

Mercury levels in the atmosphere of the Tyrrhenian Area in the Mediterranean Basin

Romano FERRARA and Bianca Elena MASERTI

CNR, Istituto di Biofisica, Via S. Lorenzo 26, 56100 Pisa (Italia)

INTRODUCTION

This paper reports the results obtained during three years of study (85-88) on the distribution of gaseous Hg in the atmosphere of the Tyrrhenian area of the Mediterranean Basin (in the open sea, on islands and in some peninsular zones characterized by the presence of the metal sources of natural and anthropogenic origin). The results were integrated with those available in the literature.

The aim of this research is to assess the influence of the atmospheric Hg flux to the Mediterranean waters. In this preliminary paper we report the results on the present Hg distribution in the atmosphere of the examined area.

EXPERIMENTAL

Separation of gaseous from the aerosol was achieved by pre-treated Sartorius membrane filters. Air was sucked for 2 hours at a constant flow rate of 1 l/min by means of a membrane pump, and gaseous mercury was collected on gold absorbers. The determination was performed by Atomic Fluorescence Spectroscopy (detection limit 0.01 ng) as reported elsewhere (1).

RESULTS

Figure 1 shows the study area, the sampling stations and the measured levels of atmospheric Hg. The lowest concentrations were observed above the open sea (2 ng/m³). This fact clearly indicates, as also reported by Slemr et al. (2), that the sources of atmospheric Hg are mainly located on the ground.

Slightly higher Hg concentration values (4 ng/m³) were measured in the atmosphere of rural areas, far from possible anthropogenic and anomalous natural sources (cinnabar deposits, hot steam jets, volcanic activity, etc.).

As far as anomalous natural sources are concerned, the highest levels were found in the atmosphere over the metalliferous region of Mt. Amiata, rich in cinnabar deposits, in proximity to the steam jets used for the production of electric power. The average concentration value of gaseous Hg in this region is 14 ng/m³; very high values (200 ng/m³) were also found above deposits of roasted cinnabar deriving from mining activity. These high values, which are encountered in the presence of high soil temperatures, are due to the natural degassing of the deposited material.

A particular investigation was carried out in the Aeolian Islands, where volcanic activity is present. The Hg concentration values were not particularly high (10-15 ng/m³); only near the solfatara of the island of Vulcano were somewhat higher values found (25 ng/m³), similar to those observed near to the solfatara of Pozzuoli (Napoli).

The Hg levels measured in the vicinity of Europe's largest active volcano (Mt. Etna, Sicily, at 500 m from the main crater) proved to be very low (3-10 ng/m³), in agreement with Barghigiani et al. (3).

Higher values were found by Brader and Flucht (4) on Mt. Vesuvio (Napoli) only close to the fumaroles present in the crater (94 ng/m³).

The measurements taken in the above areas demonstrate that volcanic activity does not always represent an important source of atmospheric Hg.

As regards the contribution of anthropogenic activity to the presence of Hg in the atmosphere, particular attention was dedicated to a chlor-alkali plant and to some large urban areas.

The concentration of Hg around the chlor-alkali complex of Rosignano Solvay (Livorno) was on the order of 20 ng/m³ in a radius of 500-700 m from the plant itself. High values were measured by Brader and Flucht (4) 150 m above the chimney (80 ng/m³). The measurements performed in various urban areas reveal an increase in the Hg concentration with respect to the values observed in rural areas. In general the concentration value ranges between 5-15 ng/m³, with lower values for the areas along the coast. From this first investigation it can be concluded that although considerable geologic anomalies are present in the Tyrrhenian area of the Mediterranean Basin, an appreciable increase of the Hg concentration in the atmosphere is generally not noted.

Natural and anthropogenic sources of Hg seems to have an influence mainly on local scale. The mercury levels over the Mediterranean open sea, and consequently the air-sea exchanges, are probably slightly affected by the presence of industrial and human activity and of a large volcanic area.

REFERENCES

- 1) Ferrara, R., Seritti, A., Barghigiani, C. and Petrosino, A. (1988). Improved instrument for mercury determination by Atomic Fluorescence Spectrometry with a high-frequency electrodeless discharge lamp. *Anal. Chem.* 117, 391-395.
- 2) Slemr, F., Seiler, W. and Schuster, G. (1981). Latitudinal distribution of mercury over the Atlantic ocean. *J. Geophys. Res.* 86, 1159-1166.
- 3) Barghigiani, C., Bargagli, R. and Gioffre, D. (in press). Mercury in the environment of Mt. Etna Volcanic area. *Environ. Technol. Letters*.
- 4) Brader, R. and Flucht, R. (1984). Mercury levels in the atmosphere of various regions and locations in Italy. *Sci. Total Environ.* 40, 231-244.

Heavy metal concentrations in recent inshore sediments from the Mersin Bay, Turkey, NE-Mediterranean

Mehmet Nuri BODUR and Mustafa ERGIN*

* Middle East Technical University, Institute of Marine Sciences,
P.K. 28, Erdemli, Icel (Turkey)

A total of 13 surface sediment samples were taken on board the R/V "Lamas" during a cruise in 1985 by using a grab sampler inshore the Mersin Bay (Fig. 1).

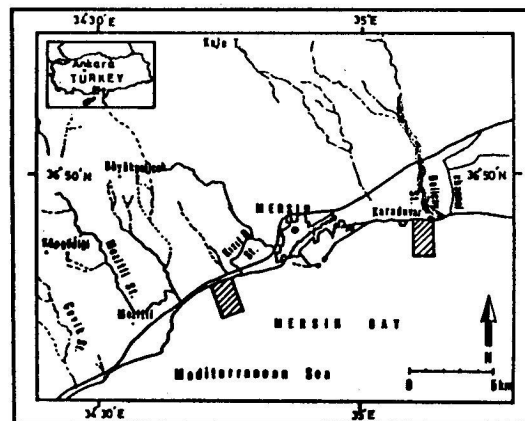


Figure 1: Study area, Mersin Bay, TURKEY.

Samples were then subjected to analysis for grain size, heavy metal, organic carbon and total carbonate contents. Sediments were usually sandy mud and appeared to be rather oxic based on their visible colors, yellow to brown.

Chromic acid-oxidizable organic carbon contents ranged from 0.55 to 0.71 % (Table 1) that were comparable with amounts normally found in marine offshore sediments. Carbonates (36-52% CaCO₃) were made up almost entirely of organism remains, such as of shell fragments. Compared to siliceous and calcareous sedimentary rocks from geologic record (e.g. shales and limestones) that are not influenced by man made activities, the contents of iron, manganese, chromium, copper and lead in this study can be attributed largely to the natural fluxes from geochemical cycle of these metals (Table 1). Zinc (at only 3 of 13 stations) and cobalt contents were somehow high suggesting their sources widely to be either diagenesis and/or compositionally variations in sedimentary materials rather than a man-made input. Although the latter seems to be not impossible but the data obtained here does not account for such a point. Nickel was presumably derived from a particular rock unit "ophiolite" which is enriched in nickel and occurring commonly in and around the study area.

It has also been shown that Ni, Co and Cu were significantly associated with the Mn and Fe phases rather than with organic matter, carbonates and clays.

Table 1: Heavy metal, clay, carbonate and organic carbon contents in the studied surface sediments inshore the Mersin Bay. For comparison, metal levels in average shales and limestones are also given.

Sample Number	Clay %	Org. %	CaCO ₃ %	Fe %	Mn ppm	Ni ppm	Zn ppm	Cr ppm	Co ppm	Cu ppm	Pb ppm
K10	16	0.58	36	4.23	550	568	149	57	40	47	14
K29	21	0.71	48	2.61	403	305	42	32	32	21	13
K30	18	t	t	2.21	414	378	39	35	34	20	16
K31	16	t	t	3.98	499	452	87	43	30	26	17
K40	22	0.59	52	2.12	264	249	52	28	19	15	11
K41	21	t	t	2.06	427	257	69	27	21	16	13
K42	25	t	t	1.87	388	367	44	29	30	22	11
K43	21	0.70	49	1.77	380	306	33	26	31	23	11
K44	16	t	t	1.62	301	224	178	22	17	14	10
K45	31	t	t	1.69	236	223	65	26	15	16	10
K54	18	0.55	51	2.55	380	462	134	27	30	22	14
K55	18	t	t	2.80	411	460	25	37	36	t	14
K56	24	t	t	2.74	348	316	48	40	30	25	t
Shales*	t	t	t	4.72	850	68	95	90	19	45	20
Limestones*	t	t	t	0.38	1100	20	20	11	0.1	4	9

t indicates not analyzed samples.

Reference:

- * Mason, B., and Moore, C.B., (1962). *Principles of geochemistry* John Wiley and Sons, Inc., p.340.