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Supplementary Information of

Impacts of Reindeer on Soil Carbon Storage in the Seasonally Frozen Ground of Northern Finland: A Pilot Study

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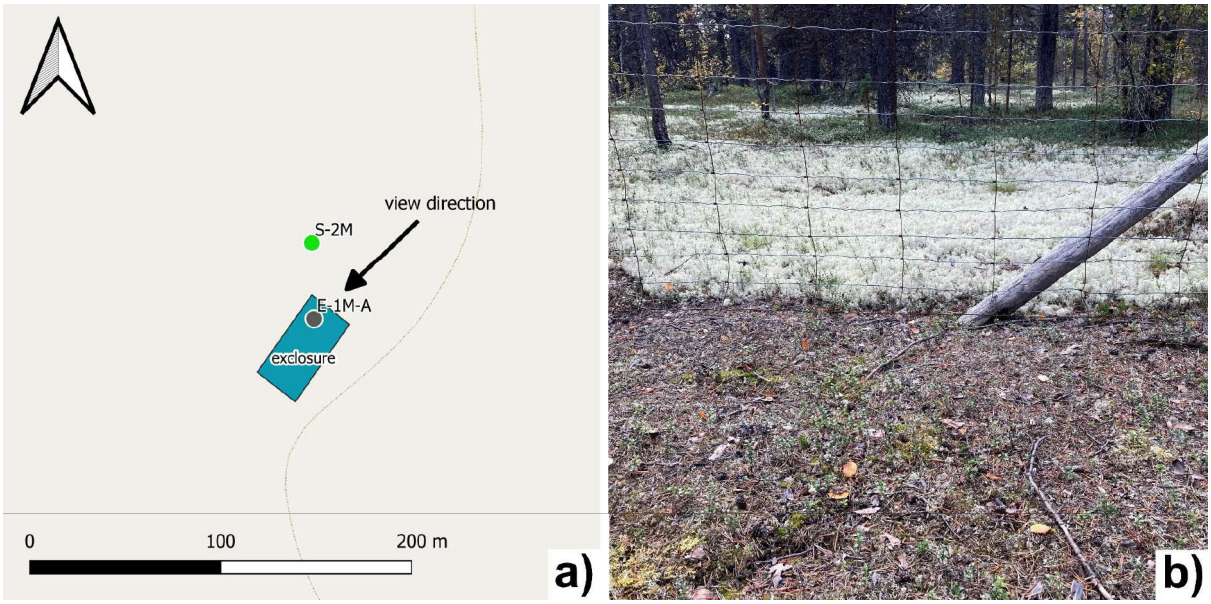

Fig S1. a) Location of the exclosure site (E-1M-A) and adjacent site S-2M (© GoogleEarth); b) view of the fence surrounding the non-grazed exclosure site E-1M, with visible difference in vegetation, especially *Cladonia rangiferina*, as a result of reindeer presence/absence.

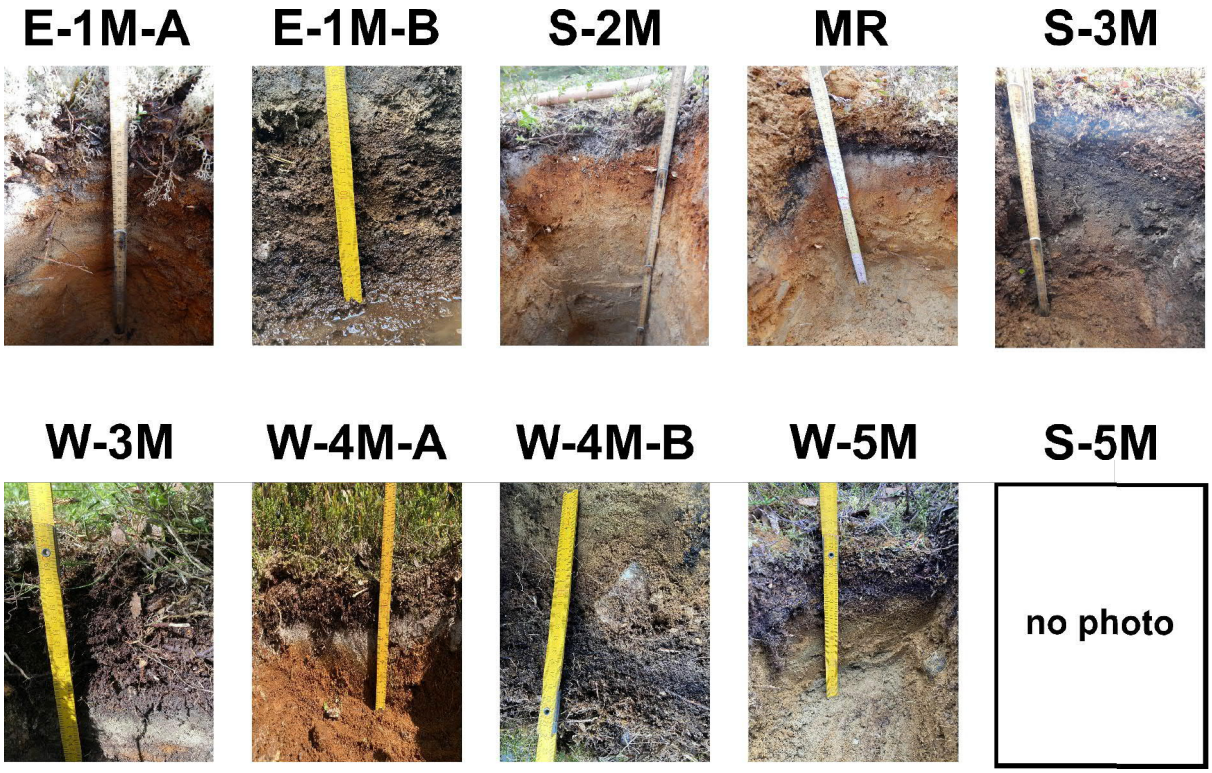

Fig S2. Soil profiles at E-1M-A, E-1M-B, S-2M, MR, S-3M, W-3M, W-4M-A, W-4M-B, W-5M and S-5M.

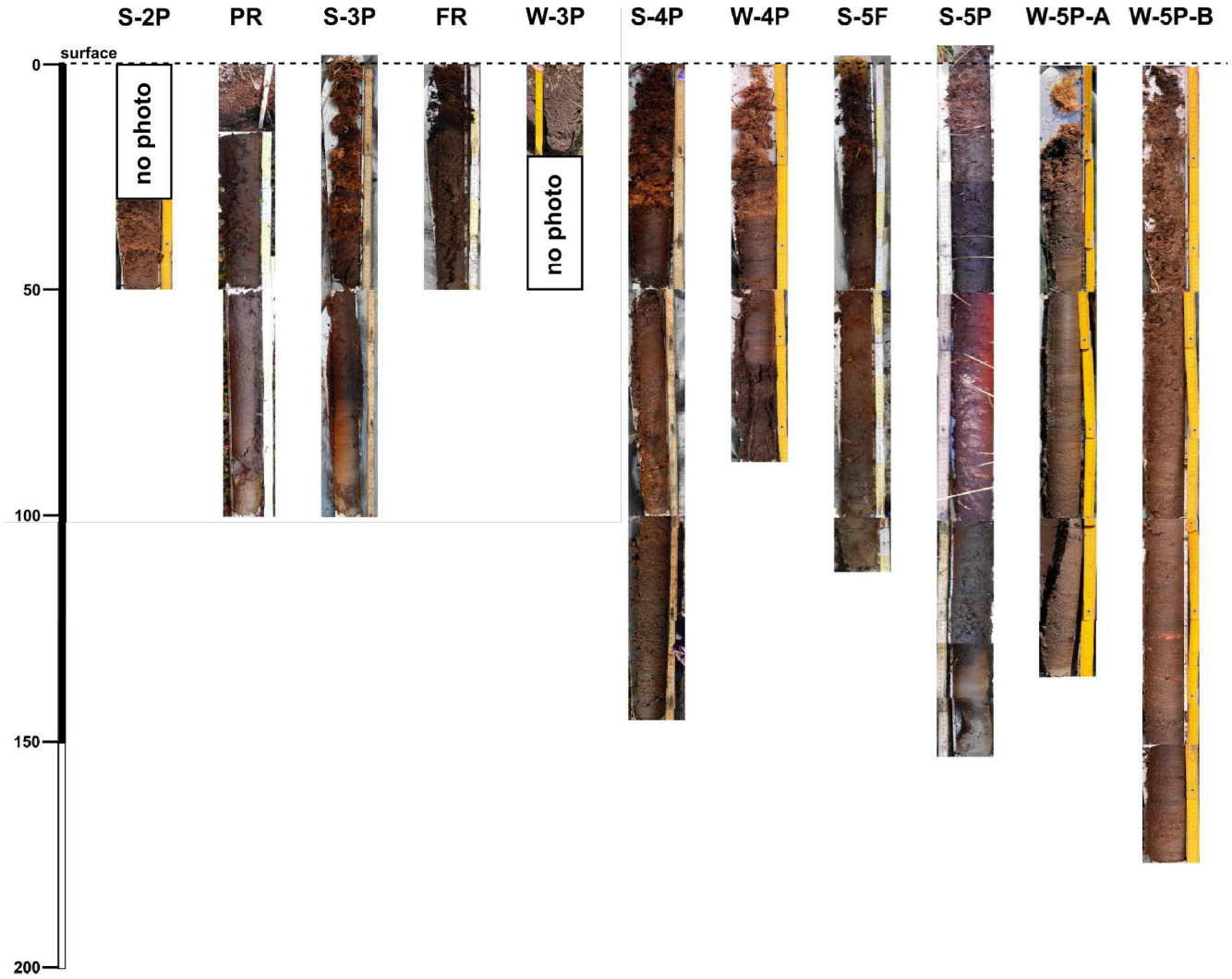

Fig S3. Peat cores obtained from sites S-2P, PR, S-3P, FR, W-3P, S-4P, W-4P, S-5F, S-5P, W-5P-A and W-5P-B; depth is given in cm bs.

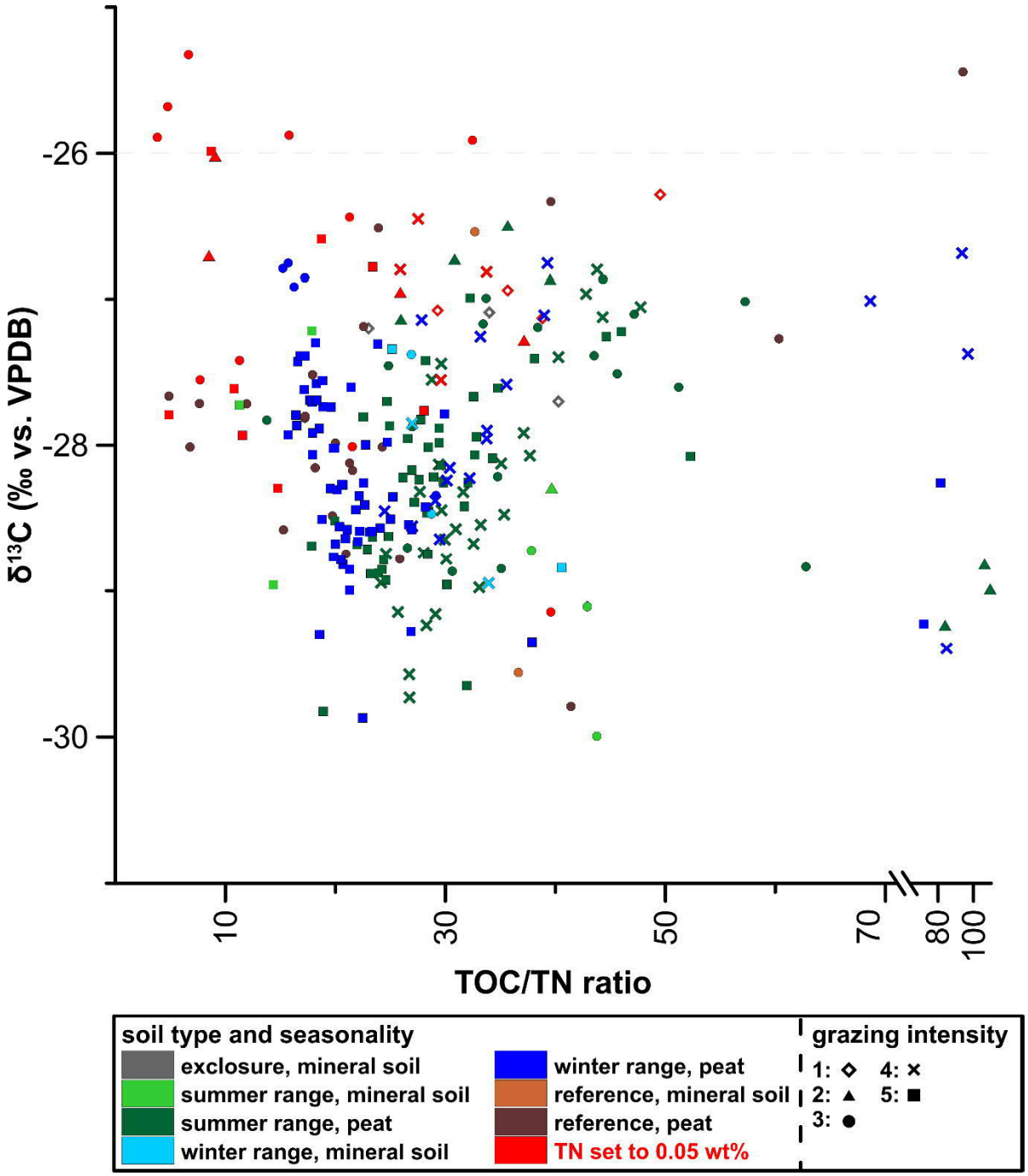

Fig S4. TOC/TN ratios plotted versus $\delta^{13}C$ values for all samples with measurable $\delta^{13}C$; for calculating TOC/TN ratios, TN was set to 0.05 wt% if measurement was below detection limit (0.1 wt%) in order to show $\delta^{13}C$ values (samples marked in red); samples identified by grazing intensity (symbol), seasonality and soil type (colour).

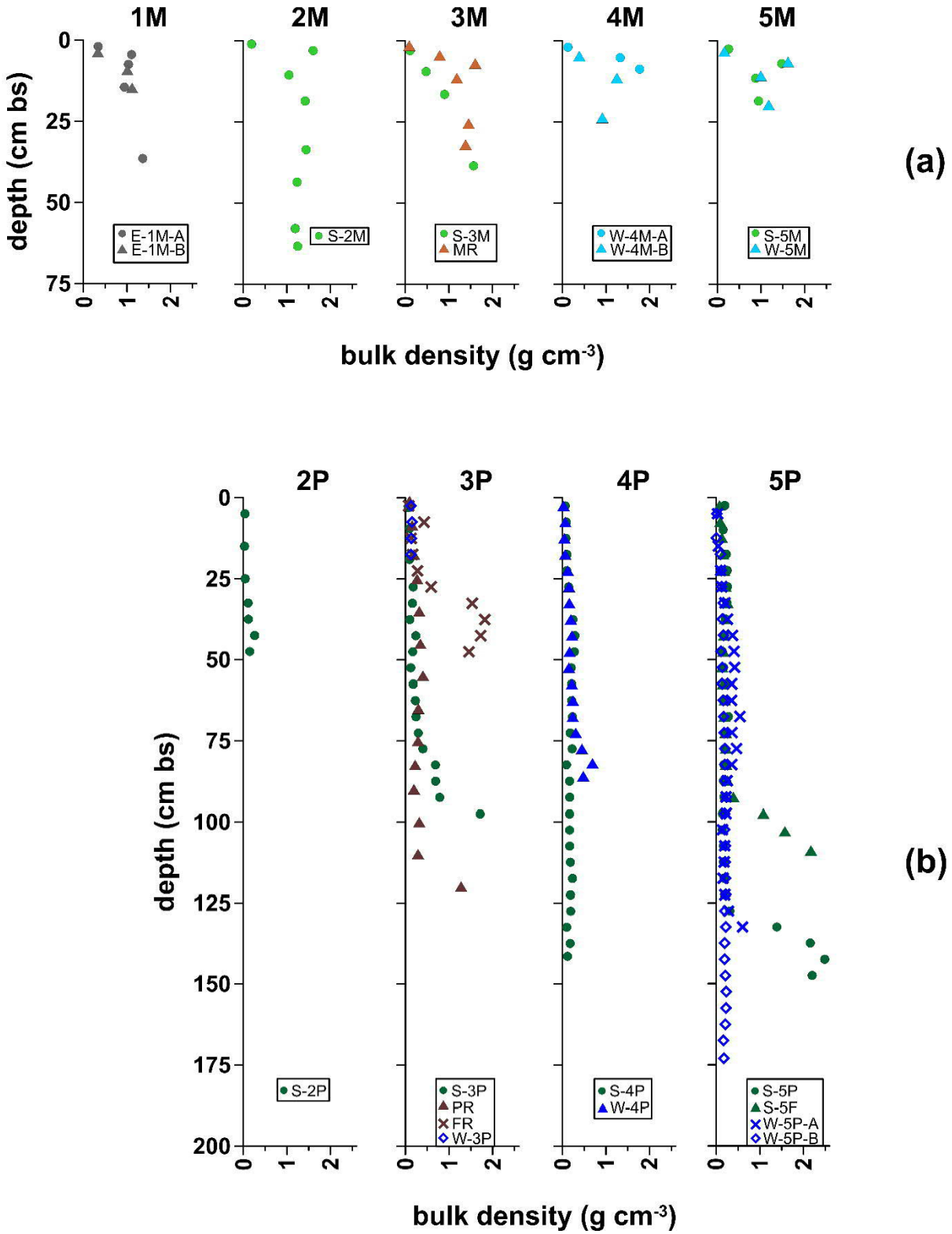

Fig S5. Dry bulk density for all sampling sites except W-3M, plotted over depth; a) mineral soil sites; b) peat sites; green colours indicate summer sites, blue indicates winter sites, grey indicates exclosure sites, brown colours mark reference sites with natural grazing regime outside the reindeer fences.

Table S1. Radiocarbon measurement data and calibrated ages

site	mean sample depth (cm bs)	material	^{14}C age (yr BP)	+/- (yr)	$F^{14}C$	+/- (abs)	calibrated ages (2σ)* (cal yr BP)	mean age* (cal yr BP)	soil layer
E-1M-A	7.5	plant / wood	modern		1.0217	0.0027			illuvial horizon
	36.5	bulk	3033	31	0.6855	0.0026	3150--3352	3239	pale sand
E-1M-B	9.25	plant / wood	modern		1.0179	0.0028			eluvial horizon
	14.75	plant / wood	modern		1.0930	0.0078			illuvial horizon
S-2M	10.5	bulk	592	23	0.9290	0.0026	585--645	605	illuvial horizon
	63.5	bulk	4209	33	0.5921	0.0025	4687--4762	4738	pale sand
S-2P	25	plant / wood	modern		1.1228	0.0031			fresh moss peat
	47.5	plant / wood	325	22	0.9603	0.0027	347--458	387	decomposed peat
S-3M	9.5	plant / wood	modern		1.0174	0.0026			organic-rich soil
	38.5	bulk	3555	24	0.6424	0.0019	3822--3922	3853	brownish sand
S-3P	19.0	plant / wood	102	21	0.9874	0.0026	30--141	113	light moss peat
	42.5	plant / wood	1747	22	0.8045	0.0022	1572--1706	1639	dark, sandy peat
	67.5	plant / wood	3468	22	0.6494	0.0018	3687--3778	3750	dark, sandy peat
	87.5	bulk	4519	25	0.5698	0.0018	5051--5193	5155	dark, sandy peat
S-4P	27.5	plant / wood	694	21	0.9173	0.0024	646--674	660	light moss peat
	57.5	plant / wood	6823	24	0.4277	0.0013	7602--7692	7650	dark peat
	97.5	plant / wood	8152	25	0.3625	0.0011	8999--9126	9063	dark peat + macro organics
	141.5	plant / wood	8798	26	0.3344	0.0011	9684--9913	9815	dark, compact peat

S-5F	22.5	plant / wood	864	21	0.8980	0.0023	723--793	759	moss peat / dark peat transition
	52.5	plant / wood	6724	24	0.4330	0.0013	7566--7621	7589	dark peat
	82.5	plant / wood	8593	25	0.3431	0.0011	9526--9559	9543	peat / sand transition
	92.5	plant / wood	8714	26	0.3380	0.0011	9549--9763	9643	organic-rich sand
S-5P	17.5	plant / wood	1213	21	0.8598	0.0023	1066--1170	1129	peat
	82.5	plant / wood	6872	24	0.4251	0.0013	7661--7781	7698	peat + marco organics
	127.5	plant / wood	8201	25	0.3603	0.0011	9163--9275	9147	peat / sand transition
	132.5	plant / wood	8197	25	0.3604	0.0011	9026--9150	9137	peat / sand transition
	147.5	bulk	4841	25	0.5474	0.0029	5571--5602	5584	greyish sand
S-5M	11.5	bulk	modern		1.0192	0.0029			illuvial horizon
	18.5	bulk	776	23	0.9079	0.0027	673--725	697	pale sand
W-3P	12.5	plant / wood	155	22	0.9809	0.0027	0--283	153	dark peat
	22.5	plant / wood	1038	23	0.8788	0.0025	917--972	943	dark peat
W-3M	20.5	plant / wood	modern		1.0189	0.0028			illuvial horizon
W-4P	27.5	plant / wood	128	22	0.9841	0.0027	11--150	108	moss peat
	57.5	plant / wood	2604	48	0.7231	0.0043	2693--2788	2736	dark, brown peat
	86.0	plant / wood	4256	48	0.5887	0.0035	4792--4888	4828	dark, sandy peat
W-4M-A	8.75	plant / wood	modern		1.0072	0.0089			illuvial horizon
W-4M-B	23.75	plant / wood	modern		1.0121	0.0037			pale / yellowish sand

W-5P-A	32.5	plant / wood	536	48	0.9355	0.0056	503--566	550	brown peat
	82.5	plant / wood	7397	50	0.3982	0.0025	8161--8344	8230	brown peat
	132.5	plant / wood	8650	50	0.3407	0.0021	9532--9746	9613	peat / sand transition
W-5P-B	47.5	plant / wood	1567	60	0.8228	0.0061	1342--1548	1453	dark peat
	92.5	plant / wood	2458	48	0.7364	0.0044	2362--2622	2541	dark peat
	137.5	plant / wood	4282	48	0.5868	0.0035	4804--4979	4852	dark peat
	173.0	plant / wood	6332	49	0.4546	0.0028	7160--7337	7256	light-brown peat
W-5M	6.5	plant / wood	modern		1.0298	0.0061			eluvial horizon
	19.75	plant / wood	modern		1.0141	0.0060			pale sand
MR	7.0	bulk	281	23	0.9656	0.0028	361--430	381	eluvial horizon
	32.0	bulk	3067	34	0.6827	0.0029	3206--3366	3283	pale sand
PR	17.5	plant / wood	176	21	0.9783	0.0026	162--225	184	dark peat
	65.0	plant / wood	5606	24	0.4976	0.0015	6308--6410	6364	dark peat
	110.0	bulk	7909	27	0.3736	0.0013	8599--8782	8714	dark peat, decomposed
FR	7.5	plant / wood	modern		1.3858	0.0034			dark peat + roots
	22.5	plant / wood	modern		1.0857	0.0028			dark peat + roots
	47.5	bulk	3224	25	0.6694	0.0021	3383--3469	3427	greyish sand

*calibrated using Calib 8.2 (Stuiver *et al*. 2021) equipped with IntCal20 (Reimer *et al*. 2020)