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Dating of fluvial sediments in the Morava River watershed (Czech Republic) based on 137Cs and Pb and Zn contamination

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Sedimentary records of Brno Dam situated NW from the city of Brno at Svratka River and sedimentary profiles of the Morava River floodplain near the city of Strážnice were dated on the base of depth dependence of 137Cs activity and the depth dependence of concentration of heavy metals (Pb, Zn) and Pb isotopic ratios in profiles were analyzed. The results allowed the reconstruction of the development of historical regional contamination of the Morava River watershed situated in south-east part of the Czech Republic from the sedimentary records. Both studied sites are situated in less contaminated areas with no particular heavy industry, without important point sources of anthropogenic contamination in their proximity; with only some local machinery as the main sources of heavy metals contamination in Brno Dam. In the case of Morava River floodplain the surroundings has rather rural character. Sedimentary profiles of the floodplain of Morava River have been retrieved from up to 5 m high erosion banks and also from floodplain by hand-drilled cores (2-4 m long). Dating of sediments by utilizing of 137Cs activities in profiles from erosion banks has been found to be limited by vertical migration of 137Cs within sedimentary profiles in sandy sediments of levees with possible accumulation on finer lithological structures within sedimentary profiles. In cores from floodplain this downward migration of 137Cs has not been so substantial. In floodplain sediments it was necessary to determinate the influence of the variable sorting of the suspended sediment on sediment composition before it was deposited in floodplain. Facial analysis and basic description of the floodplain architecture are essential; proxy lithological analyses and normalization of heavy metal concentrations to selected matrix elements are very efficient tools in this effort. The degree of contamination of floodplain sediments could only be evaluated after determination of the lithogenic (background) levels of Pb and Zn, it is necessary to avoid sediment profiles with not guaranteed horizontal stability of the metallic pollutants, i.e. both strata with signs of gleying and with high sand content (crevasse splays and levees). The age model of sedimentary sequences was obtained by measurement of 137Cs activities with maxima corresponding to the accident in NPP Chernobyl (1986) in Brno Dam and the Morava River floodplain respectively and to the nuclear tests in atmosphere (1950's – 1960's), reliably observed only in Brno Dam. The construction of the Brno dam (1940's) and the erection of flood defences (1930's) in floodplain in the Strážnice area were also used. In each profile of Morava River floodplain and of Brno Dam we found well defined onset of both Pb and Zn contamination (between 1900 and 1930's) followed by shifted of Pb (peaked in the 1950's) and Zn loads (peaked in 1960's), i.e. slightly delayed Zn contamination peak. The shift could have been caused by different regional sources of Pb and Zn (coal burning, leaded gasoline use, and zinc plating for mass scale corrosion protection of steel). These shifts could be used for indirect dating of sedimentary profiles. All the mentioned sources of Pb and Zn contamination have been scattered in Central European countries and hence affected also moderately industrialized and even rural areas with no important local pollution sources. A similar development of historical contamination could be expected in many other European countries.