



Historical record of high mercury contamination in the Babeni reservoir (Olt River, Romania)

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The Olt River is the largest and longest Romanian tributary of the Danube River. The natural hydrology of the Olt River has been fundamentally modified by the construction of numerous reservoirs in the 70's. Three of these reservoirs (Valcea, Govora and Babeni) are located close to the highly industrialised area of RM Valcea, with chemical industry contributing to a significant and multi-component regional pollution. In particular, chlor-alkali plant, which till 2000 used mercury-based technology, is supposed to be responsible for mercury pollution in the region. To evaluate the current status of mercury pollution in the Olt River and in the reservoirs, a joint Swiss-Romanian project is carried out in the framework of ESTROM programme. One of the objectives of the project is to evaluate the history of mercury contamination by examining mercury evolution in the sedimentary column in the Babeni reservoir, located downstream the channel carrying wastewater from the chlor-alkali plant. For comparison another core was collected in the upper reservoir (Valcea). In addition, to better characterise the current status of sediment contamination, numerous surfaces sediment samples were collected in all reservoirs.

Sediment cores were cut longitudinally and sedimentary features examined. Subsamples were taken for total mercury analyses (AMA 254 mercury analyzer), as well as for ^{137}Cs activity measurements with gamma-spectrometry in order to establish sediment chronology. Grain size distribution was determined by laser diffraction, using a Coulter LS-100 particle size analyzer.

The texture was fairly homogeneous in the cores but there was some lamination. Grey

and dark-grey laminas were often alternated in clayey silt. Some layers contained minor amount of sand (up to 7%). The surface sediment was oxic in the two cores (Valcea and Babeni).

In surface sediments, the highest total mercury concentration ($21 \mu\text{g/g}$) was found in the river immediately downstream the industrial discharge, upstream from the Babeni reservoir. Such high concentrations are comparable to the total mercury concentrations in sediments disposed from the Minamata Bay in 1997 (Tomiyasu et al 2006). Much lower values ($0.11\text{-}0.66 \mu\text{g/g}$) were found in Govora and Valcea reservoirs.

Historic Hg contamination was observed in cores. Mercury measurements in a sediment core from the Valcea reservoir provided a local background level, with low and fairly constant concentrations $0.093 \pm 0.008 \mu\text{g/g}$ (mean \pm standard deviation, $n = 62$). In contrast, high Hg concentrations and strong variations with depth were observed in the core collected in the lower part of the Babeni reservoir. Several strong peaks could be distinguished in older sediments (30.3 and $44.5 \mu\text{g/g}$ at $88\text{-}89$ cm and $111\text{-}112$ cm depth, respectively). The ^{137}Cs activity measurements dated these peaks at 1991 and 1987 respectively. In more recent sediments a remarkably high concentration was also observed ($8.10 \mu\text{g/g}$ at $12\text{-}13$ cm depth) although, in general, the concentrations of Hg decreased toward surface.

This study testifies a considerable contamination of surface sediments with mercury and exceedingly high mercury level in the historical record provided by the sediment cores. Recent research in Minamata Bay sediment shows $3.64 \pm 1.64 \mu\text{g/g}$ (mean and standard deviation, $n = 9$) of total mercury in surface sediment in an undredged area (Tomiyasu et al 2006). This comparison strongly suggests that mercury pollution level in the RM Valcea area could seriously impair the ecosystem and human health.

Key words: mercury, reservoir, sediment, historical record, Olt River