

NATURAL REMEDIATION OF POLLUTED AREAS BY MINING-METALLURGICAL ACTIVITIES. PART I. HEAVY METALS IN CONTAMINATED ENVIRONMENTS

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ABSTRACT

Due to his nature, durability and intensity the mining-metallurgical activities were and still are pollutant. The soil pollution is the cumulative effect of mining wasted deposits.

The 31.5 ha waste dump is situated on the North, North-West of a town. The cinder yard is on the left flank of a valley and the South district of a town; between quota +223.40 m watermark and quota +282.09 m at the baseboard of the cinder yard. The ground has a de 5-7° inclination; the deposits are 10-50 m thick and 50 m high. The waste dump contains 5.974.580 t ironworks residues.

The waste dump is a pollution source for vicinity areas, surface and ground waters.

INTRODUCTION

In the Banat's area the heavy metals concentration is high, in some areas out of the normal values.

After many studies regarding the heavy metals concentration in Romania's soils, was pointed out that in Banat's area some of the metals are 1 to 5 times over the normal. High values were registered for cadmium, chrome, cobalt, lead, manganese and others. In Banat's area the mountains was expose to a moister and wormer climate which encouraged rock weathering and their accretion in the lowland of Panonic Lacustrine Space. Although this entire natural metals accumulation, the Banat's area is not considered a polluted area.

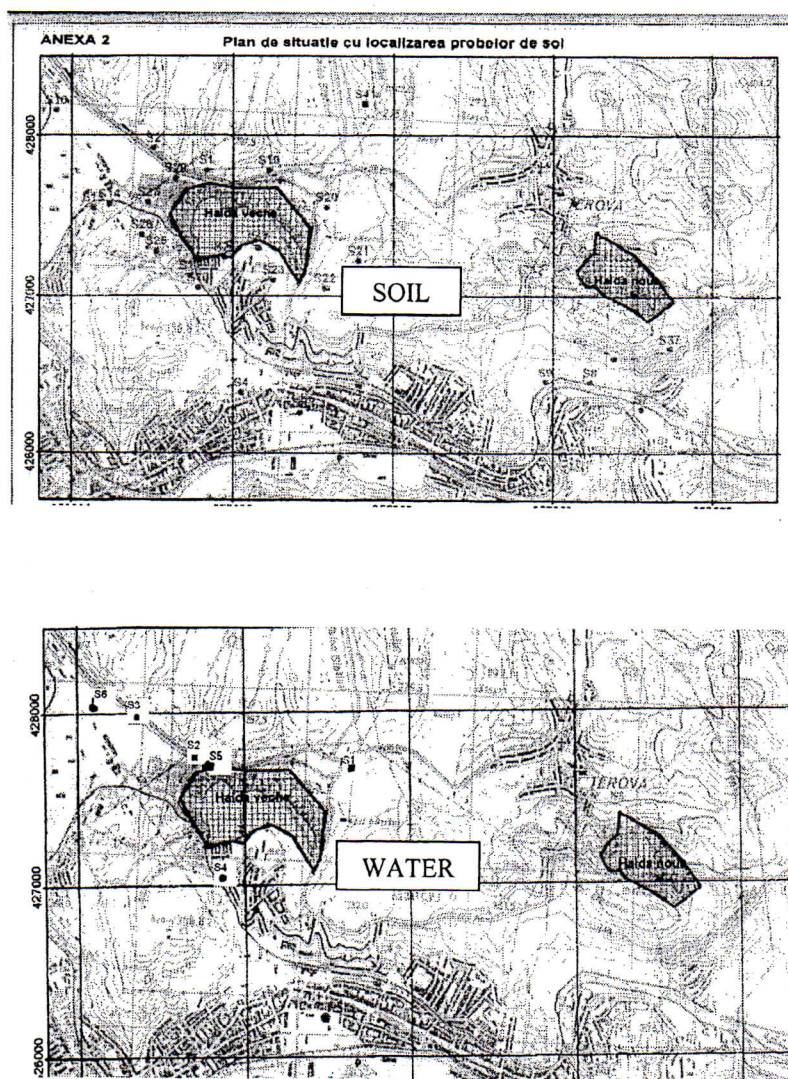
The anthropical mining and metallurgical activities that generate many materials with high content of metals such as dumbs, cinder yards are severely changing the balance and lead to the pollution of contiguous areas with one or more metals: lead, cadmium, copper, zinc, nickel, chrome and others.

MATERIALS and METHODS

In order to carry out the experiment, were done:

- analyzes of soil samples from 11 sites contiguous to a metallurgical dumb situated along the water courses formed in the rainy season;
- analyzes of water samples from the river that is bounding one side of the dumb. The water samples were taken downstream, upstream and in front of the dumb.
- analyzes of groundwater samples taken from three location.

The water and soil sampling sites are indicated on the map (Figure 1).



• SURFACE WATER (S1, S2, S3) • GROUND WATER (S4, S5, S6)

Figure 1. WATER AND SOIL SAMPLING SITES

RESULTS AND DISCUSSIONS

The determined metals concentrations from the 11th sites near the cinder yard are presented in Table 1. Due to natural causes, such as: waterfalls leaching from higher to lower areas, erosions and landslips, air-floated and sedimentary powders, important quantities of metals has reached the dumb vicinity.

From the Table 1 results that cadmium reaches in 7 of 11 sites to 5 till 10 mg/kg D.S. concentration (warning point/action point); in three of the studied locations copper is in concentrations of 100 to 500 mg/kg D.S and in half of the cases, the lead reaches 500-875 mg/kg D.S. In all cases is also present the nickel, and near water was found in a concentration of 200 mg/kg D.S.

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Two more pollutant areas can be distinguished:

1. Sites 2 and 3 in the hill area
2. Sites 8, 9, 10 and 11 in the valley area.

The waterfalls, after washing down the waste dump, are flowing over all this sites depositing the carried materials in the valley.

Table 1. METALS CONCENTRATIONS IN THE CONTAMINATED AREA

Sites for soil prelevation	Metals concentrations mg/kg D.S.					
	Lead	Cadmium	Copper	Zinc	Nickel	Chrome
1 Hill	50	3.5	190	600	40	55
2 Hill	140	7.5	100	500	100	40
3 Hill	50	7.0	24	145	25	26
4 Hill	150	5.0	33	850	30	15
5 Hill	20	6.5	40	630	90	40
6 Hill	40	5.0	30	140	100	40
7 Hill	50	10.0	20	150	100	30
8 Valley	140	2.5	65	875	50	50
9 Valley	50	4.0	70	519	40	40
10 Valley	75	2.5	40	300	40	40
11 Valley	15	10.9	200	150	210	40

D.S. - dry substance

The metals concentration from the running water is under admitted limit; also, their presence in case of a longer consumption is considered a risk.

The groundwaters are more polluted due to the leaching water that is slowly crossing the polluted aquiferous layers accumulating high quantities of toxically compounds.

Table 2. THE CHARACTERISTICS OF SURFACE AND GROUND WATERS

Sites for water prelevation	Metals concentrations mg/L					
	Lead	Cadmium	Copper	Zinc	Nickel	Chrome
S1-Surface (downstream); pH = 8.3	udl*	0.02	0.05	0.05	0,1	0.005
S2-Surface (dump) pH = 8.05	udl	0.02	0.05	0.05	0.1	0.005
S3-Surface (upstream) pH = 6.39	udl	0.01	0.01	udl	0.1	0.005
S4-Subsurface (dump)-hill; pH=7.61	0.04	0.003	0.03	0.1	0.05	0.03
S5-Subsurface(dumb) valley; pH = 11.05	0.04	0.003	0.02	2.5	0.001	0.02
S6-Subsurface-hill pH = 8.87	0.05	0.004	udl	1.5	0.4	0.01

*udl – under detection limit

CONCLUSIONS

- Through dumb leaching of contaminated soils, erosion and caving, the vicinity areas are polluted;
- The rain waters are transporting and depositing polluted materials in the depression areas;
- The surface water is crossing faster the polluted areas so it will be less polluted in comparison to the groundwater that is percolating slower the polluted layers, increasing the metals concentration.

LIST OF REFERENCES

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