SPATIAL DISTRIBUTION OF ECOTOXIC METALS IN THE SURFACE SEDIMENTS OF THE RIJEKA HARBOR

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Heavy metals introduced by human activities in the marine environment accumulate in sediments and thus are useful indicators for anthropogenic inputs. For this reason several studies, aimed at evaluating heavy metal contamination in the world harbors, have focused on the sediment compartment. However, sediments are not only a sink, but may act as source of metals in the marine environment.

Port of Rijeka is located in northern part of eastern coast of the Adriatic Sea in the Kvarner Bay. The year 1281 passed in history as the year of the first dated record of Rijeka harbor and its operations. Since then the harbor port operation grow and now the Rijeka harbor is main and the biggest port in Croatia.

Sediment samples were collected at the 10 sampling points in June 2008 by using Uwitec gravitational corers (Ê 6 cm) with PVC tube (120 cm). 9 sampling points were located in the area of Rijeka harbor, and reference sample 2 kilometers in front of harbor. Depending on the bottom conditions, sediment columns up to 35 centimeters were sampled. Sampling locations, shown in Figure 1, were determined by GPS instrument Garmin GPS Map 76 CSx (Kansas City, USA), with the accuracy of ± 5 m and plotted with the Surfer Version 8.00 software (Golden Software, Inc., USA).

Sediment columns were cut in 5 cm slices and kept in plastic bags at 3 °C until analysis were performed. The sediment slice thickness was found to be optimal to determine relevant sediment dating related to particular sedimentation conditions. The sediments were wet sieved using ambient water at Sieve shakers AS 200 Digit and the finest fraction (<63 Ìm) was separated for future analysis.

Chemical analyses were performed in the ACTLABS commercial laboratories (www.actlabs.com), Ontario, Canada, by means ICP, ICP-MS and by cold vapor AA for Hg determination. Chemical content was obtained for 63 elements and in this paper Hg, Cr, Ni, Cu, Zn, As, Cd, Pb and Ag were evaluated.

In this work, aluminum was chosen as the conservative element for the normalization of the chemical elements concentration ([X] sample/[Al] sample), as Al is assumed to have a uniform flux to the sediments from the crust rock sources, and changes in the water, salt, $CaCO_3$ or organic matter contents can be compensated.

Contour maps were used to illustrate spatial variations in the data sets using for Windows (Golden Software Inc., version 8). The Krigging algorithm was employed as the interpolation method.

In general, by using Contour maps two groups of normalized concentrations of trace metals in surface sediment spatial distribution were presented. In first group most abounded elements were Zn, Pb and As, almost certainly brought to the sediment from Petrol industry located in NW part of Rijeka harbor. The second group, source of elevated concentrations (Cr, Ag, Ni, Hg, Cd, Cu) is probably result of the old municipal sewage water pipe and and of ?death channel? of the Rijeãina River, as well as the port activity (bulk cargo transport) in that part of harbor. The contour Maps were very helpful to distinguish these two main sources of pollution.