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TRACE ELEMENTS IN THE SOILS IN THE VICINITY OF THE VILLAGE OF PISICA

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Abstract

The paper presents the results and findings obtained from the research performed for determinacion of trace elements and pH values in the soils in the vicinity of Pisica. The region is known for its intense agricultural and other anthropological activites, mining activites that also have an impact on the distribution of some microelements in the soils. Studies were carried out by ICP-AES in the laboratory of the Faculty of Mining and Geology in Stip.

Key words: Trace elements, agricultural activites, soils, pH.

Introduction

The Village of Pisica is situated 22 km far away from Stip near the road Stip - Probistip. Changes of heavy metal presence in the soil are the result of various interaction processes that ca be grouped as follows:

1. anthropogenic: changes resulting form agricultural managment (e.g. fertilizers) and atmospheric deposition.
2. soil dynamic: changes resulting from soil cultivation (e.g. tillage) biological activity (e.g. earth worms), disolved or as particles that are transported by water flow, erosion or other processes.
3. procedure errors: changes resulting from all kinds of possible errors associated with soil sampling, physical soil preparation and analytical procedure.

The content of trace elements depends on the mineral and texture of the soil (Pospilova and Lastinkova, 1998) as well as on the primary material that formed the soil (Mengel and Kirkby 1979).

Determination of macro elements, trace elements and pH was done on 6 soil samples taken from wheat fields (T1,T2,T3,K1,K2,K3) and 6 soil samples taken from grapevine fields R1,R2,R3,N1,N2,N3). Samples were taken 20 cm in depth.

Samples were dried for 48 hours at 40°C. Dry samples were prepared according to ISO 11464. They were crushed and sieved through 45 μm sieve.

One gram of sample was wetted in 2.0 mL redistilled water and with slow and constant stirring 12 ml HCL and 6 mL HNO_3 were added. The glass was covered with a glass watch and kept at room temperature for 16 hours and heated until wet salts was obtained. Wet salts were closed in 5 mL concentrated HNO_3 and the content was filtered through paper with white track. The material was put in a 100 mL measure flask.

Determination of macro elements and trace elements was done by AES-ICP, while the pH value was determined by pH meter with combined glass electrode in soil suspension obtained from 5 g soil in 20 mL redistilled water.

Results and discussion

Table 1. Values of macroelements and micro elements in the soils of Pisica.

	T1	T2	T3	K1	K2	K3
elements	%					
Al	2.96	2.34	4.07	3.10	3.35	3.57
Fe	4.98	4.88	5.11	4.10	4.51	4.14
Ca	0.924	8.330	0.906	0.757	0.861	0.878
Mg	0.736	0.630	0.867	0.809	0.874	0.899
Mn	0.737	0.806	0.852	0.081	0.087	0.261
K	0.407	0.313	0.582	0.527	0.525	0.614
Na	0.027	0.025	0.052	0.051	0.073	0.076
P	0.055	0.065	0.067	0.042	0.047	0.045
	mg/kg					
Sr	134.6	121.5	179.1	108.7	132.2	139.8
Ba	1254.9	1044.3	1483.3	378.4	344.3	425.5
Ni	21.91	19.46	20.31	18.10	19.54	21.08
Cr	24.49	23.00	29.08	26.93	28.33	24.36
Zn	1365.6	1266.8	1649.7	134.7	151.3	280.9
Cu	107.05	133.49	114.31	31.97	33.15	36.78
Pb	1145.9	1109.4	1164.8	102.26	116.19	250.05
Cd	13.99	13.44	14.51	6.44	6.97	6.87
Co	15.04	17.08	16.27	17.65	17.23	17.03
As	57.68	66.10	48.37	1.93	6.29	2.28
Ag	2.93	3.33	2.73	0.193	0.466	0.935

Table 2. Values of macroelements and micro elements in the soils of Pisica.

	R1	R2	R3	N1	N2	N3
elementi	%					
Al	2.34	1.91	2.91	3.48	3.30	2.76
Fe	3.87	4.20	4.22	4.27	4.17	3.99
Ca	1.57	0.608	8.44	8.40	1.54	1.45
Mg	0.679	0.732	0.760	0.791	0.788	0.611
Mn	0.336	0.319	0.294	0.106	0.152	0.399
K	0.407	0.354	0.480	0.493	0.523	0.524
Na	0.028	0.023	0.040	0.082	0.059	0.060
P	0.048	0.055	0.054	0.043	0.040	0.050
	mg/kg					
Sr	109.8	75.6	115.5	142.1	120.3	114.0
Ba	498.9	549.7	499.7	336.5	330.6	390.0
Ni	17.82	21.91	18.37	16.98	22.64	16.18
Cr	22.64	27.37	25.09	27.51	28.97	22.63
Zn	524.4	587.8	552.7	155.1	178.2	593.7
Cu	58.84	75.86	62.61	34.60	34.37	51.22
Pb	477.74	403.30	513.60	148.07	131.13	460.31
Cd	7.88	7.88	8.54	6.59	6.62	8.19
Co	15.86	14.91	17.45	18.59	18.57	16.17
As	26.80	33.61	32.30	4.92	4.64	3.93
Ag	0.480	0.959	0.850	0.040	0.959	1.18

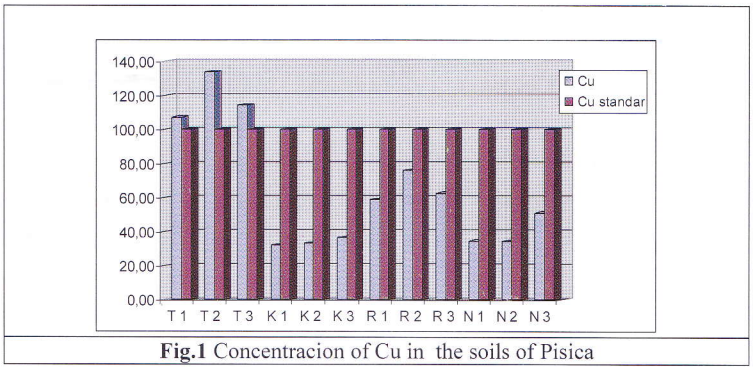

Fig.1 Concentracion of Cu in the soils of Pisica

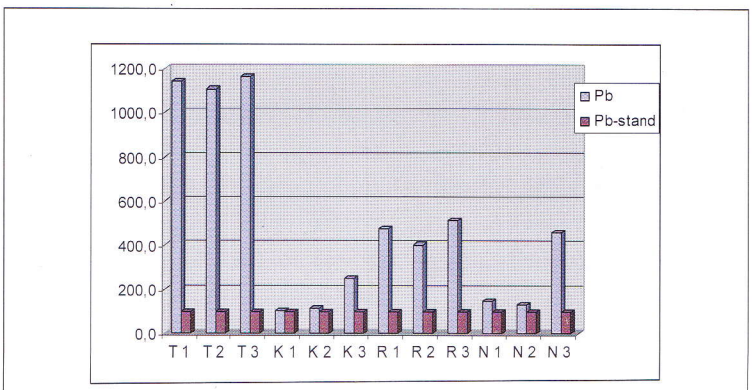

Fig.2 Concentracion of Pb in soils of Pisica

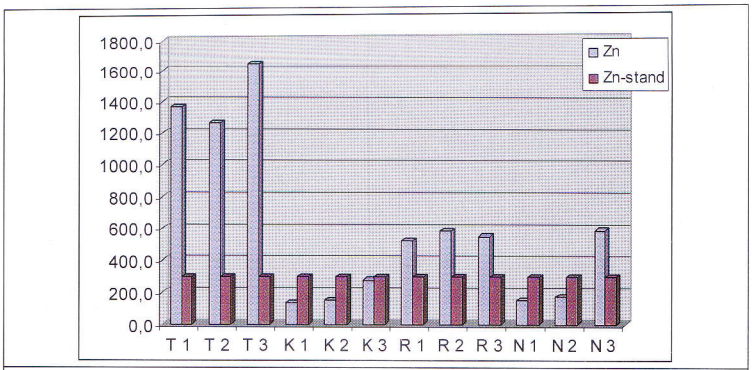

Fig.3 Concentracion of Zn in soils of Pisica

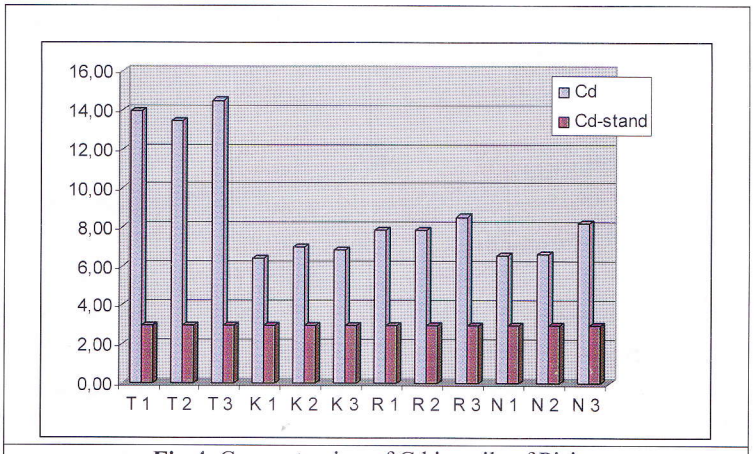

Fig.4. Concentracion of Cd in soils of Pisica

Table 3. pH values in the soil in the vicinity of Pisica

Prim	*K1*	*K2*	*K3*	*N1*	*N2*	*N3*	*R1*	*R2*	*R3*	*T1*	*T2*	*T3*
pH	*7.05*	*7.00*	*7.00*	*7.00*	*6.81*	*7.22*	*6.29*	*6.82*	*7.11*	*7.11*	*7.39*	*7.70*

Investigations revealed increased concentracion of Zn, Pb, in the samples (T1, T2, T3, R1,R2, R3, N3), Cu in the simple (T1, T2, T3) and increased concentracion of Cd in all samples.

The contents of Zn, Pb,Cu, Cd were compared with the values reported in literature in many countries in the world (Klok 1980, Govedaraju, 1994, Kabata-Pendias 1995).

Zn contents have been determined in an exceptionally wide span from 134.7-1649.7mg/kg.

Pb contents in the soils under investigation have been found in wide span of 102.26-1164.8 mg/kg.

Cd contents have been determined in wide span 6.44-14.51mg/kg. Cd in soils is easily apsorbed by rice than other plants.

Cd contnets in soil depend largely on pH value, the composition of the soil, particularly clay contnets.

The content of Ba is from 330.6-1483.3mg/kg.

Sr contents have been determined in wide span from 179.1-75.6mg/kg.

Conclusion

The investigations carried out on the presence of trace elements in soils in the vicinity of Pisica are caracterized by increased anthropogenic impacts. Investigations revealed increased concentrations of Zn, Pb, Sr, Ba, Cd. The high Zn, Pb concentrations are due to the intense antropogenic influence, notably the disasters that occurred in the lead and zinc flotation dams. The region is built up of volcanic tuffs of Tertiary age so that pedogenesis of the soils consists mainly of tuffs.

The increased cadmium concentrations come from the flotation plants of the Zletovo Mines. The concentracion of other trace elements are within the allowed limits and the values reported for such types of soils. Ideal pH values in soil for growing are: for rice 5.0-6.5, grapes 6.2-6.5. pH value of soils studied is within the 6.29- 7.70. In investigated soils, pH values is higher and will negative influence on best growth of rice and grapes.

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