

# GEOCHEMICAL CHARACTERIZATION OF HG-CONTAMINATED SEDIMENTS OF THE "PIALASSA BAIONA" (RAVENNA LAGOON, ITALY)

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## Abstract

The "Pialassa Baiona" is a transitional, heavily mercury polluted area connected to the Ravenna harbour and the North Adriatic Sea (Italy). The aim of this work has been to characterize sediments collected in the southern part of the area, called Chiaro del Pontazzo, from a geochemical point of view to understand which of the detected parameters (organic matter, S, particle-size) is mainly related to mercury. For this purpose, sediment cores, nepheloid layer samples and surficial sediments have been collected and analyzed. Benthic nepheloid layer (a fine-grained, thin, surface sediment layer) seems to be able to bind high quantity of contaminants.

**Key-words :** Interfaces, lagoons, mercury, sediments, Adriatic Sea

## Introduction

The origin of the Ravenna lagoon goes back to the first decades of 18th century, due to sandy bars deposition by long-shore currents. Up to 60's, an internal, artificial, dendritic channels system acted to avoid harbour landfill. After this period, the area lost its function and sea sedimentary contribution became nearly void.

At present, the "Pialassa Baiona" is a brackish marsh placed in the north-eastern part of Ravenna (Italy); it consists of small, shallow ponds and deeper artificial channels connected to the North Adriatic Sea through the Candiano Channel (Ravenna harbour). This area also receives fresh waters from inland through some drainage channels (Fig. 1).

Generally, inside ponds, there is a 30-100 cm pelitic material layer, over sandy sediments (1), whose deposition is promoted by an almost complete water standstill (both in flood and in ebb tide) (2).

During the period 1957-1977 high quantities of mercury (about 100-200 t) were carried in this area coming from an industrial discharge channel (Via Cupa) which inflows in the southern part of the lagoon. For this reason our research is focused on sediments collected in the southern pond (Chiaro del Pontazzo) which are particularly mercury polluted (3, 4, 5).

Previous investigations (4, 6, 7, 8) found high levels of mercury (up to 160 µg/g, dry weight) in surface sediments even if a burial of the

toxic element had been supposed on the basis of a crude estimation of sediment accumulation rate (on average about 2.6 cm/y).

## Results

For this research we collected 21 sediment cores, 9 surficial sediments and, in particular, 16 benthic nepheloid layer samples (Fig. 1). The latter are very important due to the scarcity of studies concerning this particular layer.

Nepheloid layer is a muddy, generally thin (few mm) and easily movable layer placed under water column, close to sediment-water interface. It is a reactive zone crossed by both vertical and horizontal fluxes before entering sediment reserve (9).

Total mercury concentration (10) in nepheloid layers ranges from 1.96 to 40.28 µg/g (d.w. sediment); nevertheless, only 6 of 16 samples have Hg values lower than 10 µg/g (d.w.). It can be pointed out that the unique sandy sample shows the lowest mercury concentration. Other nepheloid layer samples have a pelitic lithology and higher Hg values.

A concentration of methylmercury (11), which is the most bio-available and dangerous kind of Hg for food webs, was also detected in 5 nepheloid layer samples. All samples show methylmercury concentrations lower than method detection limit (0.005 µg/g).

A comparison between total mercury concentration in nepheloid layers and in their corresponding surficial sediment samples (2-3 cm deep) (Fig. 2) shows that in 4 of 9 cases mercury values are much higher in nepheloid layers than in surficial sediments. In other 3 samples mercury concentration is always higher in nepheloid layers, but the difference between the two kinds of sediment is not so stressed.

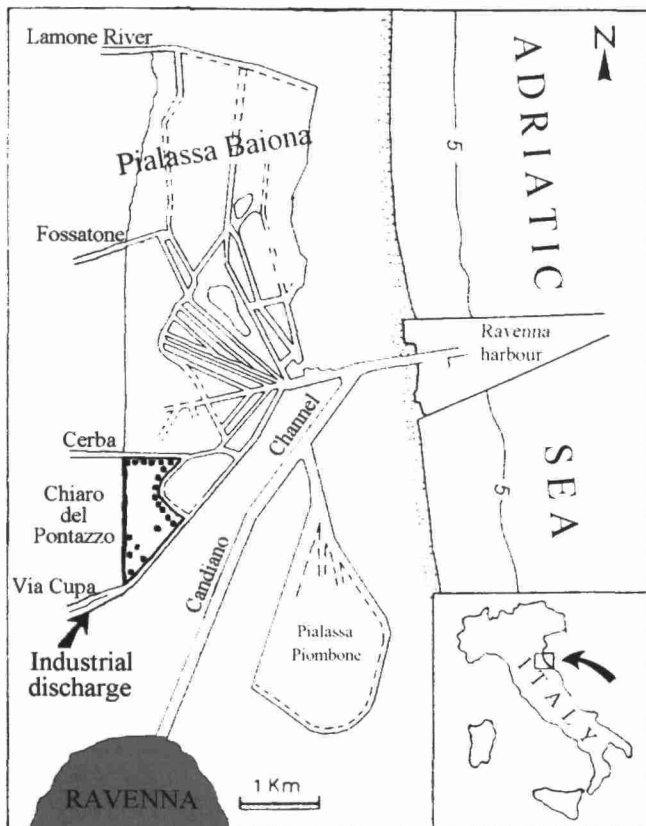


Fig. 1 - Ravenna lagoons. Study area and location of samples.

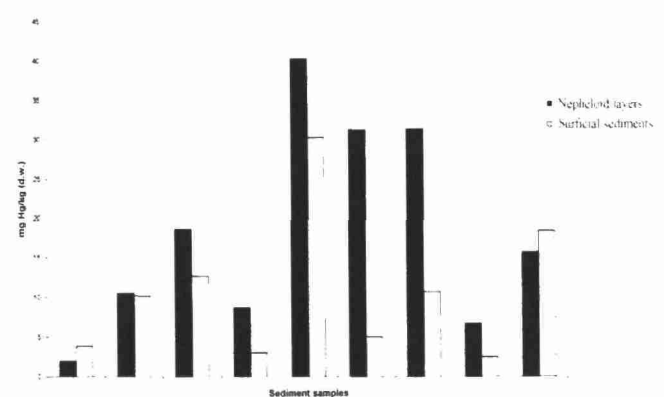


Fig. 2 - Mercury concentration (µg/g, d.w.) in nepheloid layers and in their corresponding surficial sediment samples.

The 21 sediment cores were also analyzed for a qualitative lithology. This study shows that, along Chiaro del Pontazzo northern boundary, cores have a sandy surficial layer (30-80 cm thick) which is indicative of a probable decortication due to frequent anthropic actions. In the eastern side of the area surficial core sediments are fine-grained with abundant organic matter.

9 sediment cores were analyzed for total mercury, methylmercury, organic matter and sulphur (10). Total mercury concentration results (Fig. 3) show that high quantity of this toxic element are concentrated in the first 30-40 cm; in particular, one core, at a depth of 5-10 cm, shows a mercury concentration of 95.63 µg/g (d.w.).