

Metal Pollution Assessment in Sediments of the Bulgarian Black Sea Coastal Zone

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Introduction: Sediments play a significant role as sensitive indicators for monitoring contaminants in aquatic systems. Heavy metals pollution is one of the major environmental problems in the Black Sea. The Bulgarian Black Sea coastal zone is affected by anthropogenic activities.

Sediment Quality Guideline (SQG) is used and geo-accumulation index (Igeo), Enrichment factor (EF), Contamination factor and Pollution Load Index (PLI) are calculated to evaluate contamination levels of the Black Sea.

Methods: Sediments were collected in 2005 and 2016 in 1 nm zone. Twenty-two samples from WFD monitoring stations were selected for that investigation. Sediment samples were collected using a Van Veen grab and analyses with AAS. The investigated parameters are Zn, Pb, Ni, Hg, Cu, Cd.

Results: Sediments were classified as: non-polluted, moderately polluted and heavily polluted, based on SQG of USEPA (Sany et al., 2011). As a slightly polluted were classified regarding Zn - st. Kaliakra, Pb – st. Krapets and Kaliakra, Cu – st. Kaliakra, Burgas and st. Rosenets in the area of copper mining as severely polluted with Cu.

According to the Igeo index (Muller 1979) calculated at each station, metal enrichment level was assessed as uncontaminated to moderately contaminated with Zn - st. Kaliakra and with Pb - Northern Danube influenced zone – st. Krapets, Rusalka, Kaliakra, Galata.

According to the Enrichment factor (Pekey, 2006) contamination was assessed as moderate regarding Pb and minor for the other elements.

Based on the contamination factor (Håkanson, 1980) st. Kaliakra, Galata, Rusalka were classified as moderately contaminated with Pb, st. Kaliakra with Zn and st. Varna Bay and Galata considerably contaminated with respect to Hg.

Finally, the calculated Pollution Load Index indicated low contamination (Tomilson et al., 1980).

Factor analysis was applied to summarize the spatial pattern of metal distribution. As a result, the stations with the highest anthropogenic load were identified as the sites with the highest concentrations of Pb, Ni and Cu (Figure 1).

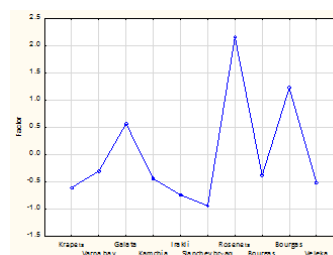


Fig. 1: Scores of Factor analyses.

Discussion: The mean concentrations were compared with the hot spots concentrations in period of 1990's (Simeonov et al., 2000) and the other Black Sea regions (Coban et al., 2009) (Tab. 1). Direct comparison with the previous period is not possible because of different sites and analytical methods but it is obvious that the values of Pb and Ni were lower than those of the current investigations. Although the results are not unequivocal, the comparison with other Black Sea regions shows that the level of metal enrichment is not high.

Table 1. Concentration of heavy metal (mg/kg dry weight).

	Zn	Pb	Ni	Hg	Cu	Cd
Bulgaria, 2005, 2016	44.57	19.75	18.01	0.04	18.96	0.20
Bulgaria 1990's	70.00	15.96	12.96		80.00	0.81
Romania	64.60	1.70	66.40		33.20	0.75
Ukraine	114.00	15.00			117.00	2.10
Georgia	3.35					2.70

The Northern Danube influenced area of the Bulgarian coastal zone was categorized according to applied indices as slightly polluted with Zn and Pb. The sediments from the "hot spot" points are with higher accumulation of Ni, Cu and Pb.

Although the results are preliminary, they do not reveal high pollution levels in the Bulgarian coastal zone.

References: [1] Sany, B.T. et al. (2011) World Academy of Science, Engineering and Technology 74:639-643; [2] Muller G., (1979) Umsch. Wiss. Tech. 79:778-783; [3] Pekey H (2006) Marine Pollution bulletin 52:1197-1208; [4] Hakanson L. (1980) Water Research. 14:975-1001; [5] Tomilson D.C. et al (1980) Helgol Meeresunters, 33:566-575. [6] Simeonov V. et al. (2000), Chemosphere 41:1411-1417; [7] Coban, B. et al. (2009) Journal of Black Sea/Mediterranean Environment, 15(1).