA-59743	Zuid-Holland, Maasvlakte	8680	60	37.8	-19.6	13.9	4.2	3.2	<i>unknown</i>	unknown
GrA-30795	Brown Bank	8660	50	45.7	-21.9	16.1	5.3	3.3	<i>unknown</i>	metapodal
GrA-42195	Zuid-Holland, Rockanje	8295	45	42.4	-22.1	13.1	6.3	3.8	<i>unknown</i>	unknown

SI Chapter 7

OxCal code used to establish the final extinction date of the woolly mammoth.

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    Phase("Mammoth Wrangel Island ")
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About the author

Margot Kuitens was born in Houten on 7 October 1985 and was raised in Opperdoes, the Netherlands. She studied Archaeology at Leiden University. Both her Bachelors and Masters were focused on archaeological sciences and prehistory, and her theses involved stable carbon and nitrogen analysis of animal tissue. After her graduation in 2009, Margot worked part-time as analyst at the Centre of Isotope Research (CIO), University of Groningen. In addition, she continued working as a researcher in the field of archaeological sciences. At the Faculty of Archaeology, Leiden University, she was among others involved in the NWO-funded Dutch Russia Research Cooperation on the ‘Collapse of the Mammoth Steppe Ecosystem’ (COMSEC), in the geo-archaeological and palaeontological research that was carried out as part of the creation of the Maasvlakte 2 harbour area of Rotterdam, and in the determination and molecular investigation of fossil bones from the archaeological site Schöningen (Germany). Her PhD thesis presents a compilation of a number of stable isotope case studies executed by Margot during the past years. Since 2017, she is employed within the ERC-funded project ‘Exact Chronology of Early Societies’ (ECHOES), based at the CIO, University of Groningen. She works on a new approach to radiocarbon dating, one that is accurate to the exact calendar year. The technique is built on the recent discovery of annual rises, or ‘Miyake Events’, in the concentration of radiocarbon in the atmosphere. Margot is using this novel method for radiocarbon dating archaeological sites at an unprecedented precision.

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Related to the PhD research

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