

Heavy metals and lead isotopes in molluscs from a coastal pond (Thau, South France) and adjacent Mediterranean Sea

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Introduction

There is a growing concern about the quality of human environment. 'Heavy' metals are particularly being studied since they represent an often invisible pollution (they may be complexed in the dissolved phase) but can become, by accumulation, more than thousandfold enriched in living organisms, thus exceeding safety levels.

Molluscs (mostly mussels and oysters) are often used to monitor pollution trends of trace metals and other organic compounds along the coasts, particularly in urban or industrial areas, since these animals equilibrate quite rapidly (1–2 months) with their environment, from which they accumulate dissolved metal species.

Radiogenic isotopes have been used in 'deep' Earth Sciences for decades with great success to trace the origin of magmas, crust/mantle interactions etc. They are now more and more being applied to surface problems.

There too, Pb isotopes combined with trace element ratios are a powerful tracer for distin-

guishing between the various sources of metals: 'fortunately' lead added to European gasoline comes from old deposits and is therefore characterized by low isotopic compositions ($^{206}\text{Pb}/^{204}\text{Pb}$, $^{207}\text{Pb}/^{204}\text{Pb}$, $^{208}\text{Pb}/^{204}\text{Pb}$), easily recognizable from Lead present in natural soils.

Pb isotopes and 'heavy' toxic metal (Pb, Zn, Cd, Tl) concentrations have been determined in mussels and oysters from the Thau coastal lagoon, the largest one in the Languedoc-Roussillon (Southern France). The Thau area is a fragile ecosystem renowned for its intense shell farming, but surrounded by growing human activities: industrial harbour, cement factory, leisure ports, camping areas, agriculture, heavy road traffic etc. This study was intended as complementary to the remobilization processes and sources of metals in the watershed of the Vene river feeding the pond.

Location

The Thau pond ($\cong 20 \times 3.5 \text{ km}$) is located right South of the Sete harbour on the Languedoc

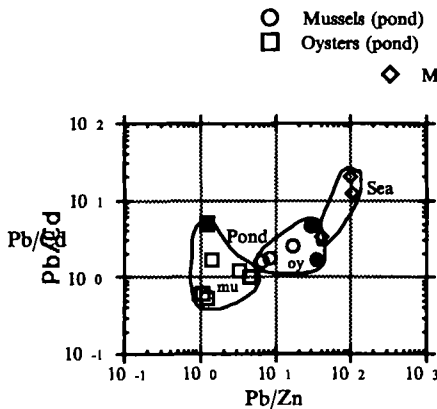


FIG. 1.

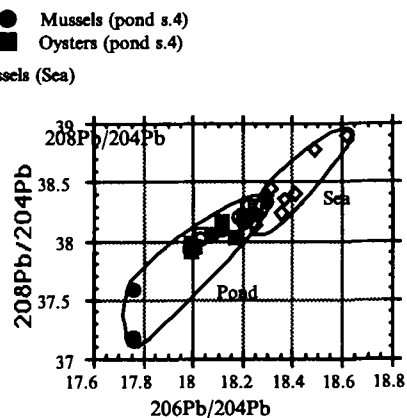


FIG. 2.

Roussillon coast. Samples (natural, not farmed) were collected in place at various sites along the coast inside of the pond and along the Sea coast South of the Sete harbour. In order to avoid short term point pollution, samples were taken 5–10 m away from the shore, 20–40 cm below water level. Both oysters (*Ostrea edulis* and *Crassostrea gigas*) and mussels (*Mytilus galloprovincialis*) were collected at each site whenever possible.

Methods

A wet chemical method was developed (Savary *et al.*, 1992), derived from Manhes (1992) for Pb : after thorough rinsing with deionized water, it involves dehydration followed by complete dissolution of the flesh in nitric acid, and chelating/anion-exchange resins separation. Concentrations were determined by isotope dilution. All the handling and chemical procedures were done in a clean lab under class 100 laminar flow.

Results and comments

Concentrations (figure 1). Metal concentrations in the flesh of molluscs (>100 ppm Zn, 0.5–2 ppm Cd and Pb dry weight) from the pond present 10^3 – 10^4 enrichment factors with respect to surrounding waters, and are comparable to data reported elsewhere (e.g., by NOAA (1989) for

molluscs collected along US urban coasts in medium-polluted areas).

As expected samples from the Mediterranean Sea have lower levels than the ones from the pond, and concentrations decrease rapidly with increasing distance from the harbour.

Pond samples are enriched in Zn and Cd vs. Pb with respect to Sea samples at the same sampling date.

Mussel concentrations tend to be higher for Pb and Tl whereas oysters seem to concentrate rather Zn and Cd.

Pb isotope compositions (figure 2). Pb isotope compositions are clearly more radiogenic for samples from the Sea (probably showing the Sete harbour signature) than for those from the pond. In Pb/Pb diagrams pond samples plot intermediate between 2 (3?) endmembers, suggesting mixing phenomena between: 1) gasoline lead; 2) soils, and 3) urban feed (water treatment plant), vineyards.

References

- Manhes G. (1982) Thesis (Univ. Paris 7).
 NOAA Technical Memorandum NOS OMA 49 (1989)
 Savary, V., Luck, J.M. and Ben Othman D. (1992) Goldschmidt Conf. (Baltimore, USA).