Supplement of SOIL, 7, 269–304, 2021
https://doi.org/10.5194/soil-7-269-2021-supplement

Supplement of

Middle Bronze Age land use practices in the northwestern Alpine foreland – a multi-proxy study of colluvial deposits, archaeological features and peat bogs

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Table S1: D_e values, number of accepted aliquots (n), overdispersion (OD, Galbraith et al., 1999), age model (Central Age Model (CAM, Galbraith et al., 1999) or Minimum Age Model (MAM, Galbraith et al. 1999; Cunningham and Wallinga, 2012)) and resulting OSL ages [ka] of selected colluvial horizons. For comparison with the ^{14}C ages, the OSL ages were calculated to CE/BCE.

Lab code	Profile	Horizon	Depth [cm]	n	OD [%]	Age model	D_e [Gy]	OSL age [ka]	BCE/CE
GI520	ABR W1	M3	115	19	14	CAM	2.8 ± 0.1	1.0 ± 0.1	1000 ± 100 CE
GI521	ABR W1	M3	145	20	11	CAM	3.5 ± 0.1	1.3 ± 0.1	700 ± 100 CE
GI522	ABR W1	M4	173	24	9	CAM	6.9 ± 0.3	2.5 ± 0.2	500 ± 200 BCE
GI523	ABR W1	M5	200	24	6	CAM	8.9 ± 0.3	3.2 ± 0.2	1200 ± 200 BCE
GI524	ABR W1	M6	211	31	10	CAM	10.2 ± 0.4	3.5 ± 0.3	1500 ± 300 BCE
GI525	ABR W1	2Bwig/Ahb	226	24	9	CAM	15.5 ± 0.6	5.3 ± 0.4	3300 ± 400 BCE
GI526	ABR W2	M3	147	25	8	CAM	2.7 ± 0.1	1.1 ± 0.1	900 ± 100 CE
GI527	ABR W2	M4	168	23	10	CAM	5.7 ± 0.2	2.0 ± 0.2	0 ± 200 CE/BCE
GI528	ABR W2	M5	183	24	13	CAM	6.8 ± 0.3	2.4 ± 0.1	400 ± 100 BCE
GI529	ABR W2	M6	195	21	12	CAM	9.3 ± 0.4	3.3 ± 0.3	1300 ± 300 BCE
GI530	ABR W2	M6	212	23	8	CAM	13.1 ± 0.5	4.7 ± 0.4	2700 ± 400 BCE
GI531	ABR W2	2Bwig/Ahb	227	21	14	CAM	27.9 ± 1.2	9.1 ± 0.8	7100 ± 800 BCE
GI740	ABR SA1	M7	120	28	43	MAM	3.6 ± 0.3	1.2 ± 0.1	800 ± 100 CE
GI741	ABR SA1	2Bw	142	36	71	MAM	5.1 ± 0.6	1.7 ± 0.2	300 ± 200 CE
GI742	ABR SA2	M2	60	35	14	MAM	1.1 ± 0.1	0.37 ± 0.04	1630 ± 40 CE
GI743	ABR SA2	M7	170	30	12	CAM	7.4 ± 0.2	2.6 ± 0.2	600 ± 200 BCE
GI744	ABR SA2	2Apb	185	29	23	MAM	10.5 ± 0.7	3.5 ± 0.3	1500 ± 300 BCE
GI745	ABR SA2	2Bw	213	28	40	MAM	16.5 ± 1.7	6.4 ± 0.7	4400 ± 700 BCE
GI784	ABR M	M1	45	31	71	MAM	0.17 ± 0.04	0.07 ± 0.02	1930 ± 20 CE
GI785	ABR M	M3	105	30	23	MAM	7.2 ± 0.6	2.2 ± 0.2	200 ± 200 BCE
GI786	ABR M	2Bwg/Ahb	135	23	14	CAM	15.0 ± 0.6	4.5 ± 0.3	2500 ± 300 BCE
GI787	ABR M	2Bwig	152	31	44	MAM	34.3 ± 1.3	10.0 ± 0.7	8000 ± 700 BCE
GI788	ABR M	2CBg	169	24	14	CAM	36.9 ± 1.6	11.0 ± 0.8	9000 ± 800 BCE

Table S2: AMS ^{14}C ages of charcoal fragments from selected profiles. ^{14}C ages are normed to $\delta^{13}C$ = -25 ‰ (Stuiver and Polach, 1977). Uncalibrated ^{14}C ages are given as years before 1950 (BP). Calibrated ^{14}C ages are given in 1 and 2 σ error ranges. Calibration was performed with SwissCal 1.0 using the IntCal13 calibration curve (Ramsey, 2009; Reimer et al., 2013).

Lab code	Profile	Horizon	Depth [cm]	$\delta^{13}C$ [‰]	BP [a ± error]	cal BCE/CE [1σ]	cal BCE/CE [2σ]
40233	ABR W1	M2	55-60	-42	1420 ± 60	cal CE 580-660	cal CE 440-760
40234	ABR W1	M5	180-185	-26.6	2890 ± 19	cal BCE 1110-1030	cal BCE 1190-1010
40235	ABR W1	M5	180-185	-30.1	2220 ± 21	cal BCE 360-210	cal BCE 370-200
40236	ABR W1	M5	190-195	-33.7	2770 ± 22	cal BCE 970-850	cal BCE 980-840
40237	ABR W1	M5	190-195	-36.7	2720 ± 25	cal BCE 900-830	cal BCE 910-820
40238	ABR W1	M5	200-205	-44.1	3770 ± 32	cal BCE 2280-2140	cal BCE 2290-2050
40239	ABR W1	M5	200-205	-41.1	3700 ± 31	cal BCE 2130-2040	cal BCE 2200-1980
40240	ABR W1	M5/M6	205-210	-28.6	4810 ± 23	cal BCE 3640-3540	cal BCE 3650-3530
40241	ABR W1	M5/M6	205-210	-29.6	4430 ± 21	cal BCE 3100-3020	cal BCE 3310-2930
40242	ABR W1	M6	210-215	-27.5	4800 ± 21	cal BCE 3640-3540	cal BCE 3640-3530
40243	ABR W1	M6	210-215	-25.6	4740 ± 21	cal BCE 3630-3390	cal BCE 3630-3380
40244	ABR W1	2Bwig/Ahb	215-220	-39.1	4790 ± 26	cal BCE 3640-3540	cal BCE 3640-3520
40245	ABR W1	2Bwig/Ahb	215-220	-32.4	4790 ± 22	cal BCE 3640-3540	cal BCE 3640-3530
40246	ABR W1	2Bwig/Ahb	220-225	-26.6	5230 ± 23	cal BCE 4040-3990	cal BCE 4220-3970
40247	ABR W1	2Bwig/Ahb	220-225	-29.3	5340 ± 23	cal BCE 4240-4070	cal BCE 4310-4060
40248	ABR W1	2Bwig/Ahb	225-230	-29.5	4830 ± 22	cal BCE 3650-3540	cal BCE 3660-3540
40249	ABR W1	2Bwig/Ahb	225-230	-33.5	4590 ± 25	cal BCE 3480-3350	cal BCE 3500-3140
40250	ABR W2	M2	90-95	-34.3	790 ± 25	cal CE 1220-1260	cal CE 1210-1280
40251	ABR W2	M2	90-95	-21.3	3260 ± 20	cal BCE 1600-1500	cal BCE 1610-1470
40252	ABR W2	M3	120-125	-40.7	2810 ± 27	cal BCE 1000-930	cal BCE 1040-900
40253	ABR W2	M3	135-140	-38.5	3090 ± 29	cal BCE 1410-1303	cal BCE 1430-1280
40254	ABR W2	M6	185-190	-30	2330 ± 19	cal BCE 400-390	cal BCE 410-380
40255	ABR W2	M6	185-190	-23.5	2550 ± 19	cal BCE 790-770	cal BCE 800-590
40256	ABR W2	M6	190-195	-24	3790 ± 21	cal BCE 2280-2150	cal BCE 2290-2140
40257	ABR W2	M6	190-195	-35.2	4510 ± 25	cal BCE 3340-3120	cal BCE 3350-3100
40258	ABR W2	M6	195-200	-35.2	4560 ± 26	cal BCE 3360-3140	cal BCE 3370-3110
40259	ABR W2	M6	195-200	-37.8	4510 ± 26	cal BCE 3340-3110	cal BCE 3350-3100

40260	ABR W2	M6	200-205	-49.6	5390 ± 39	cal BCE 4330-4230	cal BCE 4340-4070
40261	ABR W2	M6	200-205	-25.7	4730 ± 23	cal BCE 3630-3390	cal BCE 3630-3380
40262	ABR W2	M6	205-210	-25.9	4490 ± 23	cal BCE 3330-3100	cal BCE 3340-3100
40263	ABR W2	M6	205-210	-35.3	3900 ± 23	cal BCE 2460-2350	cal BCE 2470-2300
40264	ABR W2	M6	210-215	-27.5	6040 ± 22	cal BCE 4990-4860	cal BCE 5000-4850
40265	ABR W2	M6	210-215	-28.5	6110 ± 34	cal BCE 5200-4990	cal BCE 5210-4950
40266	ABR W2	2Bwig/Ahb	215-220	-35.8	6390 ± 42	cal BCE 5470-5320	cal BCE 5470-5310
40267	ABR W2	2Bwig/Ahb	215-220	-38	5190 ± 41	cal BCE 4040-3970	cal BCE 4220-3820
40268	ABR SA2	M1	30-35	-26	300 ± 23	cal CE 1520-1640	cal CE 1500-1650
40269	ABR SA2	M2	60-65	-24	670 ± 19	cal CE 1290-1380	cal CE 1280-1390
40270	ABR SA2	M2	60-65	-27	350 ± 17	cal CE 1490-1630	cal CE 1470-1630
40271	ABR SA2	M2/M3	65-70	-29.4	310 ± 19	cal CE 1520-1640	cal CE 1500-1650
40272	ABR SA2	M3	75-80	-17.8	960 ± 19	cal CE 1030-1150	cal CE 1020-1150
40273	ABR SA2	M4	85-90	-28	660 ± 17	cal CE 1290-1380	cal CE 1280-1390
40274	ABR SA2	M4	90-95	-38	1280 ± 26	cal CE 680-770	cal CE 670-770
40275	ABR SA2	M6	135-140	-25.7	2220 ± 18	cal BCE 360-210	cal BCE 370-210
40276	ABR SA2	M6	140-145	-32.2	2640 ± 23	cal BCE 820-800	cal BCE 830-800
40277	ABR SA2	M6	140-145	-48.3	2480 ± 37	cal BCE 760-540	cal BCE 780-430
40278	ABR SA2	M6	145-150	-74	2510 ± 55	cal BCE 790-540	cal BCE 800-430
40279	ABR SA2	M7	150-155	-48.6	2900 ± 35	cal BCE 1130-1020	cal BCE 1210-980
40280	ABR SA2	M7	150-155	-25.8	2930 ± 21	cal BCE 1190-1060	cal BCE 1210-1050
40281	ABR SA2	M7	160-165	-31.7	2880 ± 21	cal BCE 1110-1020	cal BCE 1190-980
40282	ABR SA2	M7	160-165	-36.8	2320 ± 26	cal BCE 400-380	cal BCE 410-270
40283	ABR SA2	M7/2Apb	170-175	-17.9	3370 ± 20	cal BCE 1690-1640	cal BCE 1740-1620
40284	ABR SA2	M7/2Apb	170-175	-40.8	2820 ± 28	cal BCE 1110-930	cal BCE 1050-910
40285	ABR SA2	2Apb	185-190	-41	3080 ± 39	cal BCE 1400-1290	cal BCE 1430-1230
40286	ABR SA2	2Apb	185-190	-39.3	3160 ± 22	cal BCE 1490-1410	cal BCE 1500-1400
40287	ABR SA2	2Bw	190-195	-36.7	3760 ± 22	cal BCE 2200-2140	cal BCE 2280-2050
40288	ABR SA2	2Bw	190-195	-34	3740 ± 22	cal BCE 2200-2060	cal BCE 2200-2040

10

Table S3: Linear regression results of urease [µgN gTS^{-1}*2h] to SOC values with different depth increments

Profile#	Depth [cm]	R^2
ABR W1	0-100	0.86
ABR W1	100-282	0.49
ABR W2	0-146	0.82
ABR W2	146-290	0.43
ABR WA1	0-135	0.86
ABR WA1	135-295	0.45
ABR WA2	0-250	0.66
ABR SA1	0-138	0.73
ABR SA1	138-200	0.39
ABR SA2	0-220	0.74

Table S4: R^2 matrix from linear regression analysis of selected soil parameters according to the soil substrates: (a): sediments of the Younger Juranagelfluh; (b) sediments of the Hohenhewen volcano; (c) glacial and fluvio-glacial sediments of the Würm glaciation). $CaCO_3$: lime content; SOC: soil organic carbon; As: arsenic; Cr: chrome; Cu: copper; Ni: nickel; Pb: lead; Zn: tin.

(a)	$CaCO_3$	SOC	pH	As	Cr	Cu	Ni	Pb	Zn
$CaCO_3$	-	-	-	0.58	0.56	0.58	0.25	0.62	0.58
SOC	-	-	-	0.02	0.04	0.18	0.00	0.27	0.28
pH	-	-	-	0.16	0.04	0.00	0.00	0.08	0.00
As	0.58	0.02	0.16	-	-	-	-	-	-
Cr	0.56	0.04	0.04	-	-	-	-	-	-
Cu	0.58	0.18	0.00	-	-	-	-	-	-
Ni	0.25	0.00	0.00	-	-	-	-	-	-
Pb	0.62	0.27	0.08	-	-	-	-	-	-
Zn	0.58	0.28	0.00	-	-	-	-	-	-

(b)	$CaCO_3$	SOC	pH	As	Cr	Cu	Ni	Pb	Zn
$CaCO_3$	-	-	-	0.27	0.01	0.01	0.09	0.27	0.44
SOC	-	-	-	0.00	0.00	0.08	0.02	0.17	0.04
pH	-	-	-	0.05	0.00	0.00	0.00	0.03	0.00
As	0.27	0.00	0.05	-	-	-	-	-	-
Cr	0.01	0.00	0.00	-	-	-	-	-	-
Cu	0.01	0.08	0.00	-	-	-	-	-	-
Ni	0.09	0.02	0.00	-	-	-	-	-	-
Pb	0.27	0.17	0.03	-	-	-	-	-	-
Zn	0.44	0.04	0.00	-	-	-	-	-	-

(c)	CaCO3	SOC	pH	As	Cr	Cu	Ni	Pb	Zn
CaCO3	-	-	-	0.28	0.42	0.62	0.10	0.56	0.31
SOC	-	-	-	0.17	0.00	0.49	0.00	0.33	0.20
pH	-	-	-	0.03	0.27	0.21	0.01	0.27	0.05
As	0.28	0.17	0.03	-	-	-	-	-	-
Cr	0.42	0.00	0.27	-	-	-	-	-	-
Cu	0.62	0.49	0.21	-	-	-	-	-	-
Ni	0.10	0.00	0.01	-	-	-	-	-	-
Pb	0.56	0.33	0.27	-	-	-	-	-	-
Zn	0.31	0.20	0.05	-	-	-	-	-	-

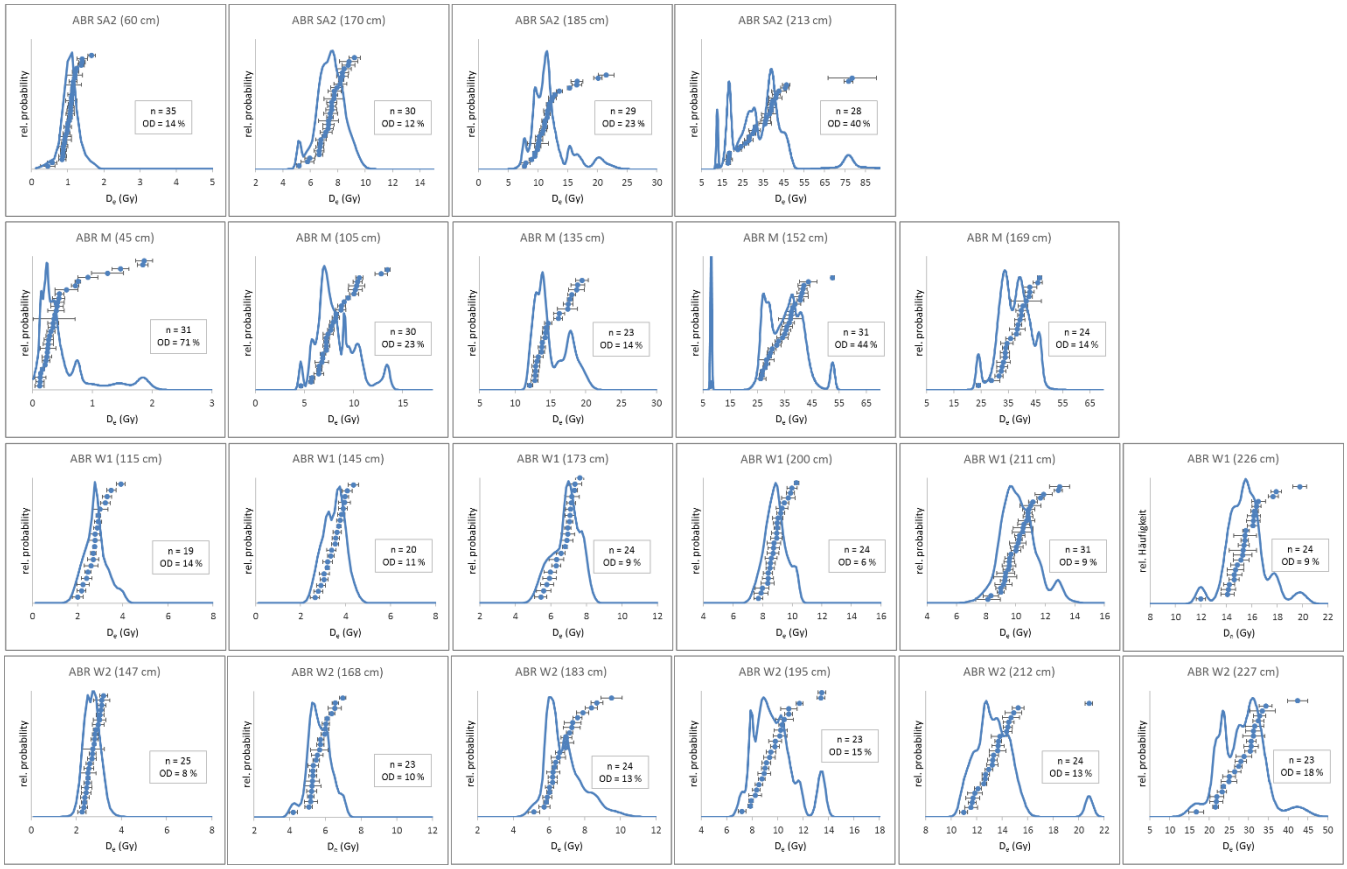

Figure S1: Probability density functions of D_e values for all sediment samples dated with OSL. Also shown are the number of measured aliquots and the overdispersion (OD), which measures the degree of scatter of D_e values excluding instrumental and protocol inherent variations.