FACTORS INFLUENCING THE ACCUMULATION OF HEAVY METALS INTO THE COASTAL SEDIMENTS OF LESVOS ISLAND, GREECE

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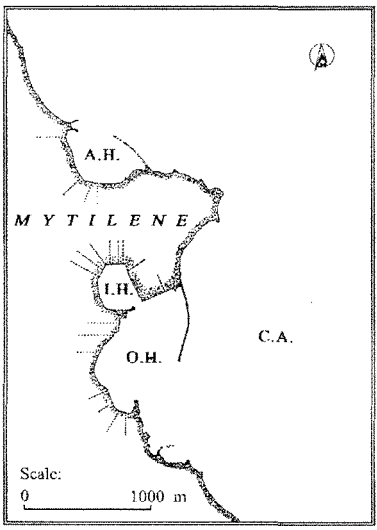

Figure 1. Study area

The urban effluents discharged into the marine coastal environment are carrying important loads of organic matter and metals (KLEIN *et al.*, 1974), in dissolved/colloidal or particulate form, which, after flocculation in the marine environment (GIBBS, 1986), settle to the bottom and are incorporated into the coastal sediments. A study conducted in the marine coastal environment of Lesvos island, near the city/harbour of Mytilene, investigated the concentrations of organic matter and heavy metals in the sediments of the area and attempted to identify the factors that influence their accumulation. The analytical techniques are presented elsewhere (ANGELIDIS *et al.*, 1994). The study area is presented in Figure 1. Along this coast, 25 sewage outfalls are discharging urban effluents containing important metal concentrations. In the Table 1 are presented the range of organic carbon and metal concentrations (0.5 N HCl extractable fraction) in four different areas : the inner harbour (IH), the outer harbour (OH), the ancient harbour (AH) and the coastal area (CA).

In general, Cu and Zn which are the most effluent associated among the metals analyzed (KLEIN *et al.*, 1974), presented higher concentrations in the harbour sediments compared to the coastal area sediments. However, among the three harbours, the inner harbour presented the highest and the ancient harbour the lowest metal concentrations. Furthermore, the sediments from the ancient harbour had very low content of fine sediments and organic carbon, although the area also receives city effluents through a number of sewage outfalls (Figure 1). Since fine particles tend to transport the most important metal load in the sediments (GIBBS, 1977), the lack of fine sedimentary material in the ancient harbour, seems to be a key factor for the low metal concentrations found there. Because the area of the ancient harbour of Mytilene is located at the north of the city and is open to the prevailing strong northern winds of the Aegean sea, wind induced waves may resuspend and remove the finer particulate matter as well as the effluent-born flocculated colloids from the area, removing thus the greater metal load. Organic carbon load is also small in the ancient harbour sediments, probably because of the same removal process of the organic rich particulate matter, as well as because of the oxidation which is induced by the rapid change of the water masses. On the other hand, in the sheltered area of the inner harbour (as well as in the western part of the outer harbour near the city shore), the organic and metal-rich fine particulate matter settles to the bottom and remains generally undisturbed, leading thus to the accumulation of pollutants into the harbour mud. From the above preliminary investigation the following conclusions can be drawn:

	IH	OH	AH	CA
silt-clay %	65.9-95.6	26.2-78.5	0.3-3.6	27.6-75.6
O.C %	3.3-4.8	1.9-4.3	0.1-0.9	1.4-3.4
Cr µg/g	15.8-19.3	13.7-17.1	13.2-13.4	13.2-16.0
Cu µg/g	30.7-58.9	16.7-30.4	12.6-32.7	9.4-17.5
Fe mg/g	3.7-4.2	1.8-4.0	1.8-2.3	2.3-3.8
Mn µg/g	99.7-111	103-133	87.8-92.9	95.4-133
Zn µg/g	75.0-157	27.8-105	68.8-89.3	27.9-52.4

Table 1. Concentrations of metals, O.C. and particle size in coastal sediments of Mytilene.

1. The concentrations of some metals, namely Cu and Zn, may be considerably high in the sheltered waters of harbours and anchorages receiving urban effluents and city runoff.

2. The low hydrodynamism of a coastal area seems to be a crucial parameter which allows the metal and O.C. enrichment of the sediments. On the other hand, in the exposed near shore areas, fine material resuspension and transport do not allow metal accumulation in the sediments, although the area may also receive urban effluents.

3. In the absence of other metal producing activities, urban effluents constitute an important source of metals for the marine environment. Therefore the sheltered marine areas (harbours and anchorages) near urban and tourist developments of the Mediterranean coast, may become potential metal deposits affecting thus the quality of the marine coastal environment.

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