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INFLUENCE OF ACIDIC DEPOSITION ON THE CHARACTERISTICS OF SOIL IN NATURE STATE RESERVE "VODĚRADSKÉ BUČINY" FROM THE POINT OF VIEW OF THE TRACE ELEMENTS CONTENT

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Chemistry and principal soil characteristics were studied in the closing weir of the experimental catchment "Lesní potok" in the Černokostelecko region, Central Bohemia. Chemistry of the bulk precipitation, throughfall and surface discharge have been studied here since 1993. The bedrock is formed by granite and the studied soil profile was defined as a Gleyic Cambisol (World Reference Base for Soil Resources, 1994). Mean pH's of the atmospheric precipitation and surface discharge are 4.2 and 4.9, respectively. Four horizons, A, Bv, Go, and Gr (this one with 4 subhorizons) were distinguished in the 1m deep soil profile of the pit (locality LP33). The sampling site is formed by the alluvial deposits with the overall thickness 10m (Hons et al., 1980). Grain size distribution and chemical characteristics (see the Table 1), total content and content of the mobile forms (determined through the digestion in 0,1 M HNO₃) of selected trace elements (Cu, Mn, Pb, Zn, Be, As, Sr, Cr), were determined in the soil sampled from the probe (see the Table 2).

Tab.1. Soil characteristics of the pit - pH_{H₂O}, pH_{KCl}, T_M (sorption capacity according to Mehlich), exchangeable H⁺, content of humus and texture - particle size distribution

av.depth	pH H ₂ O	pH KCl	T _M mmol/100g	H ⁺ mmol/100g	humus %	<0.01 mm (%)	<0.001 mm (%)	0.001-0.01 mm (%)	0.01-0.05 mm (%)	0.05-0.25 mm (%)	0.25-2.00 mm (%)
7,5 cm	3,80	3,00	24,00	26,50	8,19	19,00	6,80	12,20	33,70	12,50	34,80
24,0 cm	4,04	3,46	13,70	15,50	0,78	35,60	20,50	15,10	32,90	13,60	17,90
40,5 cm	4,14	3,79	5,10	6,50	0,41	14,80	10,40	4,40	10,10	12,50	62,60
57,5 cm	4,00	3,41	15,20	17,00	0,48	44,60	32,20	12,40	35,80	11,80	7,90
70,5 cm	4,05	3,38	14,60	15,00	0,21	43,60	32,00	11,50	34,10	9,20	13,20
85,5 cm	4,26	3,54	3,80	5,00	0,07	14,60	9,00	5,60	10,80	7,60	67,00
95,0 cm	4,33	3,43	5,70	6,50	0,14	23,30	18,10	5,30	20,30	14,60	41,80

Values of the sorption capacity (T_M, according to Mehlich) and of the particle size distribution (Table 1) reveal that the soil profile in pit is of alluvial origin. This fact explains also the uneven course of concentrations of studied elements. In spite of this, the evaluation of presented data enables to formulate certain generally valid conclusions: High content of mobile forms of Pb (found at given experimental conditions) throughout the whole profile testifies to the anthropogenic origin of this Pb form, so that is not firmly bound in the crystal lattices of the parent material. Enhanced concentrations of mobile forms of majority of the studied elements in the umbric horizon testify their most likely origin, either anthropogenic (As, Cd, Pb, Zn), or derived from their cycling by the tree vegetation (Mn, Sr, partly Zn).

av.depth	As (ppm)	Be (ppm)	Cd (ppm)	Cu (ppm)	Fe (ppm)	Mn (ppm)	Pb (ppm)	Sr (ppm)	Zn (ppm)
7,5 cm	35,3 /0,68	3,75 /0,14	0,79 /0,1	26,8 /1,16	3292 /730	118,7 /18,2	67,05 /30,0	223 /2,36	48,86 /4,6
% m.f.	1,93	3,73	16,66	4,33	22,17	15,32	44,74	1,06	9,41
24 cm	43,1 /0,18	5,43 /0,60	1,05 /0,01	28,5 /1,10	5998 /862	192,9 /15,2	58,60 /12,6	210 /0,36	69,36 /3,2
% m.f.	0,42	11,05	0,95	3,86	14,37	7,88	21,50	0,17	4,61
40,5 cm	30,6 /0,22	6,33 /0,55	0,86 /0,01	10,8 /0,14	2658 /714	75,1 /7,8	47,94 /10,0	265 /0,32	24,18 /1,0
% m.f.	0,72	8,69	1,16	1,30	26,86	10,37	20,86	0,12	4,14
57,5 cm	39,6 /0,27	6,21 /1,11	1,25 /0,017	37,9 /1,00	7901 /815	192,9 /5,3	76,38 /26,0	175 /0,62	98,89 /3,8
% m.f.	0,68	17,87	1,36	2,64	10,32	2,75	34,04	0,35	3,84
70,5 cm	42,2 /0,32	6,03 /1,39	1,26 /0,04	35,6 /1,29	7390 /838	150,8 /5,6	93,09 /26,0	203 /1,01	81,06 /3,6
% m.f.	0,76	23,05	3,17	3,63	11,34	3,71	27,93	0,50	4,44
85,5 cm	28,1 /0,34	6,30 /0,60	1,00 /0,008	13,4 /0,44	2488 /466	56,8 /4,2	40,12 /11,0	245 /0,72	28,25 /1,0
% m.f.	1,21	9,52	0,80	3,27	18,73	7,39	27,42	0,29	3,54
95 cm	35,1 /0,52	7,38 /1,22	1,19 /0,016	24,5 /0,88	5179 /630	102,7 /3,8	66,78 /16,2	280 /2,46	53,21 /2,2
% m.f.	1,48	16,53	1,34	3,59	12,16	3,70	24,26	0,88	4,13

To characterise in more detail the locality of the closing profile of the "Lesní potok" catchment, another 5 groups of samples were collected in area 20 x 20m surrounding the probe (loc. LP41 - 45) from holes bored by the Edelman auger into a depth 1m, presupposing equal distribution of the horizons determined in the pit. These samples were employed for the determination of mobile forms of studied elements and of the pH.

Tab.3 Mean content (n=15) of mobile forms of elements in the samples from holes bored by Edelman auger

average depth	Pb average	Mn average	Be average	Sr average
7,5 cm	38,5	16,7	0,16	2,30
24,0 cm	17,3	17,6	0,23	0,64
40,5 cm	18,2	7,4	0,51	0,88
57,5 cm	18,1	4,4	0,79	1,91
70,5 cm	16,5	3,6	1,04	2,35
85,5 cm	14,8	3,3	1,29	3,08
95,0 cm	14,4	3,4	1,33	3,38

Mean values of the content of mobile forms of the above mentioned selected elements reveal unambiguous trends of their geochemical characteristics. Concentrations of lead (element with poor mobility) are gradually lowering towards the deeper soil horizons, because anthropogenic (vehicular) Pb deposited from the atmosphere is firmly bound to the humus of the umbric A horizon. Concentrations of the accessible Mn are significantly lowering from the A horizon towards the Gr horizon, which is determined by its significant role in the plant metabolism and by high content of Mn in the litterfall as well as in throughfall, and, on the other hand, by its strong root uptake. Concentrations of Be increase with depth of the horizons which is typical for this element with high mobility in the acidic environment. Content of Be in the

bedrock is relatively high (13ppm) and its vertical distribution in the soil profile reflects the gradual leaching of Be by the acid atmospheric precipitation, which is documented by the relatively high concentration of Be in the surface discharge (Skřivan et al., 1996). Strontium is an element - with respect to its total content in the soil profile - relatively low mobile and it participates in the metabolism (it substitutes Ca in the plant tissues), which is documented through its increased concentration in throughfall in comparison with the bulk precipitation, and consequently by the elevated content of leachable Sr in the A horizon.

Presented data should extend knowledge on content and distribution of studied elements in the soil profile. They also represent a basis for the more detailed description of geochemical reservoirs in the experimental catchment "Lesní potok" and for the evaluation of elemental fluxes in this area.

References:

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