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ENVIRONMENTAL MINEROLOGICAL STUDY OF SOIL 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 on average and small amounts of vanadium (50 ppm) and nickel (15 ppm). It has emitted more than 1000 tons of heavy metal containing solid pollutants into the air for the last 40 years. More than 95% 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.

Up to now no extensive investigation has been carried out to discover the penetration of heavy metal pollution into the soil. Beside the assessment of environmental damage, our primary goal was to describe the mobilisation–fixation properties of the soil-forming minerals. We took 5 drill core soil samples (from surface down to 1 meter depth) from different locations of the Csepel Island. Each location is 5–10 km far from the thermal power plant (this might be the maximum spread of significant pollution, GANOR et al, 1988). The soils are alluvial meadow soils and alluvial soils (Fluvisols, FAO classification).

XPD qualitative and quantitative phase analyses, thermoanalythical, ICP-MS, and different chemical separation methods were used. The XPD and thermoanalytical results show a very similar composition for the soils samples. They consist of quartz (40–50% on average), a significant amount of feldspars and carbonates (calcite and dolomite, up to 40%) and small quantities of clay minerals and other sheet silicates (illite, smectite, chlorite, kaolinite), as measured by XPD quantitative phase analysis. Different chemical digestion methods were used. To determine the total amount of V and Ni aqua regia microwave digestion was used. The total amount of V and Ni are 14–28 and 10–35 ppm, respectively. The main interacting soil constituents are: calcite (5–10% of the total amount of V and 10–20% of Ni, acetic acid digestion), organic matter (5–7% of both V and Ni, NaOH digestion), amorphous iron (oxy)hydroxide (50–70% of both V and Ni, hydrochloric acid digestion) and clay minerals (1–10% of both V and Ni, KNO_3 digestion). Good correlation were found between the amount of Fe and V, and V and Ni contents.

In order to be able to draw a general conclusion from the data obtained by these investigations, our analytical results are subjected to the fuzzy logic statistical method.

References

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