Atmospheric input of particulate matter to the Eastern Mediterranean

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It is well known that the Eastern Mediterranean Sea is greatly affected by the eolian dusts originated from Sahara desert, and transported to the region by synoptic scale atmospheric features. The magnitude of which is reported by GANOR and MAMANE, 1982 and as an annual flux rate of 50-200 tones per square kilometer. The effect of such inputs is essential in understanding the chemical oceanography of the region. Mediterranean Sea provides an excellent example in providing a study area which is surrounded by industrial, semi industrial and arid countries and by world largest desert belt. The diversity of the catchment areas have further increased the importance of the impact of wind transported materials to the region.

The issue of long term monitoring of the atmospheric fluxes of trace metals to the Eastern Mediterranean Sea has not been well studied and there were no land based stations to cover this aspect. During 1990 a 18 meter high atmospheric collection tower has been constructed at the harbour jetty of the institute (36° 33N, 34°15E) and during 1990 110 samples were collected by using two terylene meshes of 300 m mesh presenting a surface area of 1 m to incoming wind. Since Aug. 1991 Andersen type Hi-Vol samplers and Andersen Wet-Dry deposition sampler utilized to collect atmospheric particulates together with mesh collection technique. During 1990 mesh collection programme dust loadings had reached to a level of 1 g per day. The classification of the dust samples according to Munsell color chart has shown that there exists two main class associated with the dust samples indicating the diversity in catchment areas. The results obtained from the elemental analysis of mesh samples of this study together with some other studies are summarized in Table 1 for comparision.

The elemental analysis of the total atmospheric material collected with Hi-Vol sampler during Aug-Sep 1991 have been completed (35 samples). The average particulate loading durin Aug 1991 was 6.7 $\mu g/m^3$ and for Sep 1991 it was 8.1 $\mu g/m^3$. Results for Pb and Al are plotted on Composite Enrichment Factor (EF) diagrams as explained by SAYDAM, 1981 together with samples collected from other parts of the continent and Western Mediterranean region during EROS-2000 programme Fig.1.

The EF diagram of the Pb has shown that the samples collected will have tendency to fall in a region which indicates a dilution of the European background material by crustal solids. The analysis of the rain samples which are collected by wet-dry deposition sampler has resulted with an average pH of 6.8 and nitrates of 42.5 µM. The preliminary results has shown that these values are in good agreement with the ones obtained at Western Mediterranean EROS 2000 which is classified as Saharan dominated atmospheric materials.

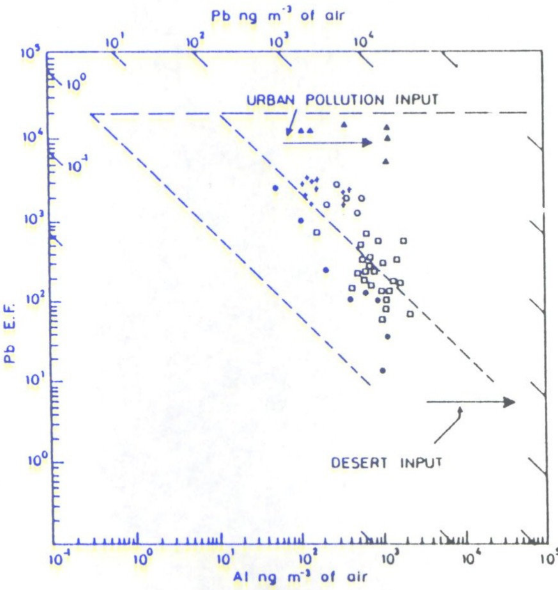

Figure 1. Composite enrichment factor diagram for Pb (after SAYDAM, 1981). Data for the following aerosol samples are plotted : Eastern Mediterranean open-ocean samples (filled circles; data from SAYDAM, 1981); polluted samples from Ghent, Belgium (filled triangles, data from DEMUNYCK *et al.*, 1976 ; U.K. non-urban sites (crosses, data from CAWSE, 1978, 1980) ; "polluted" samples from Cap Ferrat (open circles, data from CHESTER *et al.*, 1989); North Eastern Mediterranean land based station data (open circles, present work).

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Evaluation of some trace metals in sediments from the continental shelf off Egypt

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Sediments are the ultimate sink for contaminants in the marine environment. Evaluation of environment levels in sediments is one approach to assessing environmental impact (SALOMON and FORSTNER, 1984). The pollution problems in the Mediterranean Sea are chiefly due to the discharge of high quantity of untreated water outfall and to virtually total absence of control on toxic components. To determine the extent of pollution in an aquatic system by means of the heavy metal load in sediments, it is of primary importance to establish the natural level of these sediments i.e. the pre civilizational level and then substract it from existing values for metal concentrations in order to derive the total enrichment caused by anthropogenic influences.

The objective of the present study is to determine the levels of some elements (Fe, Mn, Ni, Cu, Zn and Pb) in some scattered samples from the Egyptian continental shelf and to compare them with background levels of normal unpolluted sediments.

This study covers the Mediterranean continental shelf off Egypt between Rosetta (west) and Arish (east).

The studied elements in their total forms were extracted by using hydrofluoric acid in conjunction with nitric and perchloric acids. The present data and the unpolluted reference levels of the studied elements (after TUREKIAN and WEDEPOHL, 1961; Fig 1) were statistically analyzed using correlation analyses between variables, cluster and factor analyses.

The average Fe (6 %) concentration of the present samples corresponds to that given by TUREKIAN and WEDEPOHL, (1961) for the same type of sediments. Unlike Fe the Mn (998.9 ppm) Ni, (89.09 ppm), Cu (44.54 ppm) and Zn (107.9 ppm) average concentrations presently found are lower than their reference levels. The Pb averaging 93.9 ppm slightly exceeded that level reported by TUREKIAN and WEDEPOHL (1961; Fig. 1).

High positive interelemental correlation was observed among the elements (Table 1).

The Fe was very highly positive correlated with Mn, Ni, Cu, Zn and Pb. AUSTRIA and CHORK (1976) showed that Fe may account for more than 50 % of the concentration of Cu, Ni and Zn in sediments. The high positive correlation among the other elements probably reflects their contribution by lithogenic source as previously mentioned by (KRAUSKOPF, 1979).

R-mode factor analysis was used to interpret the interelement associations in the shelf-sediments (Table 2).

Only one factor was produced which appears to be a clay factor. It accounts for 80.5 % (Eigenvalue 4.83) of the total variance and shows a strong association of Fe Mn Cu, Zn and Pb. The mineralogical characteristics of the studied sediments reveal that heavy minerals especially opaques, mainly magnetite and ilimenite are particularly abundant at Rosetta mouth and Cape Burollus. The observed relation in the present study is explained by the sorption or coprecipitation of trace metals with iron oxides in the surficial sediments as previously found by SALOMONS and FORSTNER, 1984.

Table (1): Correlation coefficients matrix.

	Fe	Mn	Ni	Cu	Zn	Pb
Fe	1.00					
Mn	0.82	1.00				
Ni	0.97	0.80	1.00			
Cu	0.71	0.62	0.73	1.00		
Zn	0.90	0.69	0.92	0.60	1.00	
Pb	0.82	0.57	0.85	0.58	0.83	1.00

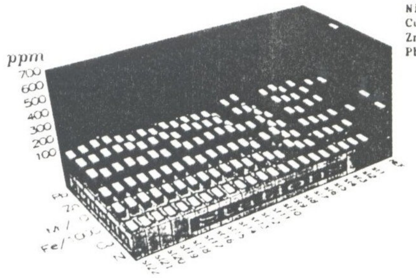

Fig. (1) : Distribution of elements including reference data.

The Q-mode cluster analysis was employed including the reference data. This dendrogram (Fig 2) showed two clusters. The first cluster group includes all samples of the present study. The second cluster group comprised the only reference sample. All samples in the first cluster were combined at short distances showing great similarity (Fig 2). The two clusters showed great dissimilarity as the results were clearly lower for Mn. Ni, Cu and Zn.

Table (2) : Factor Matrix.
Variable Communality Factor : 1

FE	0.95186	Eigenvalue :	4.83
Mn	0.69691	PCT :	80.5
Ni	0.96749	C.P. :	80.5
Cu	0.60411		
Zn	0.85644		
Pb	0.75412		

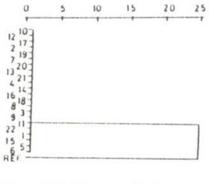

Fig. (2): Cluster Dendrogram

The elements introduced into the study area are either associated with solid material or as elements whose sources are the river runoff or sea water. The main cause that control the elemental composition of the sediments is the relative proportion of the component minerals. The terrigenous deposits are enriched by trace elements generally incorporated in clay minerals.

In general the studied elements are simply referred to as geochemical. No clear evidence has supported the anthropogenic origin of these elements.

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