INVESTIGATION OF METAL ACCUMULATION IN SURFACE SEDIMENT IN SÜRMENE BAY OF THE EASTERN BLACK SEA

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Abstract
The objective of this surface sediment study was to determine the concentration levels of metals (Cr, Mn, Al, Co, Ni, Cu, Zn, As, Mo and Pb) in spatial extent and relationship with other potential causative factors (sediment grain size, other physical and chemical characteristics of the sediment). These current metal levels were compared with the ground values to determine the status of the metal enrichment in Sürmene Bay surface sediments (located between 40°57'27" N - 40°17'15" E and 40°56'05" N - 40°04'56" E is in the Trabzon city of the Eastern Black Sea Region).

Keywords: Black Sea, Metals, Sediments, Pollution

Introduction
Sediment is a natural contaminant accumulation area in marine environment. Contaminants from various sources are transported to the coastal area and finally accumulate on sediment layer [1]. Pollutants have some catastrophic effects on aquatic life and living organisms as they can cause to transition and accumulation of metal contents in oceanic environment. This situation can lead to elevated metal concentration in surface sediments and known as metal enrichment mechanism. This elevated concentration are generally well correlated with particle grain size distribution [2].

Material and Methods
Sediment samples were collected from 17 stations located on Sürmene Bay in December, 2011 and composed of samples after subsampled from the top 2 cm from each stations (Figure 1). All sediment samples were preserved at -18 °C. Grain size were classified according to Folk [3]. pH and Oxidation Reduction Potential (ORP) were measured using a Hach Lange HQ40D multi meter. Total Organic Carbon (TOC) was determined using Walkley-Black titration method [4]. Carbonate levels were measured by Piper method [5]. Enrichment Factor (EF) was computed by applying Cukrov method [2]. Metal analysis (Cr, Mn, Al, Co, Ni, Cu, Zn, As, Mo and Pb) was performed using sediment passed through a sieve with 63-micron in this study. Analysis after digestion in the closed microwave digestion system were determined using ICP-MS (inductively coupled plasma mass spectrometry) The Collison Reaction Interface (CRI) was used during the determination of As. Both Sc and In (50 ppb) were added to all standards, blanks and samples and acted as internal standards. All data were given mg/kg dry weight (dw). In this study spearman correlation was performed to evaluate variables.

Results and Discussion
The silt fractions were generally dominant (50%) according to distribution of grain size in sediment samples. Minimum and maximum values were determined for carbonate as 8.54-18.05%, for total organic carbon as 0.26-2.43%, for pH as 6.91-8.24 and for ORP as 159-269 mV. Sediment metal levels (mg/kg dry weight) were determined for Cr as 13.4-82.3, for Mn as 200-447, for Al as 19965-48723, for Co as 8.0-32.8, for Ni as 9.8-26, for Cu as 24.9-3107, for Zn as 102-4259, for As as 5.4-58, for Mo as 0.21-20, for Pb as 15.5-208. Results were compared with earth’s crust and the average shale values. Concentrations of Al, Cr, Mn and Ni were found to be higher than the earth’s crust and the average shale values while concentrations of Co, Cu, Zn, Mo and Pb were characterized with relatively lower figures. Based on calculated EF values deficiency low enrichment values were found for Cr, Mn, Co and Ni, moderate enrichment value was found for Pb, significant enrichment values were found for Zn, As and Mo, and very high enrichment value was found for Cu in the study area.

Fig. 1. Map of the sampling area

References