

Interpretation of Geochemical Data for Assessing Sediment Contamination in Two Major Mediterranean Ports

K. KOSTAKIS¹, E.M. SKORDAKI², G.
PAPATHEODOROU², G. FERENTINOS² AND I.
GEORGIOUDIS¹

¹Department of Civil Engineering, Technological Education
Institute of Piraeus, 12244 Egaleo, Greece,
katerina.kostakis@usask.ca

²Laboratory of Marine Geology and Physical Oceanography,
Dept. of Geology, Univ. of Patras, 26500 Patras, Greece

The present research has been funded, through the ARCHIMEDES Project, by the European Union and the Greek government in an effort to monitor the impact of anthropogenic activities on the Greek coastal marine environment. The distribution of heavy metals and rare elements in marine sediments of two major ports in Greece has been examined, namely Piraeus and Patras. The objectives of the study were to assess the levels of sediment contamination with respect to average concentrations in the area, to examine the relationship between the different chemical elements and their distribution and to identify possible sources of contamination that can explain the spatial patterns of soil pollution in the area.

The detection of the metal concentrations involved a sensitive technique that included the pre-treatment of the samples by a 2% HNO₃ partial leaching method. Partial leaching of the samples was employed in order to release the metals that were adsorbed on the surface of the sediment samples. The measurements of the metal concentrations were conducted by the application of high resolution inductively coupled plasma mass spectrometry (HR-ICPMS) methods.

Preliminary results have indicated elevated concentrations of various metals (As, Cu, Ni, Zn, Mn, Fe, Cr) in surface sediments collected from the Central Port of Patras. In addition, the results show that the metal concentrations and distributions in this coastal environment depend considerably on the content of clay, organic C and carbonate minerals in the surface sediments of Patras Port.

A comparison of lateral and vertical variability of concentrations was performed using analysis of variance (ANOVA). Factor analysis was also used to group the elements with similar behaviour, thus identifying common origins of pollution, whether natural or anthropogenic.

All sediment samples from Piraeus Port exhibit elevated Zr, Sn, W, Ag, Cd, As and Fe. Interestingly, the rare earth elements results for the samples from Patras Port show a correlation between the increased metal concentrations and the levels of Y, Ce, Dy, Gd, Er and Yb. Similarly, the elevated rare earth elements' concentrations in sediments collected from Piraeus port show a relationship with the high Zr, Sn, W, Ag, Cd and As levels in the same samples.