Trace elements in sediments and floodplain soils of the Wieprz river, Poland

Izabela Bojakowska[1], Olimpia Kozłowska[1], Jarosław Kucharzyk[1], Dariusz Lech[1]

[1]Polish Geological Institute - National Research Institute,
Rakowiecka 4, 00-975 Warsaw, Poland

Phone: +48-(0)-22 849 53 49 e.296
E-mail:
izabela.bojakowska@pgi.gov.pl

Introduction: The Wieprz River, the length 302 km, is the right side tributary of the Vistula River. The Wieprz river catchments in the northern part is covered by Quaternary rocks (boulder clay, stagnant silts and sands) and in central and southern part by Quaternary loess and Paleocene and Cretaceous limestone, marl, chalk and gaize. In the Wieprz river basin there are typical agricultural areas, giant forest complexes and the large industrial centers such as Lublin and • widnik also. In the catchment area coal deposits (Lublin Coal Basin) and carbonaceous materials for the cement industry are exploited.

Methods: From the Wieprz River and its floodplain, in chosen 38 profiles sediment and soil samples were collected. In addition sediment samples were taken near the mouth of its tributaries. Soil samples were taken at 5 and 15 m from the edge of water from both sides of the river. The samples were analyzed for contents of Ag, Al, As, Cd, Co, Cu, Mo, Pb, Sb, Se, Sn and Tl by ICP-MS method, using the ELAN DRC II, Perkin Elmer, the contents of Ba, Ca, Co, Cr, Fe, K, Mg, Mn, Na, P and Sr, Ti, V and Zn by ICP-OES methods, using iCAP6500 Thermo Scientific, the contents of Hg by AAS technique, using the AMA 254 Altec.

Results: In the Wieprz river sediments following elements were investigated: Cr (up to 26 mg/kg), Cd (up to 6.4 mg/kg), lead (up to 35 mg/kg), Ni (up to 17 mg/kg), Zn (up to 117 mg/kg), Hg (up to 0.452 mg/kg), Ag (up to 0.9 mg/kg) and Sn (up to 1.9 mg/kg). Cadmium pollution of the Wieprz river sediments on the section from Ł czna up to the mouth of the river was found. In most of the tributaries examined elements are present in concentrations similar or lower than the geochemical background values. Although the sediments of the Bystrzyca river (on which Lublin is located with 351 thousand residents) were characterized by a high content of Cd - 11.7 mg/kg and increased content of many heavy metals, sediments of the Stoki stream (which is discharged into the wastewater from • widnik) contained 7.3 mg/kg Cd and 79 mg/kg Cu and the Bzdurka river sediments were characterized by very high contents of V (158 mg/kg) and zinc (712 mg/kg). The soils are found to contain As up to 13 mg/kg, Cd - 25 mg/kg, Co - 11 mg/kg, Cr - 55 mg/kg, Cu - 56 mg/kg, Ni - 26 mg/kg, Pb - mg 138 mg/kg, Zn - 336 mg/kg, Ag - 1.6 mg/kg, Sn - 9.9 mg/kg, Hg – 0.235 mg/kg.

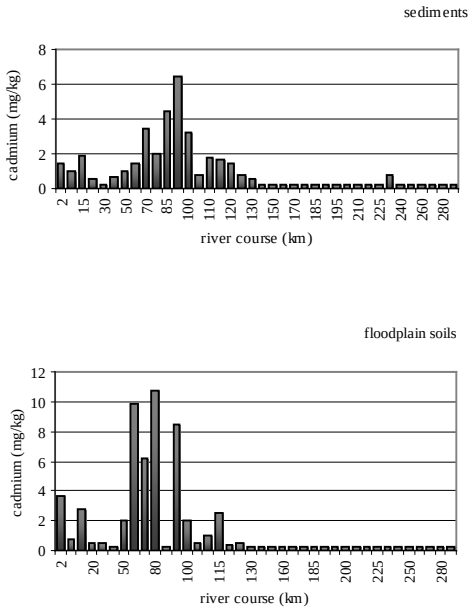

Fig. 1:Cadmium in sediments and floodplain soils.

Discussion: Soil samples taken at a distance of 5 m from the river were characterized by higher concentration of Cd, Co, Cr, Cu, Ni, Pb, Zn and Ag than soil samples collected at a greater distance (15 m), which indicates that the source of these metals in soils was the movement of river contaminated sediment on floodplain terraces. The occurrence the increased content of Cu, Pb, Zn and Sn was found in the floodplain soils of the upper river course (250-225 km) and increased content of Cd, Cr, Cu, Pb, Sn and Zn was noticed in the floodplain soils of lower river course (from 130 km). It have not been noticed in the Wieprz river floodplain soils the exceed of permissible levels of As, Hg, Sn, Co, Ba, Mo and Ni by Regulation of the Minister of Environment on standards for soil and ground quality. However, the exceeding the permitted levels of cadmium (1mg/kg) was stated in 22% of samples and 11,5% of samples found to exceed the permissible content of zinc (100 mg/kg). The individual samples were recorded exceeded the permissible content of chromium (50 mg/kg), copper (30 mg/kg) and lead (50 mg/kg).