CHEMICAL AND RADIOCHEMICAL CHARACTERIZATION OF TOTAL ATMOSPHERIC DEPOSITIONS IN VENICE LAGOON

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Atmospheric depositions play a relevant role in the environmental cycling of chemical substances. Their contribution may be especially crucial in heavily industrialised areas, where stack and diffused emissions may distinctively contaminate the atmosphere with well-known environmental consequences. Among the possible effects, ^{210}Pb emitted from coal-fired power plants may significantly affect the natural atmospheric ^{210}Pb flux, therefore disturbing its use in radiochronological reconstruction of the sedimentary history of the local environment.

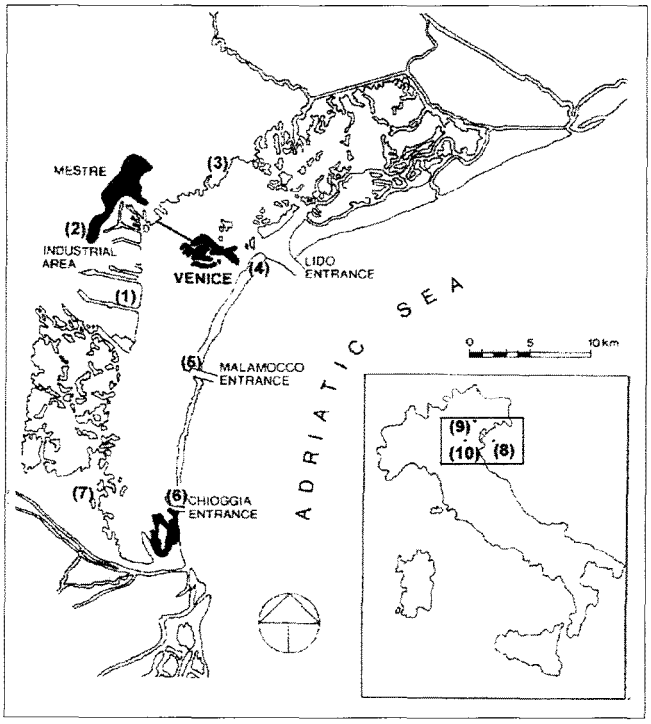
Since the use of the ^{210}Pb technique is of basic importance for the evaluation of the dynamic aspects of pollution, it follows that a detailed knowledge of all the atmospheric inputs, together with recent environmental modifications of the catchment area, are required for a correct model application.

In this work, chemical (main species and trace elements) and radiochemical data from total atmospheric depositions over the Venice Lagoon are presented. While the whole area is currently the subject of extensive and detailed investigations as regards the hydrological system and inflows, data concerning atmospheric inputs are still fairly limited, with the exception of the local air monitoring network which includes only classical gaseous pollutants.

Samples were collected at 7 stations within the lagoon area including the industrialised area and the major urban settlements of Venice, Mestre and Chioggia. In addition, samples from 3 other sites outside the lagoon area, but lying within approximately 20 km from the main town, were obtained for analysis. In Fig. 1, the study area and sampling stations are shown.

Mean annual fluxes, determined for the period April 1989 - March 1990, for some chemical and radiochemical species are reported in Table 1. The deposition of chemical species from the atmosphere appears to be mainly dominated by precipitation scavenging. Total N, P and S fluxes are representative of a typical heavily urbanized area; in particular, data from station (1) highlight the local effects of industrial activity. However the values observed for ^{210}Pb are in a range already observed at this latitude; this allows excluding, at least in first approximation, significant contributions from the large coal-fired power plant located near station (1).

Fig.1. Lagoon of Venice and sampling stations (1-10)



Tab.1 Total deposition observed in the Lagoon stations

	Station (1)	Stations (2-7)
Rain (mm)	621	498-637
Dry dep.(g m^{-2} yV)	82	11.3-18.3
Total N (g m^{-2} yV)	4.4	1.3-2.1
Total P (g m^{-2} y^{-1})	1.9	0.05-0.33
Total S as SO_2 (g m^{-2} y^{-1})	19	2.9-4.4

* *n.s.= unsupported ^{210}Pb*

INVENTORIES OF $^{239,240}Pu$ IN SLOPE AND DEEP-SEA SEDIMENTS FROM THE IONIAN SEA AND THE ALGERIAN BASIN

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While a good data set already exists on plutonium levels and inventories in Mediterranean shelf sediments, only few plutonium data are presently available for slope and deep-sea areas. For this reason, selected deep Mediterranean areas having different morphological and sedimentological characteristics were studied, and plutonium vertical profiles and inventories have been determined. In this paper we report the results obtained for the margin of the continental shelf, the slope and the bottom of the Taranto Valley, a deep submarine canyon in the Ionian Sea, and for an open-sea reference area in the Algerian Abyssal Plain.

The sediment cores were collected by a modified Reineck corer and sectioned onboard in slices 1 cm thick. $^{239,240}Pu$ was separated from the matrix by leaching, double anion exchange and electroplating, and measured by alpha spectrometry.

The inventories of $^{239,240}Pu$ in sediments of the Taranto Valley are shown in Fig.1. In general there was a decrease in Pu inventories along the canyon from the shelf to the slope and the deepest part of the canyon. In shelf and slope cores, plutonium was detectable down to depths of at least 30 cm which was the average length of the cores collected. The inventories ranged from 90 to >160 Bq/m^2 and, in all cases, were higher than the cumulative fallout deposition at these latitudes (81 Bq/m^2, PERKINS and THOMAS, 1980). For the two samples at 150 m and 450 m, only a lower limit of the inventory is reported (>120 and >160 Bq/m^2 respectively), because plutonium concentrations were still relatively high at the bottom of our cores. These results are in good agreement to those reported for the continental shelf of the Gulf of Taranto by TRIULZI *et al.* (1982).

In the sediments collected at the bottom of the canyon at depths of 1500 m and 2000 m, $^{239,240}Pu$ was only detectable in the first 15 cm. The inventories of $^{239,240}Pu$ (58 Bq/m^2 at 2000 and 45 Bq/m^2 at 1500 m) were about 50% of the cumulative fallout deposition.

To evaluate the influence of morphological and sedimentological factors on the transport of plutonium from the continental shelf to the deep sea, the results obtained for the Taranto Valley were compared to the inventory of $^{239,240}Pu$ in a sediment core collected in the Algerian Abyssal Plain, an area where only pelagic sedimentation is active. In the latter case, plutonium was only present in the first 4 cm of the core and its concentration decreased regularly from the surface to depth. The inventory was 3± 2 Bq/m^2 (4% of the cumulative fallout deposition), comparable to the values obtained for deep cores from oligotrophic Atlantic areas (BUFFONI *et al.*, 1992).

The inventories calculated for the deepest part of the Taranto Valley are almost twenty times higher than in the open Western Mediterranean as a consequence of several processes :

- productivity is very low in the open Mediterranean Sea, resulting in scarce export production and in a low probability of the particle-associated plutonium reaching the sea bottom. In contrast, the particle population increases considerably in areas close to land and river mouths thus producing an effective removal of plutonium from the water column;
- the continental shelf of the Gulf of Taranto is very narrow and the slope is indented by several small canyons, some of them corresponding to mouths of rivers. Under these conditions, the particulate material exported by rivers and the associated radionuclides may easily be transported to deeper areas preferentially through the small canyons;
- slumping processes and hydrodynamic conditions inside the canyons facilitate the resuspension of sediments, thus enhancing the scavenging of particle-associated radionuclides from the water column.

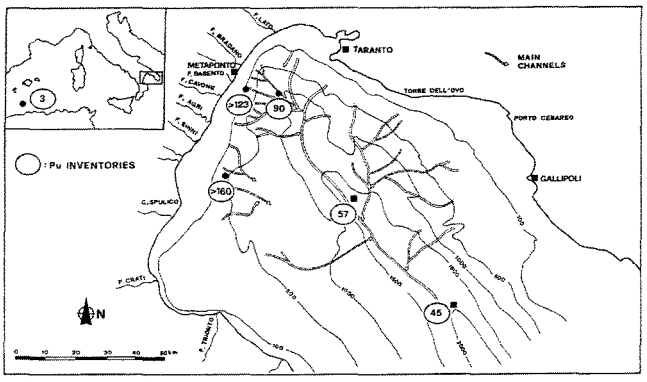

Fig. 1 - Inventories of $^{239,240}Pu$ (Bq/m^2) in sediments of the Gulf of Taranto (main figure) and in the Algerian Basin (upper left square).

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