

# LEAD, ZINC, COPPER AND IRON PARTITIONING SPATIAL DISTRIBUTION IN LAVRIO PORT SEDIMENTS

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## Abstract

The recently renovated port of Lavrio accommodates bulk cargo ships and coastal ferries. In the coastal area there is a mineralization of mixed sulphides and oxidized ores of lead, zinc and iron. In the present paper, the spatial distribution of Pb, Zn, Cu and Fe partitioning in Lavrio port sediments is studied. It is concluded that the geology of the inland coastal area, the metallurgical activities and the inappropriate material used for maritime constructions have affected dramatically the metal partitioning distribution. There is a need for the appropriate high quality port management.

*Keywords: metal, partitioning, pollution, port, sediments.*

## Introduction

Ports accommodate various polluting activities and are considered as effective natural traps. Port sediment study allows pollution sources comparison, feasible transport pathways investigation, geochemical changes identification, presence and mobility of potential pollutants indication. Metal partitioning among sediment geochemical phases provides information about the source, mode of occurrence, biological and physicochemical availability, mobilization and uptake. In Lavrio, there is a mineralization of mixed sulphides and oxidized ores of Pb, Zn and Fe, at the contact between schists and marbles. The intensive mining and metallurgical activities have resulted in the formation of huge spoils of wastes (1). The recently renovated port of Lavrio accommodates bulk cargo ships and coastal ferries. It acts as metal source (2, 3) for the neighboring coastal zone.

## Methodology

In 1999 surface sediment samples were collected from Lavrio port. They were analysed for total metal content (treatment by mixture of conc. HNO<sub>3</sub>, HClO<sub>4</sub>, HF at high T) (4) and metal partitioning (5 with some modifications, 6). The five fractions examined are the exchangeable (Exch), carbonate associated (Car), reducible (Red), organic matter-sulphide bound (Or+Sul), and residual (Res). All metal concentrations were measured by AAS. The relative standard deviation of the measurements was <5%. The spatial distribution was achieved by using the program Surfer®, version 7, 1999 edition (Golden Software Inc.). The distributions are expressed in ppm (µg/g).

## Results

Figure 1 shows the spatial distribution of Cu (Exch). It shows enrichment near the loading facilities and the old pier (left side of the map). This distribution is similar with that of Pb (Exch) with the exception of enrichment in the south side of the map. Figure 2 shows the spatial distribution of Zn (Car), Zn (Red), Fe (Red), Zn (Or+Sul). Enrichment is found at the vicinity of the new pier (under construction at the time of sampling). This pattern is almost identical with that of Fe (Car) while it has many similarities with those of Cu (Car) and Pb (Or+Sul). Figure 3 shows the spatial distribution of Cu (Or+Sul) and Pb (Red). Enrichments are found near the loading facilities and the new pier.

## Conclusions

The exchangeable metal enrichment, representing the most easily released fraction, indicates man-made pollution and the possibility for metal biological uptake. Metal partitioning enrichment near loading facilities shows the influence of the mineralization and the metallurgical activities on the coastal area. Metal partitioning

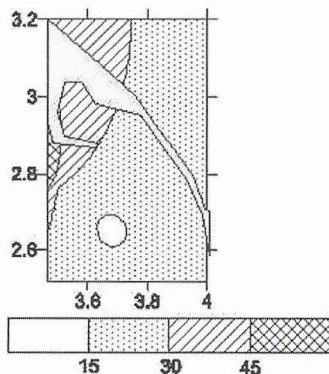


Fig. 1. Cu (exch) distribution (ppm).

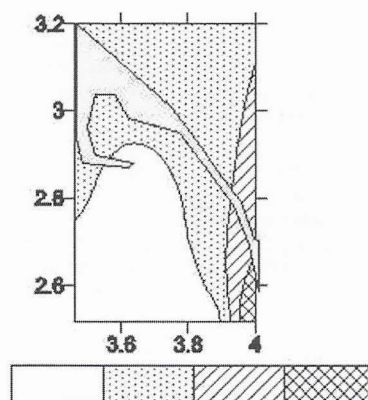


Fig. 2. Zn (Car), Zn (Red), Zn (or+sul) and Fe (Red) distributions (ppm).

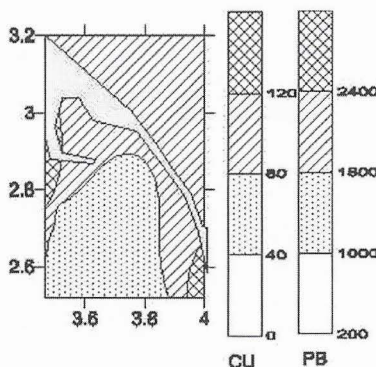


Fig. 3. Cu (or+sul) and Pb (Red) distribution (ppm)

enrichment at the vicinity of the new pier indicates that it has been constructed with material coming from the area of the old mining and the smelter wastes deposits. Lavrio port, due to coastal geology and human activities, like metallurgical works in past and maritime constructions at present, acts as a metal source for the neighboring coastal area. There is an urgent need for a high quality port management.

## References

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