

ENVIRONMENTAL MINEROLOGICAL STUDY OF SOILS OF THE CSEPEL ISLAND (HUNGARY); TRACING THE TOXIC HEAVY METALS (V, Ni)

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The “Dunamenti” Thermal Power Plant (DTPP) has been working since 1959 at Százhalombatta, 20 kilometres south from Budapest. The power plant operates on extra heavy fuel oil containing 3,5% S (average) and small quantities of vanadium (50 ppm) and nickel (15 ppm). It emitted almost 1000 tons of heavy metal containing solid pollutants into the air in the last 40 years. 95 percent of the flying ash’s metal content are vanadium and nickel compounds. The flying ash settled down on the ground according to its morphology, size and density. Considering the dominant direction of wind, the main area of dustfall pollution is the Csepel Island in the Danube.

During the last decade some, mainly chemical, examination were done on the metal content of the dust: 5% of vanadium and 1,5% of nickel were detected in the airborne particles (ÓVÁRI & ZÁRAY, 1996, MOLNÁR, 1993). Óvári and Záray (1996) demonstrated that V and Ni are present as NiS, NiSO₄x6H₂O and VOSO₄x3H₂O.

Up to now no extensive investigation has been carried out to discover the penetration of heavy metal pollution into the soil. We took 5 drill core soil samples (from surface down to 1 meter depth) from different location of the Csepel Island. Each of them are 5–10 km far from the DTPP (this might be the maximum spread of significant pollution). The soils are alluvial meadow soils and alluvial soils (Fluvisols, FAO classification). They contain almost 50 % of quartz, significant amount of feldspars and carbonates (calcite and dolomite, up to 15 %) and small quantities of clay minerals and other sheet silicates (illite, smectite, chlorite, kaolinite).

X-ray powder diffraction, ICP-MS, thermoanalytical and conventional chemical methods were used. The XPD results show a very similar composition for the soils samples. Only the distribution of minerals changes with depth (carbonates and clay minerals increase, quartz and feldspars decrease). The vanadium concentration of the samples are 10–30 ppm, while the nickel contents are 10–48 ppm as measured by ICP-MS. Correlation were found between V and Fe and V and Ni contents. It is supposed that the main absorbents of these metals are the organic matter, clay mineral and carbonate soil constituents, so we focus our future investigations on these minerals.

Our primary aim is to find correlation between vanadium and nickel content versus depth, mineral species, and the organic matter as well as the distance from the DTPP.

References

- ÓVÁRI, M. & ZÁRAY, Gy. (1996). Proc. of the 39th Hungarian Annual Conference on Spectrochemistry. Hungarian Chemists’ Association, Budapest, pp. 167–173. [in Hungarian]
MOLNÁR, Zs. (1993). Environmental parameters of Pest County. Middle Danube Valley Environmental Control Headquarters, Budapest, pp. 212–223. [in Hungarian]