

DETERMINATION OF METAL CONCENTRATIONS IN SURFACE AND TRAPPED SEDIMENT OF THE GOLDEN HORN ESTUARY, ISTANBUL

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Introduction

The Golden Horn Estuary exposed many pollutants due to domestic and industrial waste dischargers and also atmospheric deposition. Besides, it is located in the centre of Istanbul metropolitan and there are also two freshwater inputs into the Golden Horn through Alibeyköy and Kağıthane creeks at the western end, opposite the Bosphorus strait. Considering all these characteristics of this aquatic environment, it is important to investigate the levels of the metals (Ag, Al, As, Cd, Cu, Co, Cr, Fe, K, Mg, Mn, Mo, Na, Ni, Pb, Sn, Tl, V and Zn) using samples of surface and trapped sediment since sediment is the main accumulation matrix of marine environment. Therefore, the present study contributes a comprehensive data set to the literature regarding the concentrations of metals in the Golden Horn.

Methods

Surface sediment samples were collected seasonally from 14 locations in the Golden Horn Estuary from February 2013 to January 2014 (Figure 1). Also two sediment traps were established to see current levels of metal contamination during 18 months (June 2013-December 2014). All samples were dried at $-50\text{ }^{\circ}\text{C}$ to constant weight in a freeze dryer and homogenized. The samples were digested using a microwave digestion system (MILESTONE). From each sample, 0.25 g of sediment was put into a Teflon vessel, to which was added 4 ml of concentrated (37%) HF and 6 ml of concentrated (65%) HNO₃. All samples were measured using ICP-MS.

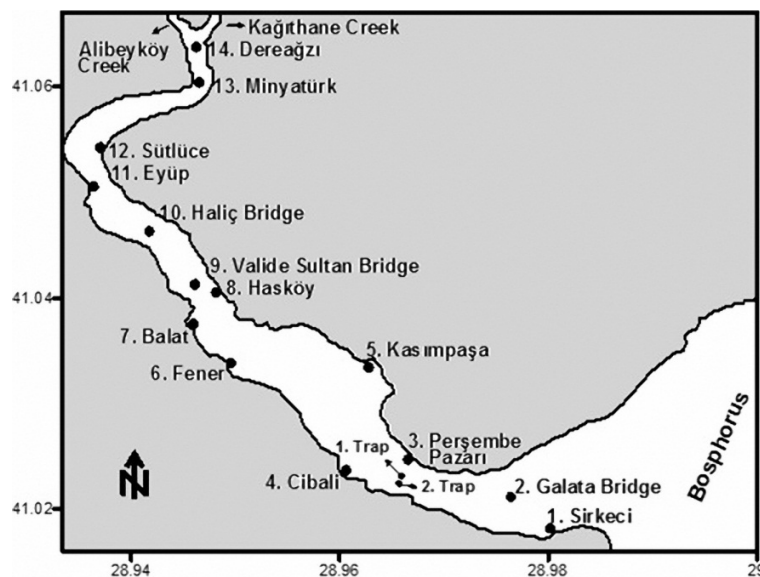


Figure 1. Study area and sampling locations

Results

In the present study, element concentrations were found to decrease in order as Al – Fe > K > Mn > Zn – Pb > Cr > V – Cu > Ni > Co > Sb > Cd > Ag in surface sediment samples. Enrichment factor (EF) was calculated to see contribution of contamination by artificial activities. It was observed that enrichment factors of Ni, Cu, Cr, Zn and As are higher than 1 whereas enrichment factors of Cd and Pb are lower than 1. Besides it was seen that metal concentrations in trapped sediment are generally slightly lower than the concentrations in the surface sediment.

Conclusion

In the present study, it was seen that the concentrations of the elements are comparable with the levels of similar studies in the literature (Kut et al., 2000; Balkıs et al., 2007; Kılıç and Belivermiş 2013). The investigation of metal concentrations in trapped sediment indicated that there is a relationship among the concentrations of biogenic elements (Cd, Ni and Zn). Also other relationship was observed among the concentrations of lithogenic elements (Al, As, Co, Pb and V). The low metal concentrations in sediments of the inner part are mostly related that which have been removed from the inner part of the estuary during the rehabilitation period by Istanbul Municipality (Coleman et al., 2009). Also relatively low metal concentrations were in outer part of estuary which is probably due to higher circulation and current rate of water.

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References

- Balkıs N, Topcuoğlu S, Guven K, Öztürk B, Topaloğlu B, Kırbasoğlu Ç, Aksu A (2007) Heavy metals in shallow sediments from the Black Sea, Marmara Sea and Aegean Sea regions of Turkey. *Journal of Black Sea/Mediterranean Environment* 13:147–153.
- Coleman HM, Kanat G, Aydinol Turkdogan FI (2009) Restoration of the Golden Horn Estuary (Haliç). *Water Research* 43:4989–5003.
- Kılıç Ö, Bellivermiş M (2013) Spatial and Seasonal Distribution of Trace Metal Concentrations in Mussel (*Mytilus galloprovincialis*) and sediment of Bosphorus and Golden Horn. *Bulletin of Environmental Contamination and Toxicology* 91:402-408.
- Kut D, Topcuoğlu S, Esen N, Küçükcezzar R, Güven K (2000) Trace metals in marine algae and sediment samples from the Bosphorus. *Water, Air, and Soil Pollution* 118(1):27–33.