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## Some heavy metal contents in the marine environment along the Romanian Black Sea Coast

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Between 1982-1987 a rather large quantity of data on the presence and content of heavy metals in the three major components of marine environment-- water, sediments and organisms - was accumulated (PECHEANU, 1982; PECHEANU and MIHNEA, 1986; PECHEANU and VELESCU, 1986).

The aim of this paper is to shortly present the variation range, spatial distribution as well as the determining factors on heavy metal dynamics along the Romanian coastal waters.

Water, sediments and organisms samples were collected from different areas in the shallow zones under the anthropic influence along the Romanian Black Sea coast. In order to avoid contamination they were preserved in plastic bags or bottles.

Metallic ions in sea water were determined after a previous concentration and extraction with APDC and MBIK.

Surface sediments were collected by means of a Van Veen sampler and organisms by fishing nets. After preliminary processing operations samples were digested in $HNO_3$ acid.

Heavy metal content was determined in air-acetylene flame by an atomic absorption spectrophotometer PYE-UNICAM 2900 with double beam.

In the table the lower and the upper limits for each metal in the three components between 1982-1987 are presented.

As can be notices from the table there are relatively low values for marine water in comparison with those published concerning other areas.

In the sediments the highest content was determined in samples collected in front of the Danube Delta (IV), followed by those inside the Constantza harbour (III) where different impurification sources are present. Industrial waste waters contain heavy metal quantities which are found in the nearby sediments (II). The lowest values were found in the samples taken from domestic waste water influenced area (I) because of the their origin and composition.

Concentrating ability of sessile organisms (mussels) in comparison to migratory ones was proved.

A comparison of our data even the higher ones (IV, III sediments and mussels) with those mentioned by other authors from different areas of world ocean points out that there is not a heavy metal pollution in the Romanian marine waters yet.

| | | Cu | Pb | Zn | Cd |
|---|---|---|---|---|---|
| Marine water | | | µg/l | | |
| 1982 - 1985 | | ND - 7 | ND - 13 | 1 - 91 | ND - 2 |
| | | | µg/g | | |
| Surface sediments 1982 - 1984 | I | 2 - 12 | 4 - 13 | 12 - 35 | ND - 0.4 |
| | II | 3 - 69 | 6 - 44 | 22 - 171 | - |
| | III | 32 - 47 | 48 - 51 | 109 - 120 | 1.8 - 2 |
| | IV | 108 | 78 | 154 | 3 |
| | | | µg/g W.W. / µg/g D.W. | | |
| Mussels | 30-50 mm | 1 - 2 | 0.3 - 0.7 | 31 - 47 | 0.6 - 98 |
| | 50-70 mm | 7 - 10 | - | 208 - 308 | 3 - 5 |
| | | | µg/g W.W. | | |
| Organisms* 1982-1987 | Sprat | | | | |
| | Anchovy | 1 - 2 | 0.3 - 0.5 | 15 - 28 | 0.04 - 0.13 |
| | Horse makerel | | | | |
| | Whiting | | | | |

ND - not detected

I, II, III, IV - areas under anthropic influences

* G.Munteanu and I.Pecheanu personal communications

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## Chlorophyll a in the Romanian inshore Black Sea area

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ABSTRACT: Chlorophyll a concentration as an eutrophication degree indicator, in the Southern part of the Romanian inshore is presented.

One of the most important effect produced by pollution was the high eutrophication (in µg at $l^{-1}$: $P\text{-}PO_4$ = 0.03-125; $N\text{-}NO_2$ = 0.01-4.5; $N\text{-}NO_3$ = 0.47-90; $N\text{-}NH_4$ = 0.2-19; $Si\text{-}SiO_3$ = 0.55-305) that permitted mass algal growth or heavy blooms (up to $422 \times 10^6$ cell $l^{-1}$). The phytoplankton density is not a complete indicator of the eutrophication as the community can be represented by micro- or ultrananoplankton and thus, the biomass could be different for the same number of cells. We need useful information to describe not only the number of cells but the photosynthetic capacity, too. Rather few data on chlorophyll a concentration for the Black Sea were available (BOLOGA and cowork., 1985). The present paper is based on 1,126 samples, employing SCOR UNESCO standards for chlorophyll a analyse (Table 1).

Table 1: Chlorophyll a concentration in the nearshore area (in µg $l^{-1}$)

| Year | Size range | Min. and max. | n | $\bar{x}$ | $\sigma^2$ | SD ($\sigma$) |
|---|---|---|---|---|---|---|
| 1983 | 0 - 1 | 0.03 - 0.88 | 57 | 0.50 | 0.08 | 0.28 |
| | 1 - 5 | 1.02 - 4.86 | 86 | 2.41 | 1.01 | 1.01 |
| | 5 - 10 | 5.13 - 9.77 | 23 | 6.99 | 1.80 | 1.34 |
| | > 10 | 10.35 - 185.32 | 55 | 34.61 | 1285.30 | 35.85 |
| 1984 | 0 - 1 | 0.10 - 1.00 | 68 | 0.55 | 0.06 | 0.24 |
| | 1 - 5 | 1.01 - 4.78 | 90 | 2.14 | 1.09 | 1.04 |
| | 5 - 10 | 5.08 - 9.99 | 24 | 6.96 | 2.39 | 1.54 |
| | > 10 | 10.33 - 49.68 | 34 | 21.10 | 105.71 | 10.28 |
| 1985 | 0 - 1 | > 0 - 1.00 | 182 | 0.43 | 0.07 | 0.26 |
| | 1 - 5 | 1.03 - 4.82 | 155 | 2.03 | 0.94 | 0.97 |
| | 5 - 10 | 5.02 - 9.45 | 21 | 6.56 | 1.57 | 1.25 |
| | > 10 | 10.33 - 62.50 | 30 | 20.79 | 168.68 | 12.99 |
| 1986 | 0 - 1 | 0.12 - 1.00 | 35 | 0.57 | 0.06 | 0.24 |
| | 1 - 5 | 1.02 - 4.70 | 39 | 2.45 | 1.22 | 1.11 |
| | 5 - 10 | 5.17 - 9.94 | 21 | 7.55 | 2.84 | 1.69 |
| | > 10 | 10.06 - 59.34 | 105 | 25.47 | 154.14 | 12.41 |
| 1987 | 0 - 1 | 0.09 - 0.99 | 14 | 0.48 | 0.09 | 0.31 |
| | 1 - 5 | 1.02 - 4.88 | 33 | 2.61 | 1.49 | 1.22 |
| | 5 - 10 | 5.21 - 9.35 | 11 | 7.32 | 1.65 | 1.28 |
| | > 10 | 10.32 - 86.91 | 43 | 23.72 | 375.09 | 19.37 |

During 1983-1987 thirteen hydro-biological stations were sampled monthly intervals from February to October, at the surface, 5, 10, 20m depth, on the 5, 10, 20 m isobathes as well as a control area 10, 20, 30 Nm from the coast, at the surface, 5, 10, 20, 30, 40 and 50 m depth.

The minimum and maximum determined values ranged between more than zero and 185.32 µg $l^{-1}$. The distribution of values was (in µg $l^{-1}$): 31.61% = 0-1; 35.79% = 1-5; 8.88% = 5-10; 26.38% = 10-185.32. According to MARCHETTI (1984) the mentioned concentration limits of this pigment fit to the oligo, mezo, eutrophic and hypertrophic waters. The values from more than zero to 5 were characteristically for deeper or offshore zones as well as for all studied area after strong winds that removed inshore sea water and brought instead of it clean and poor one. In 35.26% of samples chlorophyll a concentrations was bigger than 10 µg $l^{-1}$; they usually were found in nearshore, surface (0-10 m), or during blooms phenomena. No strong positive correlations between phytoplankton density and chlorophyll a levels were observed but there is a tight relation between this pigment concentration and both taxonomical structure and physiological state of the community.

It follows therefrom that: 1) chlorophyll a concentration could be considered a good global indicator of the trophic potential of a zone; 2) the nearshore area exhibit the tendency to eutrophic and hypertrophic conditions in comparison to the offshore which evolved to mezo and eutrophic ones.

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