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THE TRACE ELEMENT DISTRIBUTION OF LAKE MUD IN SEVERAL HYPERSALINE LAKES OF THE DANUBE-TISZA INTERFLUVE, SOUTH HUNGARY

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ABSTRACT

Trace element analyses on the sediments of the Vadkerti Lake and the Kolon Lake (southern part of the Danube Tisza Interfluve) have shown that the amount of certain trace elements is abnormally high. The Cu and the As content is several times higher than the allowed value, and the Pb content is just acceptable. These anomalies have anthropogene origin and they are the results of intensive grape and fruit cultivation in the region.

INTRODUCTION

The two lakes which were chosen to examine more detailed regarding radiological features, the permanent Vadkerti Lake (Soltvadkert) and the temporary Kolon Lake (Izsák) are located on the blown sand covered Danube-Tisza Interfluve, where in the lakes, according to MOLNÁR (1980), in an alkali environment hypersaline carbonate formation takes place. This process is characteristic in the first place in case of the bottom of the Kolon Lake, which is covered by water temporarily. Here a more than 0.5 m thick sediment with a carbonate content higher than 50% can be observed some 10 cm under the muddy-sandy water of the lake. Under this sediment blown sand can be found. In case of the Vadkerti Lake this carbonate-rich layer is thin and it can be observed only in some places. Hidrodinamically, the basin of the Vadkerti Lake is a part of the territory dominated by ascending ground waters, therefore, it is filled with water permanently and there is even an outflow for the excess water (ERDÉLYI, 1990). Years ago in the SW corner of the lake on the territory of the beach the lake mud was dredged.

METHODS

Two samples were collected from each points of sampling with an instrument constructed specially for this occasion. One of the samples was taken from the surface of the bottom, the other from beneath the surface from a depth of 40-50 cm. Samples were collected from points 25, 50 and 100 m far from each other along the longitudinal and the

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cross axis of the lake by divers due to the 1.4-3.0 m depth of the water. Since the past two years have brought a rainy weather the basin of the temporary Kolon lake was pretty full, therefore, only its shores could be handled as areas of periodic water cover, and sampling was restricted to these areas. 22 pairs of samples (44 samples in all) were collected from the four sites.

Radiographs were taken with an NZA-8500 X-ray analyzer in order to determine the samples' trace element content (Pb, Cu, Zn, As, Sr, Cd, Ag, Cr, Co, V, Zr, K, Ca, Ti, Fe). The Mo K radiation source operated with a 29 KV excitation voltage and with a 4 mA anode current. Measurements were performed in a He atmosphere of 0.1 mbar pressure from boric acidic pastilles weighing 500 mg, compacted with a 6 ton pressure. In order to receive more proper data the 13.5-16 KeV interval was remeasured under a 33 KV excitation voltage. XRF analysis was carried out on 62 samples in all. These measurements were verified in the Soil Science and Agrochemistry Institute of the Hungarian Academy of Sciences. Deviations stayed under 8%.

DISCUSSION

Table 1. presents the mean element-content of the 22 pairs of samples which can be chosen on the basis of the results of radiological and X-ray diffractional analyses. Based on the results of XRF examinations, we could not make areal distinctions regarding the mud of the two lakes. However, differences in trace element distribution of the two sampling levels is inevitable. Values of K and Ca concentrations correlate well to the mineral composition. Naturally, the amount of Sr follows precisely the changes of Ca concentration.

Regarding the base metal content of the sediments of the Vadkerti and the Kolon Lakes, the high amount of arsenic, copper, lead (and zinc) is striking. Compared to the concentrations determined by the MI-08-1735-1990 directive regarding arenaceous soils *the Cu and the As content is several times higher than the allowed value, and the Pb content is just acceptable.* These anomalies have antropogene origin and they are the results of intensive grape and fruit cultivation in the region. In the exact vicinity of the examined territories huge vineyards and fruit farms can be found.

CONCLUSIONS

In case of each area of examination the enrichment of Cu As and Pb in the sediment is several times higher than the threshold value. For the metal contamination the surrounding large scale vineyards and fruit farms are responsible.

Based on our researches at the two typical lakes, we suggest that the radiological analysis of the sediments of lakes, temporarily water covered areas, dead and outflowing waterflows which are located on the territory influenced by the ascending waters of the deep hydrodinamic water system would be important. According to the results of this research, on the above mentioned territory there is a real chance for the formation of much higher radioactive element concentrations than those we have detected currently.

TABLE 1

The mean trace element content of the four examined sites, data are based on XRF analyses

Site		sample	Min. Max. Mean	Pb	Cu	Zn	As	Sr	Cd	Ag	Cr	Co	V	Zr	K	Ca	Ti	Fe^{tot}
				ppm											%			
Vadkerti Lake	upper samples	14	min.	50	140	5	0	120	0	0	0	0	50	100	0,6	1,7	0,06	0,66
			max.	90	300	40	220	870	trace	trace	30	5	150	130	1,4	9,3	0,12	1,35
			mean	80	201	16	53	448	-	-	4	0,7	104	113	0,94	6,2	0,09	1,05
	lower samples	14	min.	45	130	5	0	170	0	0	0	0	55	105	0,7	1,8	0,09	0,8
			max.	100	240	50	170	670	trace	trace	25	5	155	135	1,2	9,0	0,2	1,36
			mean	71	191	14	39	398	-	-	3	0,7	110	118	0,95	5,5	0,11	1,13
Kolon Lake	upper samples	8	min.	7	22	4	0	150	0	0	0	0	50	90	0,45	4,3	0,01	0,88
			max.	46	100	45	80	920	0	0	8	0	130	135	1,15	10,6	0,1	2,56
			mean	12	85	17	46	560	-	-	2	-	102	121	0,78	7,5	0,05	1,13
	lower samples	8	min.	5	10	0	0	480	0	0	0	0	10	20	0,05	6,9	0	0,15
			max.	26	40	16	55	1250	0	0	0	0	75	84	0,53	14,6	0,01	0,56
			mean	7	23	10	18	855	-	-	-	-	27	33	0,32	12,8	-	0,38

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THE MEASURING METHODOLOGY OF EXCESS RADIOACTIVE LOAD CAUSED BY COAL MINING IN THE VICINITY OF PÉCS (MECSEK MTS. - HUNGARY)

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ABSTRACT

Beside several other harmful effects of coal mining on the environment (destroying landscape, dust and noise pollution), we must lay a great emphasis on dealing with its excess radioactive load as well, since it is widely known that some coal types have a remarkably high radioactive element content. In Hungary the coal of the Tatabánya Coalfield (ZETHNER, 1958), the Cretaceous coal of Ajka (BODROGI ET AL., 1959) and the Liassic coal of the Mecsek Mts. are of that character. It is getting to be necessary to develop a measuring methodology that can be authoritative in land reclamation plans, environmental geological surveys on other Hungarian territories with similar problems and that corresponds to the directives of the IAEA (International Atomic Energy Agency). This measuring system involves "in situ" and laboratory analyses, and as a result of this, beside the actual environmental impact analysis it provides further information on the geological setting of the territory. With an informative purpose we also publish the preliminary results of the measurements that are performed on the coalfields of the Mecsek Mts.

INTRODUCTION

In Pécs and in its vicinity as a result of coal mining, that started two hundred years ago, a great amount of waste material has been already extracted. The excess radioactive load of this waste on the people of the area has not been examined in every detail yet. The high radioactive element content of these coals and their wastes is well-known for a long time. High values can be explained by the uranium accumulating effect of organic material and by the granitoidic base level of the clastic, sedimental rocks of the coal formation (PÁL MOLNÁR et al., 1999). The mean uranium-content of previously examined Liassic coal samples is 25 g/t, but in case of clay shales 150-220 g/t values are not rare either (SZALAY et al., 1959). According to estimations, the coal mining in the Mecsek Mts. has raised the radioactivity of the surface of the area approximately by 60 % (VADOS et al., 1999).

We can receive a total view of the radioactivity of the environment only by measurements that last at least for a year, since several parameters (e.g. falling dust, radon exhalation, aerosol activity) significantly depend on the meteorological situation. Thus, measurements are of full value only if the examination of variable parameters is extended to a whole year period.

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