SEASONAL VARIABILITY OF DISSOLVED TRACE ELEMENTS AT TWO STATIONS OF THE AEGEAN SEA

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Abstract

Dissolved trace elements (Cd, Co, Cu, Fe, Ni, Mn, Pb) were measured on a seasonal basis at two Stations (MNB1, MSB1) in the North and South Aegean Sea, respectively. From the results obtained it appeared that the differences in the hydrology and input sources of the two sub-areas (North and South Aegean) are reflected in the distribution of trace elements. The seasonal variations observed were more pronounced for Mn and Cd, and are related to the strength of the input sources rather than to biological processes.

Keywords: Trace elements, surface waters, Aegean Sea, Eastern Mediterranean

Introduction

The North Aegean Sea represents a Mediterranean regime with both coastal and pelagic characteristics. The area receives fresh and brackish water inputs from three major rivers (Evros, Nestos, Strymon) situated along the northern Greek coastline and from the Black Sea and the Sea of Marmara through the Dardanelles Straits. It has been well documented that the surface layer of the North Aegean is largely affected by the presence of the above mentioned inputs (1). On the contrary, the South Aegean is unaffected by coastal runoff or the Black Sea outflow, and it is considered as a more typical pelagic area of the Mediterranean. The scope of this presentation is to show whether the above mentioned differences in the hydrology and input sources of the two sub-areas (North and South Aegean) are depicted in the distribution of trace elements.

Methods and Materials

For this purpose we present dissolved trace metal (Cd, Co, Cu, Fe, Ni, Mn, Pb) concentrations for two locations in the Aegean Sea on a seasonal basis. The location 40.16,00N 25.12,00E (MNB1) in the North Aegean was sampled five times in the period from March 97 to April 98 (3/97, 5/97, 9/97, 2/98, 4/98) and the location 35.44,70N 25.06,00E (MSB2) in the South Aegean was sampled three times (3/97, 9/97, 4/98) during the same period. The above Stations were chosen because they depict the prevailing trends in these two sub-areas. During sampling and analysis precaution was taken against contamination and "clean techniques" were applied. The analytical method used is presented elsewhere (2). Trace element concentrations were determined by graphite furnace AAS, a Perkin Elmer 4100, HGA 600. The accuracy of the method was tested against a certified reference seawater sample (NASS-4). Salinity data were taken from the CTD profiles.

Results and Discussion

Mean Cd concentrations at Station MNB1 exhibit maximum values of 0.128 nM and 0.109 nM during spring and summer, respectively, which fall to 0.047 nM during winter. This seasonal pattern, although less pronounced, is followed at Station MSB1 too, with mean Cd concentration 0.103 nM in spring and 0.071 nM in winter and summer. Copper showed similar concentration levels in both areas during all seasons with values fluctuating around 2.00 nM. Mean Ni concentrations were slightly higher at Station MNB1 (5.40 nM in winter, 6.94 in spring and 5.25 nM in summer) than at Station MSB1 (3.58 nM in winter, 4.93 nM in spring, 5.25 nM in summer) and no clear seasonal pattern could be established for this element. Manganese shows increased concentrations at Station MNB1 compared to those of Station MSB1. In particular mean Mn concentration at MNB1 during winter and spring is 2.36 nM and 2.02 nM respectively and peaks to 3.68 nM during summer. At Station MSB1 mean Mn concentrations are low, 1.18 nM in winter and 1.00 nM in spring, but peak to 2.35 nM in summer. So in both areas there is a clear trend with increasing Mn concentrations during the summer months. Cobalt was measured only in the North Aegean Station (MNB1) during summer and spring and showed mean concentration values of ~0.190 nM. Lead and iron were measured at both stations only during summer (9/97) and spring (4/98). Lead showed similar concentration values in both areas ~0.2 nM. Increased Fe mean concentrations (~4.00 nM) were recorded at Station MNB1, whereas Station MSB1 showed somewhat lower Fe levels. The above-mentioned results are referring to the whole watercolumn as shown in Figs. 1 and 2.

In Figures 1 and 2, the vertical distribution of trace elements at the two sampling locations is presented along with the salinity data. From Figure 1 it is apparent that the low salinity surface layer of Station MNB1 is enhanced in trace elements. It seems that the increased fresh and brackish water inputs in the North Aegean carry significant amounts of trace elements, which result in elevated trace element levels in the surface layer. This is very clearly depicted in the case of Mn, where the very low salinity values of September '98 correspond to maximum Mn concentrations. It is obvious that the above-described feature weakens any nutrient-like behaviour expected from elements such as Cd, Cu and Ni and strengthens the scavenging character of elements such as Mn, Fe, Co and Pb. The scavenging character is also clearly depicted in Figure 2 for Station MSB1 in the South Aegean. In contrast to the North Aegean situation, in the South Aegean there is neither surface enhancement nor surface depletion for elements Cd, Cu, and Ni and it seems that any nutrient-like behaviour present is very weak and not clearly detected from the present data set. It should be noted here, that this feature is common in the Western Mediterranean Sea too (3), and has been attributed to the proximity of land sources and the oligotrophic character of the Mediterranean Sea.

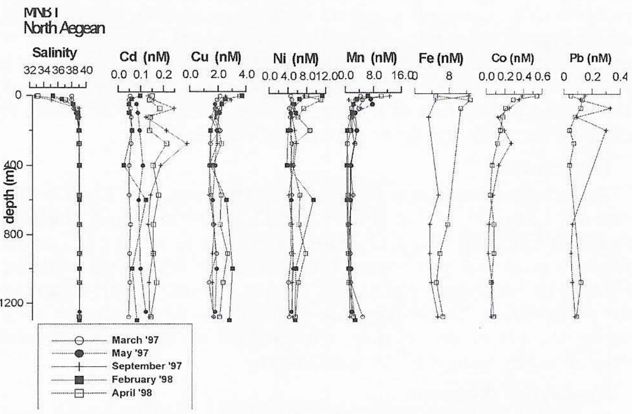

Figure 1: Vertical profiles of salinity and trace elements in the North Aegean Sea

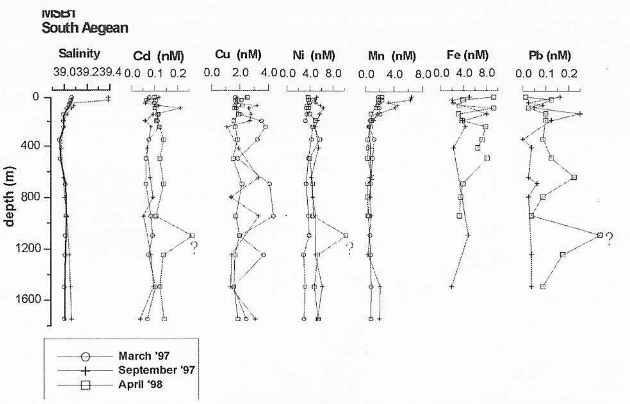

Figure 2: Vertical profiles of salinity and trace elements in the South Aegean Sea

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