Paleosols can promote root growth of recent vegetation – a case study from the sandy soil–sediment sequence Rakt, the Netherlands

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Supplementary Table 1: Depth distribution of color index b*, with high values indicating yellow and low values indicating blue color, as well as most relevant elements.

Unit	Depth [m]	Color [ ]	Element contents [wt-%]								
		b*	Na_2O	MgO	Al_2O_3	SiO_2	S	K_2O	MnO ($x10^{-3}$)	Cu ($x10^{-4}$)	Mo ($x10^{-4}$)
EP[a]	0.00-0.10	5.3 ± 0.4	0.70 ± 0.04	0.09 ± 0.01	2.5 ± 0.0	86.5 ± 0.9	0.08 ± 0.01	1.00 ± 0.01	4.5 ± 0.2	2.3 ± 0.3	3.1 ± 0.2
	0.10-0.20	7.2 ± 0.2	0.65 ± 0.05	0.08 ± 0.01	2.3 ± 0.1	87.1 ± 1.2	0.03 ± 0.00	0.94 ± 0.03	3.6 ± 0.1	1.4 ± 0.1	3.2 ± 0.1
	0.20-0.30	8.7 ± 0.2	0.59 ± 0.07	0.09 ± 0.01	2.4 ± 0.1	89.0 ± 1.1	0.02 ± 0.00	0.88 ± 0.01	3.1 ± 0.3	0.4 ± 0.2	2.6 ± 0.3
ds[a]	0.25-0.35	7.1 ± 1.1	0.64 ± 0.02	0.11 ± 0.03	2.6 ± 0.3	88.5 ± 0.3	0.02 ± 0.01	0.94 ± 0.03	3.8 ± 0.7	1.1 ± 0.6	3.1 ± 0.2
	0.40-0.50	8.9 ± 0.1	0.54 ± 0.04	0.09 ± 0.01	2.2 ± 0.1	89.9 ± 4.1	0.01 ± 0.00	0.90 ± 0.05	4.0 ± 0.4	0.6 ± 0.6	3.2 ± 0.5
PA[a]	0.40-0.50	6.7 ± 0.5	0.60 ± 0.02	0.13 ± 0.01	2.8 ± 0.3	88.3 ± 0.8	0.03 ± 0.01	0.90 ± 0.04	5.8 ± 0.5	1.6 ± 0.6	2.7 ± 0.0
	0.50-0.60	7.9 ± 1.4	0.55 ± 0.07	0.13 ± 0.02	3.0 ± 0.4	87.0 ± 1.3	0.03 ± 0.01	0.89 ± 0.04	4.2 ± 0.6	0.2 ± 0.2	2.9 ± 0.4
	0.60-0.70	4.8 ± 0.1	0.60 ± 0.05	0.17 ± 0.02	3.6 ± 0.2	85.3 ± 1.4	0.06 ± 0.01	0.93 ± 0.01	6.8 ± 0.8	1.5 ± 0.1	2.7 ± 0.5
	0.75-0.85	4.3 ± 0.2	0.55 ± 0.03	0.16 ± 0.02	3.4 ± 0.2	86.3 ± 1.7	0.05 ± 0.01	0.93 ± 0.01	7.9 ± 1.1	3.3 ± 0.1	3.2 ± 0.5
	0.90-1.00	4.5 ± 0.3	0.65 ± 0.04	0.16 ± 0.01	3.4 ± 0.2	85.4 ± 0.5	0.06 ± 0.01	0.92 ± 0.01	5.7 ± 0.2	2.2 ± 0.3	3.9 ± 0.5
	1.05-1.15	4.0 ± 0.2	0.60 ± 0.02	0.16 ± 0.01	3.6 ± 0.1	86.4 ± 0.4	0.07 ± 0.00	0.95 ± 0.01	5.7 ± 0.4	3.9 ± 0.5	3.7 ± 0.4
	1.20-1.30	3.2 ± 0.2	0.60 ± 0.05	0.17 ± 0.02	3.8 ± 0.1	83.6 ± 1.1	0.08 ± 0.01	0.88 ± 0.02	5.5 ± 0.2	3.1 ± 0.4	3.4 ± 0.0
	1.35-1.45	3.6 ± 0.1	0.69 ± 0.03	0.16 ± 0.00	3.5 ± 0.0	84.2 ± 0.2	0.06 ± 0.00	0.88 ± 0.01	6.3 ± 0.4	2.6 ± 0.5	4.1 ± 0.0
rEP[a]	1.50-1.60	4.1 ± 0.4	0.84 ± 0.03	0.27 ± 0.01	7.2 ± 0.2	75.5 ± 0.4	0.07 ± 0.00	1.08 ± 0.01	13.4 ± 3.2	1.3 ± 0.7	3.0 ± 0.1
	1.65-1.75	4.3 ± 0.4	0.76 ± 0.12	0.34 ± 0.03	7.8 ± 0.1	76.6 ± 0.5	0.06 ± 0.00	1.04 ± 0.00	6.6 ± 0.4	0.6 ± 0.6	2.3 ± 0.3
	1.80-1.90	11.1 ± 0.3	0.76 ± 0.02	0.24 ± 0.02	4.3 ± 0.0	86.4 ± 1.2	0.02 ± 0.00	1.05 ± 0.01	7.8 ± 0.6	0.7 ± 0.7	2.8 ± 0.1
cs[a]	1.95-205	9.6 ± 0.4	0.90 ± 0.02	0.27 ± 0.02	4.6 ± 0.2	85.4 ± 0.6	0.02 ± 0.00	1.13 ± 0.04	7.8 ± 0.4	0.2 ± 0.1	2.7 ± 0.1
	2.10-2.20	11.9 ± 0.3	0.72 ± 0.03	0.21 ± 0.01	3.6 ±0.1	88.2 ± 0.8	0.01 ± 0.00	1.06 ± 0.05	5.8 ± 0.5	1.0 ± 0.5	2.9 ± 0.2
	2.25-2.35	11.7 ± 0.1	0.83 ± 0.08	0.22 ± 0.01	3.5 ± 0.1	96.0 ± 3.5	0.01 ± 0.00	1.18 ± 0.07	6.2 ± 0.8	1.5 ± 0.8	3.3 ± 0.3

[a] EP – Epialbic Podzol, ds – driftsand, PA – Plaggic Anthrosol, rEP – relict Entic Podzol, cs - coversand

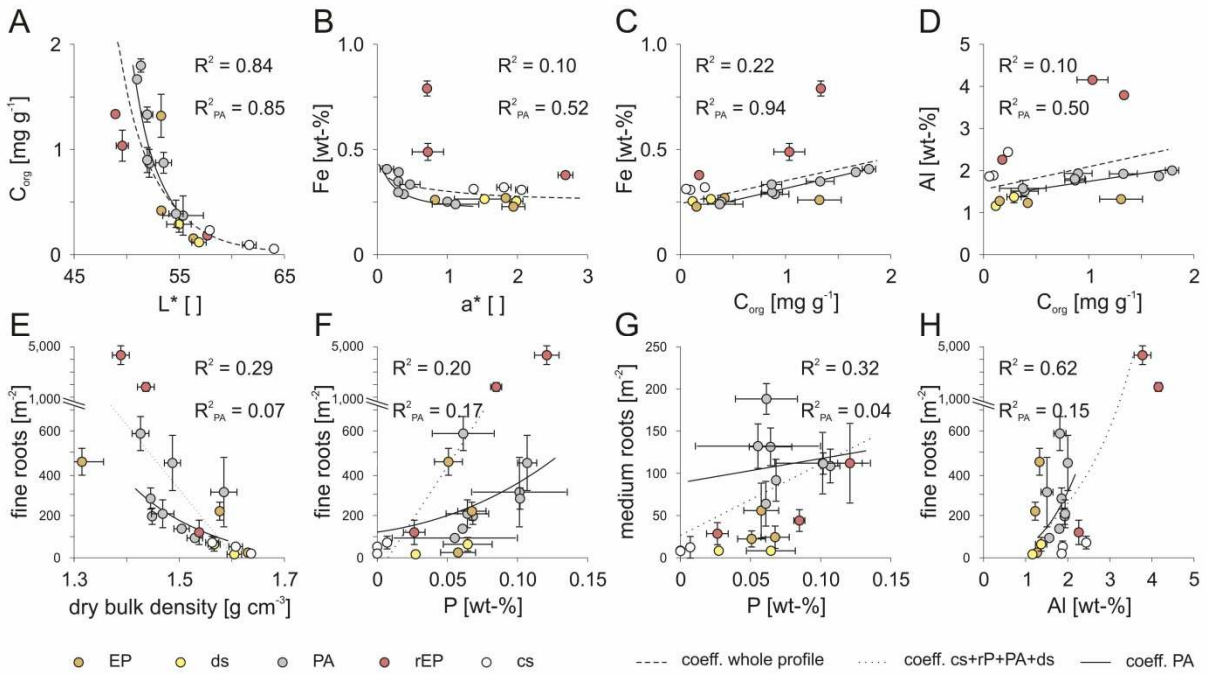
Supplementary Table 2: Significance of differences between individual depth intervals or complete units, determined for various physical and geochemical parameters as well as root distribution.

Compared depth intervals or units[a]	Parameter	p value[b]
PA (0.4-1.35 m) vs. ds + cs	dry bulk density	0.000001**
	clay	0.00016**
	a*	0.000001**
	L*	0.000001**
	pH	0.038*
	C_{org}	0.000001**
	Na	0.0016**
	K	0.00005**
	Ca	0.00016**
	Mg	0.18
	P	0.00001**
	S	0.000001**
	Cu	0.0006**
	Mo	0.19
lower part of PA (0.9-1.35 m) vs. ds + cs	Mo	0.0012**
top EP (0 m) vs. bottom EP (0.2 m)	L*	0.018*
	a*	0.003**
	pH	0.00018**
top rEP (1.5 m) vs. bottom rEP (1.8 m)	L*	0.00002**
	a*	0.0001**
	pH	0.0004**
bottom EP (0.2 m) vs. bottom ds (0.4 m)	L*	0.58
	a*	0.83
	pH	0.07
bottom rEP (1.8 m) vs. bottom cs (2.25 m)	L*	0.00007**
	a*	0.0005**
	pH	0.002**
EP (0-0.4 m) vs. ds (0.25-0.4 m)	dry bulk density	0.20
	pH	0.000001**
	C_{org}	0.06
	P	0.32
	S	0.052
rEP (1.5-1.8 m) vs. cs (1.95-2.25 m)	dry bulk density	0.000001**
	pH	0.00005**
	C_{org}	0.001**
	P	0.00008**
	S	0.0004**
top EP (0 m) vs. top rEP (1.55 m)	fine root quantities	0.000001**
	medium root quantities	0.000001**

[a] EP – Epialbic Podzol, ds – driftsand, PA – Plaggic Anthrosol, rEP – relict Entic Podzol, cs – coversand

[b] * significant ($p < 0.05$), ** highly significant ($p < 0.01$)

Supplementary Figure 1: Scatter plots between various physical and geochemical parameters (A-D), as well as between the latter and root frequencies (E-H). Correlations were tested within the PA and for the whole profile, whereas for the root diagrams, the focus was laid on the buried soils and sediments, excluding the EP.



Supplementary Table 3: Depth distribution of physical properties shown in Fig. 3 of the article.

Unit	Depth [m]	Dry bulk density [g cm^{-3}]	Grain size distribution [%]			Color [ ]	
			Sand (63-2000 µm)	Silt (2-63 µm)	Clay (< 2 µm)	L*	a*
EP[a]	0.00-0.10	1.32 ± 0.04	97.0 ± 0.7	2.5 ± 1.0	0.5 ± 0.3	53.3 ± 0.6	0.83 ± 0.06
	0.10-0.20	1.58 ± 0.01	97.9 ± 0.7	1.4 ± 0.0	0.6 ± 0.3	53.3 ± 0.3	1.83 ± 0.05
	0.20-0.30	1.63 ± 0.01	99.2 ± 0.1	0.5 ± 0.0	0.2 ± 0.1	56.4 ± 0.5	1.94 ± 0.16
ds[a]	0.25-0.35	1.57 ± 0.01	97.8 ± 0.5	1.8 ± 0.5	0.4 ± 0.0	55.0 ± 1.2	1.53 ± 0.43
	0.40-0.50	1.60 ± 0.01	98.7 ± 0.2	1.2 ± 0.3	0.2 ± 0.1	56.9 ± 0.7	1.98 ± 0.09
PA[a]	0.40-0.50	1.58 ± 0.02	96.2 ± 1.4	2.8 ± 1.4	1.0 ± 0.0	54.7 ± 0.7	1.00 ± 0.14
	0.50-0.60	1.53 ± 0.01	98.3 ± 0.1	1.0 ± 0.0	0.7 ± 0.1	55.4 ± 1.9	1.11 ± 0.33
	0.60-0.70	1.47 ± 0.02	93.1 ± 0.3	4.4 ± 0.1	2.4 ± 0.1	52.0 ± 0.3	0.38 ± 0.04
	0.75-0.85	1.43 ± 0.02	92.0 ± 0.5	5.3 ± 0.6	2.6 ± 0.1	53.5 ± 0.8	0.31 ± 0.02
	0.90-1.00	1.50 ± 0.01	90.9 ± 1.4	6.6 ± 0.4	2.6 ± 0.9	52.2 ± 0.3	0.47 ± 0.14
	1.05-1.15	1.45 ± 0.00	90.2 ± 0.4	6.4 ± 0.2	3.3 ± 0.2	52.0 ± 0.5	0.30 ± 0.06
	1.20-1.30	1.49 ± 0.02	91.1 ± 0.2	6.2 ± 0.1	2.7 ± 0.3	51.4 ± 0.2	0.14 ± 0.06
	1.35-1.45	1.45 ± 0.01	91.7 ± 0.0	6.0 ± 0.3	2.3 ± 0.3	51.0 ± 0.3	0.30 ± 0.09
rEP[a]	1.50-1.60	1.39 ± 0.02	95.1 ± 0.5	3.9 ± 0.4	1.0 ± 0.1	48.9 ± 0.1	0.71 ± 0.07
	1.65-1.75	1.44 ± 0.02	96.2 ± 0.2	2.7 ± 0.1	1.1 ± 0.1	49.6 ± 0.6	0.72 ± 0.22
	1.80-1.90	1.54 ± 0.01	96.6 ± 0.6	3.0 ± 0.7	0.4 ± 0.1	57.7 ± 0.3	2.69 ± 0.11
cs[a]	1.95-205	1.56 ± 0.01	94.7 ± 0.9	3.6 ± 0.7	1.6 ± 0.2	57.9 ± 0.3	1.81 ± 0.10
	2.10-2.20	1.61 ± 0.01	97.2 ± 0.0	1.9 ± 0.5	0.9 ±0.5	61.7 ± 0.7	2.06 ± 0.09
	2.25-2.35	1.64 ± 0.01	97.9 ± 0.2	1.6 ± 0.1	0.5 ± 0.3	64.1 ± 0.2	1.38 ± 0.07

[a] EP – Epialbic Podzol, ds – driftsand, PA – Plaggic Anthrosol, rEP – relict Entic Podzol, cs - coversand

Supplementary Table 4: Depth distribution of geochemical properties shown in Fig. 4 of the article.

Unit	Depth [m]	pH [ ]	C_{org} [mg g^{-1}]	Element contents [wt-%]		
				P	Ca	Fe
EP[a]	0.00-0.10	3.1 ± 0.0	13.2 ± 2.0	0.05 ± 0.01	0.09 ± 0.00	0.26 ± 0.01
	0.10-0.20	3.2 ± 0.0	4.2 ± 0.3	0.07 ± 0.01	0.07 ± 0.00	0.27 ± 0.01
	0.20-0.30	3.5 ± 0.1	1.6 ± 0.1	0.06 ± 0.01	0.06 ± 0.01	0.23 ± 0.01
ds[a]	0.25-0.35	3.5 ± 0.0	2.9 ± 0.7	0.06 ± 0.02	0.07 ± 0.01	0.26 ± 0.01
	0.40-0.50	3.7 ± 0.1	1.2 ± 0.0	0.03 ± 0.00	0.06 ± 0.00	0.25 ± 0.02
PA[a]	0.40-0.50	3.8 ± 0.0	3.9 ± 1.3	0.10 ± 0.03	0.07 ± 0.01	0.25 ± 0.01
	0.50-0.60	4.1 ± 0.2	3.7 ± 1.8	0.06 ± 0.04	0.06 ± 0.01	0.24 ± 0.01
	0.60-0.70	4.0 ± 0.0	9.0 ± 1.2	0.06 ± 0.02	0.06 ± 0.00	0.29 ± 0.01
	0.75-0.85	3.9 ± 0.1	8.7 ± 1.0	0.06 ± 0.02	0.07 ± 0.00	0.30 ± 0.01
	0.90-1.00	4.0 ± 0.0	8.7 ± 1.3	0.06 ± 0.00	0.07 ± 0.00	0.33 ± 0.02
	1.05-1.15	4.0 ± 0.0	13.3 ± 0.7	0.07 ± 0.00	0.07 ± 0.00	0.35 ± 0.01
	1.20-1.30	3.9 ± 0.0	17.9 ± 0.6	0.11 ± 0.01	0.06 ± 0.00	0.41 ± 0.00
	1.35-1.45	4.0 ± 0.0	16.7 ± 0.4	0.10 ± 0.00	0.06 ± 0.00	0.39 ± 0.01
rEP[a]	1.50-1.60	4.1 ± 0.0	13.4 ± 0.4	0.12 ± 0.01	0.08 ± 0.00	0.79 ± 0.04
	1.65-1.75	4.2 ± 0.0	10.4 ± 1.5	0.08 ± 0.00	0.09 ± 0.01	0.49 ± 0.04
	1.80-1.90	4.5 ± 0.0	1.8 ± 0.1	0.03 ± 0.01	0.11 ± 0.01	0.38 ± 0.01
cs[a]	1.95-205	4.5 ± 0.0	2.3 ± 0.2	0.01 ± 0.00	0.11 ± 0.01	0.32 ± 0.03
	2.10-2.20	4.6 ± 0.0	0.9 ± 0.1	0.00	0.09 ± 0.00	0.31 ± 0.01
	2.25-2.35	4.7 ± 0.0	0.6 ± 0.1	0.00	0.10 ± 0.01	0.31 ± 0.03

[a] EP – Epialbic Podzol, ds – driftsand, PA – Plaggic Anthrosol, rEP – relict Entic Podzol, cs - coversand

Supplementary Table 5: Depth distribution of fine root frequencies shown in Fig. 6, 7 and 8 of the article.

Unit	Depth [m]	Horizontal levels	Back wall		Front wall		Side wall	
			Left	Right	Left	Right	Left	Right
EP[a]	0.00-0.10	454 ± 65	456 ± 52	360 ± 12	648 ± 25	480 ± 64	384 ± 42	432 ± 12
	0.10-0.20	220 ± 43	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.20-0.30	24 ± 12	192 ± 4	48 ± 11	84 ± 22	24 ± 8	504 ± 30	60 ± 11
ds[a]	0.25-0.35	64 ± 32	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.40-0.50	16 ± 11	156 ± 8	84 ± 16	120 ± 22	360 ± 36	324 ± 54	120 ± 11
PA[a]	0.40-0.50	312 ± 164	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.50-0.60	92 ± 20	600 ± 38	1716 ± 61	1176 ± 104	528 ± 33	240 ± 22	480 ± 46
	0.60-0.70	208 ± 66	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.75-0.85	588 ± 80	624 ± 11	1644 ± 174	216 ± 18	564 ± 56	552 ± 21	516 ± 42
	0.90-1.00	136 ± 25	540 ± 91	540 ± 52	300 ± 21	132 ± 4	120 ± 17	396 ± 18
	1.05-1.15	196 ± 38	336 ± 14	540 ± 39	240 ± 16	216 ± 7	300 ± 38	444 ± 24
	1.20-1.30	448 ± 131	240 ± 14	900 ± 69	408 ± 8	576 ± 75	540 ± 37	432 ± 14
	1.35-1.45	280 ± 50	468 ± 0	1068 ± 14	660 ± 24	492 ± 11	1164 ± 54	864 ± 30
rEP[a]	1.50-1.60	4324 ± 734	828 ± 103	n.d.	n.d.	n.d.	1236 ± 52	1380 ± 156
	1.65-1.75	1816 ± 319	408 ± 112	n.d.	n.d.	n.d.	192 ± 14	108 ± 12
	1.80-1.90	120 ± 58	192 ± 64	n.d.	n.d.	n.d.	24 ± 4	24 ± 4
cs[a]	1.95-205	72 ± 30	n.d.	n.d.	48 ± 11	n.d.	n.d.	n.d.
	2.10-2.20	52 ± 26	n.d.	n.d.	36 ± 7	n.d.	n.d.	n.d.
	2.25-2.35	20 ± 12	n.d.	n.d.	0	n.d.	n.d.	n.d.

[a] EP – Epialbic Podzol, ds – driftsand, PA – Plaggic Anthrosol, rEP – relict Entic Podzol, cs – coversand

n.d. – not determined

Supplementary Table 6: Depth distribution of medium root frequencies shown in Fig. 6, 7 and 8 of the article.

Unit	Depth [m]	Horizontal levels	Back wall		Front wall		Side wall	
			Left	Right	Left	Right	Left	Right
EP[a]	0.00-0.10	22 ± 9	72 ± 7	48 ± 4	168 ± 20	120 ± 11	84 ± 8	0
	0.10-0.20	24 ± 13	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.20-0.30	56 ± 33	108 ± 36	12 ± 4	24 ± 8	36 ± 0	156 ± 14	0
ds[a]	0.25-0.35	8 ± 8	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.40-0.50	8 ± 8	60 ± 4	120 ± 4	156 ± 4	108 ± 18	108 ± 21	108 ± 12
PA[a]	0.40-0.50	112 ± 36	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.50-0.60	132 ± 26	264 ± 14	192 ± 11	264 ± 41	252 ± 7	60 ± 8	156 ± 11
	0.60-0.70	132 ± 22	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.75-0.85	188 ± 19	228 ± 24	180 ± 7	84 ± 4	252 ± 21	180 ± 25	204 ± 31
	0.90-1.00	64 ± 27	96 ± 16	36 ± 12	60 ± 8	0	84 ± 14	132 ± 8
	1.05-1.15	92 ± 25	120 ± 11	84 ± 8	120 ± 8	72 ± 12	96 ± 8	48 ± 8
	1.20-1.30	108 ± 20	144 ± 7	156 ± 11	312 ± 21	228 ± 16	216 ± 12	84 ± 4
	1.35-1.45	120 ± 13	120 ± 8	168 ± 11	396 ± 28	300 ± 8	192 ± 21	156 ± 4
rEP[a]	1.50-1.60	112 ± 47	84 ± 14	n.d.	n.d.	n.d.	216 ± 25	108 ± 18
	1.65-1.75	44 ± 13	0	n.d.	n.d.	n.d.	36 ± 7	24 ± 4
	1.80-1.90	28 ± 13	12 ± 4	n.d.	n.d.	n.d.	36 ± 7	0
cs[a]	1.95-205	12 ± 12	n.d.	n.d.	0	n.d.	n.d.	n.d.
	2.10-2.20	8 ± 5	n.d.	n.d.	0	n.d.	n.d.	n.d.
	2.25-2.35	8 ± 8	n.d.	n.d.	12 ± 4	n.d.	n.d.	n.d.

[a] EP – Epialbic Podzol, ds – driftsand, PA – Plaggic Anthrosol, rEP – relict Entic Podzol, cs - coversand

n.d. – not determined

Supplementary Table 7: Depth distribution of coarse root frequencies shown in Fig. 6 of the article.

Unit	Depth [m]	Horizontal levels	Back wall		Front wall		Side wall	
			Left	Right	Left	Right	Left	Right
EP[a]	0.00-0.10	0	12 ± 4	0	0	0	0	12 ± 4
	0.10-0.20	0	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.20-0.30	0	24 ± 4	24 ± 4	0	0	24 ± 4	0
ds[a]	0.25-0.35	8 ± 5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.40-0.50	0	12 ± 4	0	0	0	12 ± 4	0
PA[a]	0.40-0.50	4 ± 4	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.50-0.60	4 ± 4	0	48 ± 11	12 ± 4	0	0	12 ± 4
	0.60-0.70	8 ± 5	n.d.	n.d.	n.d.	n.d.	n.d.	n.d.
	0.75-0.85	8 ± 8	24 ± 4	36 ± 7	12 ± 4	84 ± 11	12 ± 4	12 ± 4
	0.90-1.00	0	0	0	0	24 ± 4	0	12 ± 4
	1.05-1.15	4 ± 4	24 ± 8	12 ± 4	0	12 ± 4	0	0
	1.20-1.30	0	36 ± 7	0	0	0	0	0
	1.35-1.45	0	36 ± 7	12 ± 4	12 ± 4	12 ± 4	12 ± 4	0
rEP[a]	1.50-1.60	0	0	n.d.	n.d.	n.d.	0	24 ± 4
	1.65-1.75	0	0	n.d.	n.d.	n.d.	0	0
	1.80-1.90	0	0	n.d.	n.d.	n.d.	36 ± 7	12 ± 4
cs[a]	1.95-205	0	n.d.	n.d.	0	n.d.	n.d.	n.d.
	2.10-2.20	0	n.d.	n.d.	0	n.d.	n.d.	n.d.
	2.25-2.35	0	n.d.	n.d.	0	n.d.	n.d.	n.d.

[a] EP – Epialbic Podzol, ds – driftsand, PA – Plaggic Anthrosol, rEP – relict Entic Podzol, cs - coversand

n.d. – not determined