

An Account of the Levels of the Dissolved and Particulate Trace Metals in the Amvrakikos Gulf

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The Amvrakikos Gulf, from ecological and fisheries point of view, is one of the most important coastal areas of Greece. It is a basin of 455Km<sup>2</sup> with max depth of 60m, surrounded by lagoons receiving the outflow of two rivers. It is connected to the Ionian Sea through a narrow (500m width) and shallow (10m depth) natural channel. Virtually nothing is known about the metal levels in its waters apart from a preliminary report of our group. (Scoullou et al, 1986)

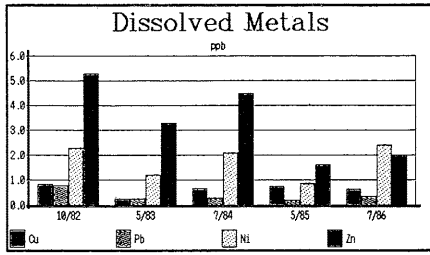


figure 1

The purpose of the present paper is to establish average seasonal levels of Cu,Zn,Pb and Ni as they were obtained from a grid of 15 stations sampled during a five year period (1982-1986). (fig. 1, 2)

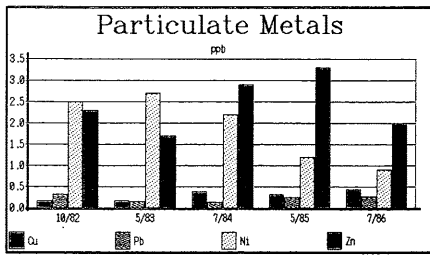


figure 2

Seawater samples were collected using polypropylene IOS bottles and plastic coated steel wires. The samples were filtered through 0.45µ Millipore filters which were treated in PTFE covered beakers with conc. HNO<sub>3</sub> whereas dissolved metals were preconcentrated on Chelex-100 resins using a slight modification (Scoullou and Dassenakis, 1984) of the Riley and Taylor (1968) method. The metals were determined by flameless AAS. From the five samplings presented here one represents autumn (October 1982), two represent spring (May 1983 and 1985) and two summer (July 1984 and 1986).

The most prominent characteristic followed by all metals is the autumn maximum of their concentrations, particularly of the dissolved species of Cu, Pb and Zn and the particulate phase of Pb and Ni. This phenomenon is attributed to the breakdown of the very stable thermocline which enriches the entire water column with metals accumulated in the near bottom layers throughout spring and summer and also to the contribution of washout of the land and the atmosphere after the first rains. The two spring samplings offer in general comparable levels of dissolved Pb and Ni, particulate Pb and total Zn although the percentage contributions of the two phases differ. The spring 1985 Cu concentrations, however, were significantly higher than those of the same period of 1983, influenced mainly by much higher levels observed in the deeper waters. (fig.3)

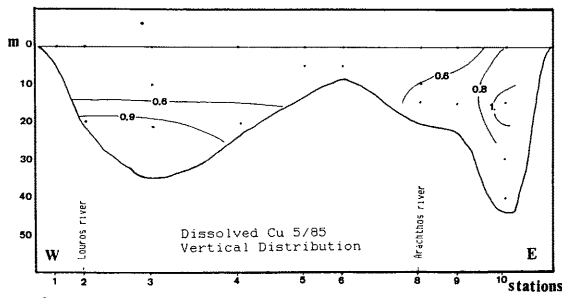


figure 3

The summer samplings of 1984 and 1986 also provide comparable levels for most metals (e.g. in ppb, for total Cu =1.05 and 1.06; Pb=0.43 and 0.58; Ni=4.3 and 3.3 respectively) whereas for Zn the 1984 value 7.4 ppb is nearly double of the 1986 one (4.0 ppb).

It is noteworthy that due to the morphological characteristics of the gulf a prominent stratification prevails already in May. The density gradients allow the surface waters to flush out rapidly, whereas the deep water mass is trapped in the gulf for long periods. The accumulation of all metals below the thermocline is clearly demonstrated during the summer.

The percentage contribution of the dissolved phases to the total is significant (50-70%) for all metals mentioned above. In the 1984 sampling some extremely high values were observed at stations of the western part of the gulf influenced directly by the town of Preveza and the Ionian sea.

References

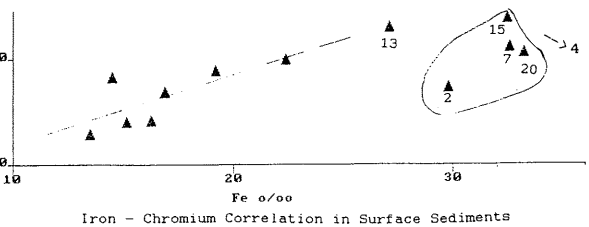
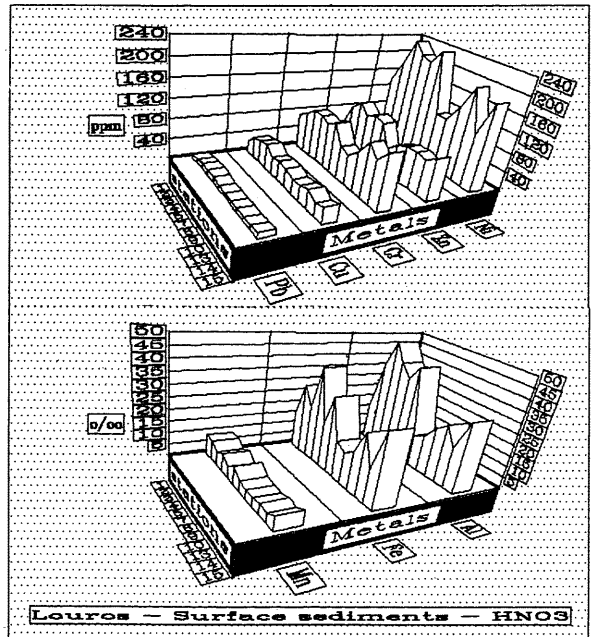
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General Trends in Trace Metal Distributions of Louros Estuary Sediments

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The estuary of the river Louros is located within the semienclosed Amvrakikos Gulf which is connected to the Ionian sea, in the north-western coast of Greece. Previous works on metals in the estuary are scarce. (Scoullou et al. 1986, 1988) The present paper summarises our results on trace metal studies in the Louros river estuary from a trench of 15 stations extended from a site within the river located approximately 30 Km upstream from the river mouth to a station placed 4 Km offshore. Station 1 is clearly a riverine one and no traces of saline water were determined during the samplings. Station 16 could be considered as a marine one, whereas at station 2 in a distance of 5.5 Km a very thin layer of saline water S<sub>w</sub>=25.6‰ was observed near the river bed.



Sediment samples were collected by using a Mackereth (1969) minicorer. All chemical treatments were performed on the <61µm sediment fraction. The samples were treated with conc. HNO<sub>3</sub> in PTFE beakers and for the extraction of the labile metal the samples were leached for 12 hours with 0.5 N HCl (Agemian and Chau, 1976). The carbonate content was determined as a weight difference before and after the HCl leaching. Organic carbon was determined by using the Gaudette et al (1974), method. The carbonate content of the sediment is relatively stable and high fluctuating around 30%, whereas the carbon content in the upper part of the river (st 1) is around 0.6 % and in the intermixing zone around 2.3%. The relative invariability in the concentrations of several metals (Fe, Cr, Ni) extracted by diluted HCl could be attributed to a significant contribution of the Fe, Cr and Ni connected with carbonates in their HCl extracted fraction throughout the estuary. This is not the case for a series of other metals such as Pb, Cu, Mn, Cd and Zn which show an important variability and in general higher values in the riverine stations and the upper limits of the intermixing zone and a relative decrease in the area around the sill and the mouth of the river. The concentrations tend to increase again offshore, a tendency also followed by Cd. This indicates that considerable percentage of extractable forms in the river mouth area, is not related with carbonates but are coprecipitated and trapped with organics etc. The HNO<sub>3</sub> extractable Mn, Cu and Pb follows the same distribution as their HCl extractable fractions. The even distribution of the difference Me<sub>HNO3</sub>-Me<sub>HCl</sub> might reflect a relative homogeneity of the mineralogy of the sediment, for the above mentioned metals, within certain limits. It is noteworthy that the HNO<sub>3</sub> extractable fraction of Fe, Cr and Ni varies considerably from station to station. Considering the interelemental ratios one could identify good linear correlations between Cr, Ni and Fe a feature rather common in many estuaries. This correlation is not followed, in a group of stations where Fe has particularly high concentrations (Fe>25‰). In the same envelope, station 20, (Tsopele lagoon) is included indicating that the given sediments (st. 2,4,7,13,15) are most likely influenced by sediments rich in Fe<sub>s</sub>, formed in the adjacent lagoons and finding their way to the river. The good correlation with Fe is also followed by Zn and Cu.

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