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Magnetic susceptibility as an indicator to paleo-environmental pollution in an urban lagoon near Istanbul city

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For assessing anthropogenic pollution, magnetic susceptibility profiles and accompanying data were measured along three short cores recovered at the southern part of an urban lagoon; Kucukcekmece, Istanbul, Turkey. This marine inlet, connected to the Sea of Marmara by a very narrow channel, was used as a drinking water reservoir 40-50 years ago before it was contaminated by municipal, agricultural and industrial activities, mainly carried by three streams feeding the lagoon. The magnetic signals decrease gradually from the lake bottom towards the core base showing some characteristic anomalies. These signatures were tested as an environmental magnetic parameter against the lithological diversity (silici-clastic, total organic matter and carbonate), metal enrichments with larger variations (Pb, Mn, Zn, Ni, Co, Cr, U and Al) and probable hydrocarbon contamination. Mineral assemblage was determined by a computer driven X-ray diffractometer. The heavy metal concentrations and total petroleum hydrocarbons (TPH) were measured by ICP-MS and UVF spectrometry, respectively.

Magnetic susceptibility shows slightly higher values in interlayers containing higher silici-clastic material and organic content which may suggest first-order changes in the relative supplies of terrigenous and biogenic materials. On the basis of cluster analyses, enhanced magnetic signals could be correlated with the elevated concentrations of Co, Zn, U, Pb and TPH along the cores. The Pb concentrations at the upper parts of the cores were higher than the “Severe Effect Level” and could pose a potential risk for living organisms. Greater amounts of organic carbon tend to accumulate in muddy sediments. In fact, there are a few studies reporting some relationship between enhanced magnetic signals and organic contamination mainly due to petroleum aromatic hydrocarbons.

In conclusion, the magnetic susceptibility changes in sedimentary depositional environments could be used as a rapid and cost-effective tool in identification of silici-clastic content, enrichment of some metals (iron cycling and bacterial activity) and increased TPH concentrations in hydrocarbon contaminated sediments along the cores.