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F. Baffi<sup>a</sup>; M. Fabiano<sup>b</sup>; A. Dadone<sup>a</sup>; R. Frache<sup>a</sup>

<sup>a</sup> Istituto di Chimica Generale ed Inorganica, Università di Genova, Genova, Italia <sup>b</sup> Istituto di Scienze Ambientali Marine, Università di Genova, Genova, Italia

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# The Role of the Organic Particulate Matter in the Distribution of Trace Metals in Sea Water

F. BAFFI,† M. FABIANO,‡ A. DADONE† and R. FRACHE†

† *Istituto di Chimica Generale ed Inorganica, Università di Genova, Genova, Italia*; ‡ *Istituto di Scienze Ambientali Marine, Università di Genova, Genova, Italia. Contribution of the 'Gruppo Ricerca Oceanologica-Genova'*

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## INTRODUCTION

Studies on the distribution of heavy metals in water began and developed within the framework of research which has as its main purpose the evaluation of the anthropomorphic impact upon the environment. This outlook has resulted in the investigation being directed towards a definition of the concentrations of the chemical species being examined.

Recently, researchers have been focusing their attention on phenomena which control the fate of these elements when they reach the aquatic environment. Within the framework of the activity carried out by the 'Gruppo Ricerca Oceanologica-Genova' investigations of the role of organic particulate matter in defining the distribution of trace metals have been developed. In this context a control area about two miles off the coast of the promontory of

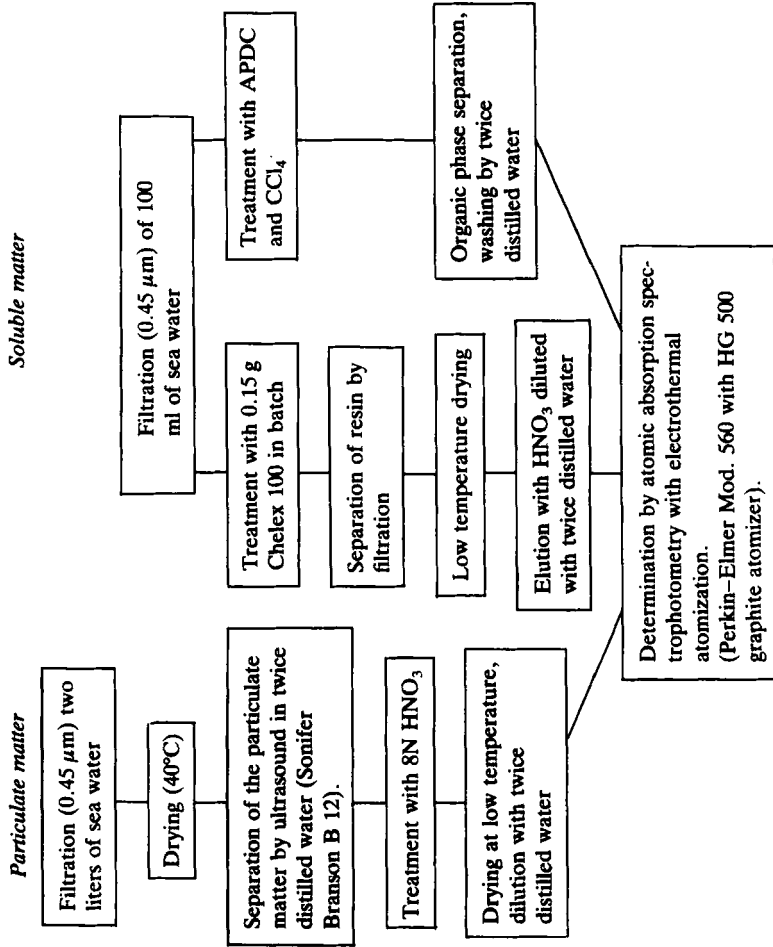


FIGURE 1 Determination of Cu, Fe and Ni.

Portofino (from January to December 1980) and five Ligurian coastal areas, corresponding to the areas known as Corniglia, Chiavari, Genova, Savona and Alassio, respectively (during the oceanographic cruise N/O Bannock-February 1981) were investigated.

## EXPERIMENTAL PROCEDURE

For the analysis of Cu, Fe and Ni and the particulate matter in the water, the scheme of Figure 1 was employed.

## RESULTS

### Annual variations of trace metals in particulate matter

The purpose of the investigation is to identify, in a general way, the development of the concentration of some heavy metals in particulate matter. For this purpose the annual sampling cycle was divided into time periods characterized by particular hydrological and biological events:

- A. period of active production of organic substance (February-March)
- B. 'grazing' period (April-May)
- C. thermal stratification period (June-October)
- D. period of homogeneity of the hydrological values within the column (November-January) and in water layers which are sufficiently homogeneous among themselves.
- X. photic layer (0-25 m)
- Y. transitional layer (50-100 m)
- Z. aphotic layer (150-200 m)

The concentrations of the metals, when viewed in relation to the different environmental situations reported in the Table I, have revealed some phenomena which seem to characterize the distribu-

TABLE I  
Mean concentrations ( $\mu\text{g l}^{-1}$ ) of particulate  
metals in the different periods and layers

		A	B	C	D
X	Cu	128.4	175.0	47.0	32.8
	Fe	2.2	2.3	1.8	1.0
	Ni	0.9	0.7	0.2	0.2
Y	Cu	34.3	277.3	81.0	24.5
	Fe	1.7	2.0	1.5	0.0
	Ni	0.3	1.9	0.5	0.1
Z	Cu	4.5	34.5	185.2	16.7
	Fe	0.7	3.5	1.3	0.2
	Ni	0.0	0.8	0.6	0.1

tion of the metal concentrations in the particulate matter:

- assimilation on the part of the rapidly growing phytoplanktonic organisms (AX)
- formation of particulate matter rich in metals during the zooplanktonic 'grazing' period (BX-BY)
- progressive movement towards the bottom (CY-CZ)
- redistribution down the water column (DX-DY-DZ)

### Relationship between phytoplanktonic populations and heavy metals

For the purpose of verifying a correlation between algae populations and metals in particulate matter, the data pertaining to the

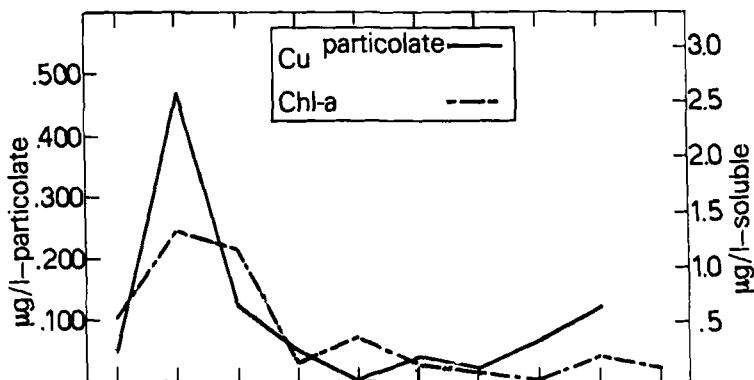


FIGURE 2 Relationship between Cu particulate and chlorophyll-a.

phytoplankton biomass (chlorophyll-a) and Cu, Fe and Ni in soluble form and in particulate matter were treated statistically. The results showed a significant correlation between copper and chlorophyll-a (Figure 2), demonstrating that the latter appears for the entire sampling cycle, if one considers the surface samples, and only for the period of active production if one considers the data relative to the photic layer. Furthermore, this relationship is absent when the data of the entire water column are considered.

### **Development of the researches**

It is intended that this investigation is further developed in the sense of obtaining greater knowledge of the organic fraction of the particulate substance and of evaluating the quantity of metal which is transported by means of organic particulate matter towards the bottom.