

Environmental risk assessment of marine sediments resuspension combining trace metals kinetics analyses with the *Paracentrotus lividus* embryo development test.

Authors: D. Sartori¹, B. Misson², N. Laglyon², S. D'Onofrio², M. E. Piccione¹, A. Scuderi¹, S. Macchia¹

¹ Istituto Superiore per la Protezione e la Ricerca Ambientale – ISPRA – via del Cedro 38, 57122 Livorno

² Univ Toulon, Aix Marseille Univ., CNRS, IRD, MIO UM 110, Mediterranean Institute of Oceanography, La Garde, France



...Interpretation of bioassays can sometimes be problematic when compared to chemical data..



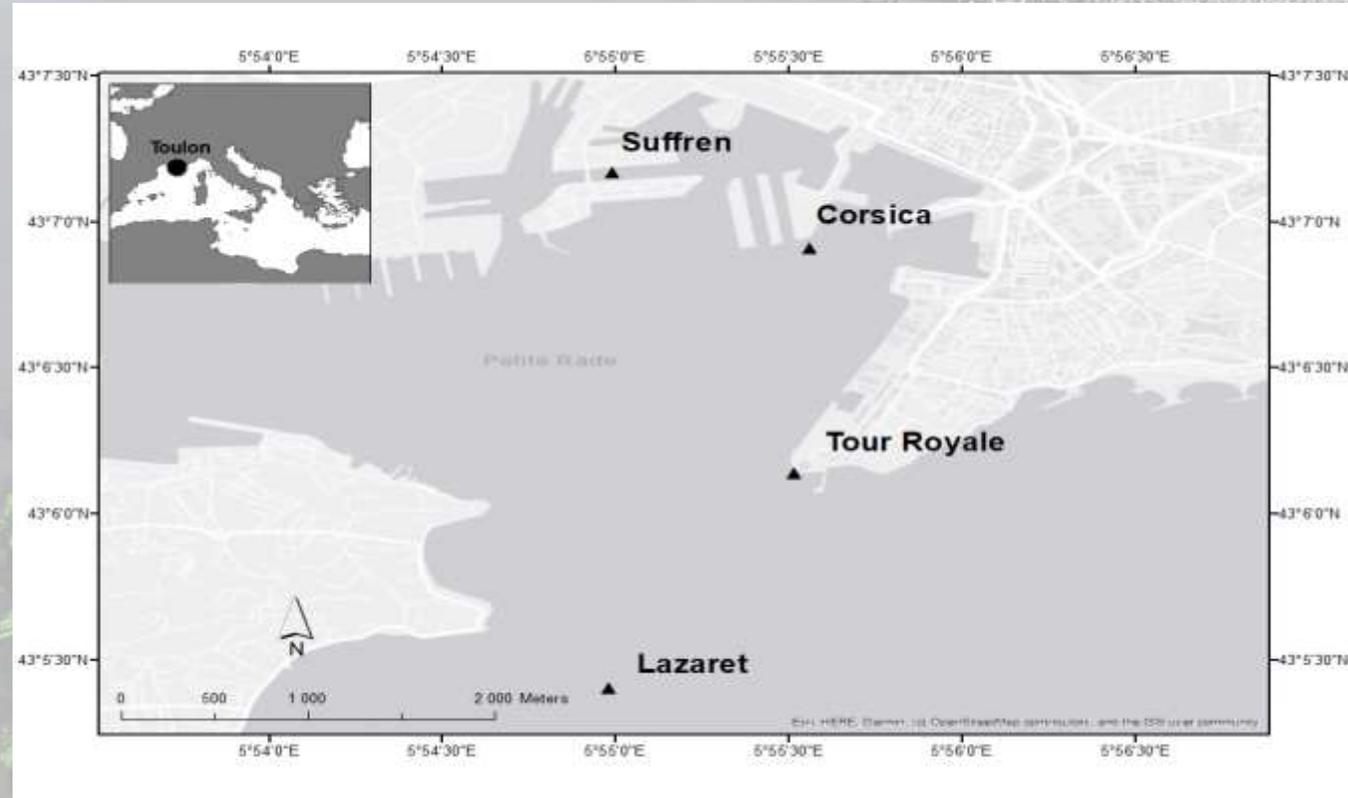
- Evaluate the correlation between trace metals concentration and *P. lividus* results;
- Evaluate the influence of sediment initial contamination, as well as the potential contribution of different metals showing different kinetics of transfer, to elutriate toxicity

Environmental risk assessment of marine sediments resuspension combining trace metals kinetics analyses with the *Paracentrotus lividus* embryo development test.

Materials and method

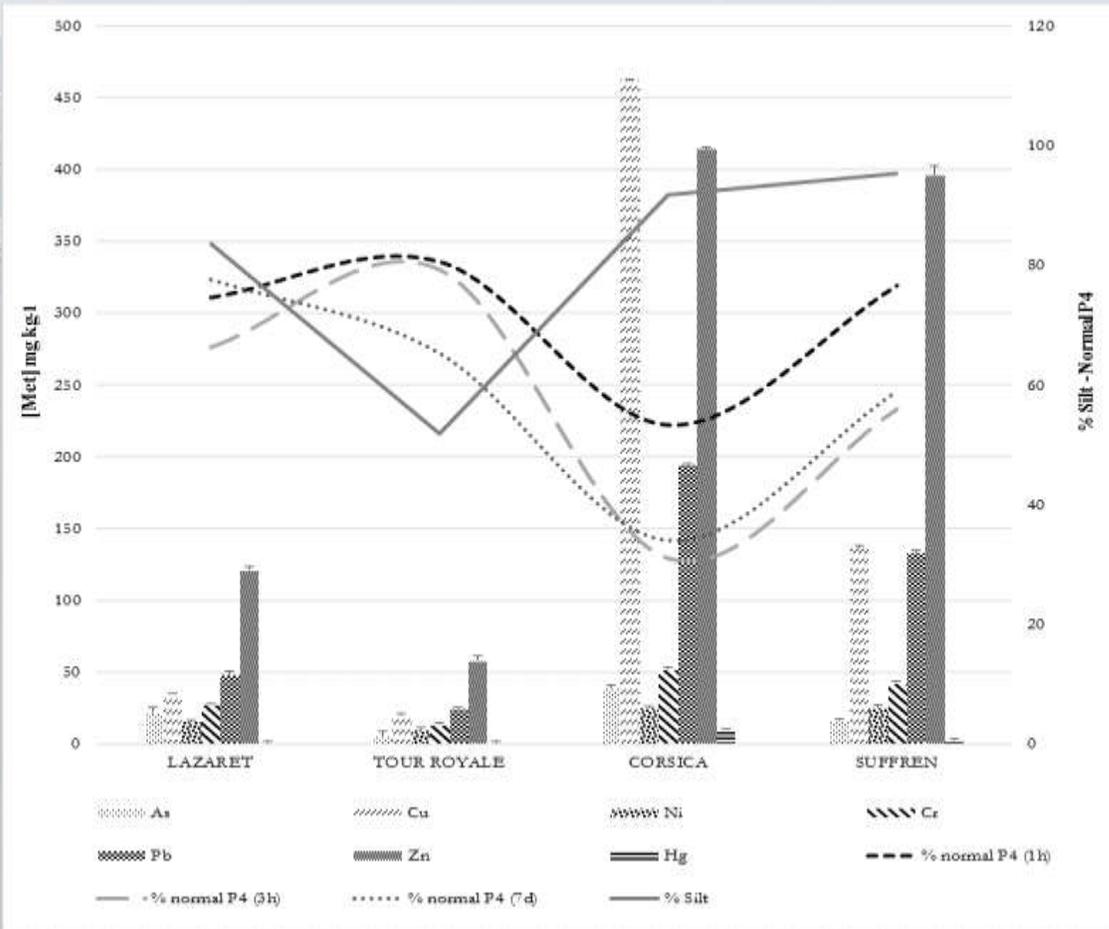
- Heavy metals concentrations in sediments by ICP-AseES;
- Granulometry analysis;
- Elutriate (ASTM protocol), using three different seawater/sediment stirring times (1 h, 3 h and 7 days);
- Embryo development test with *Paracentrotus lividus* on elutriate and water sample;
- Concentration of Cd, Cu, Pb, and Zn in each elutriate measured by DPASV and compared to initial seawater

4 sampling site in Toulon harbour (SE France)



In Toulon Bay metal contamination is well established and documented (Cossa *et al.*, 2014; Dang *et al.*, 2014, 2015; Misson *et al.*, 2016; Pougnat *et al.*, 2014; Tessier *et al.*, 2011; Wafo *et al.*, 2016).

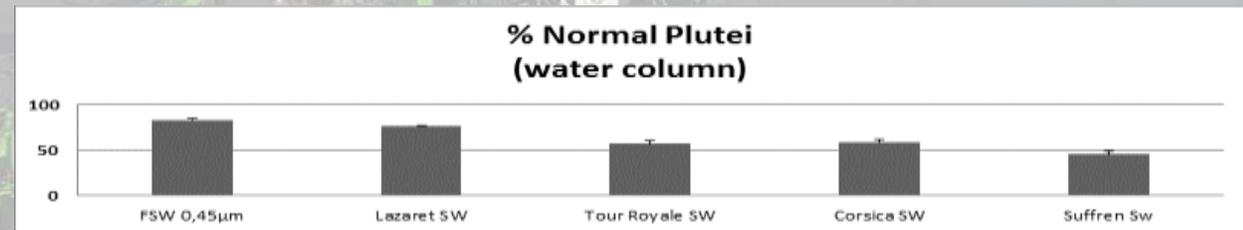
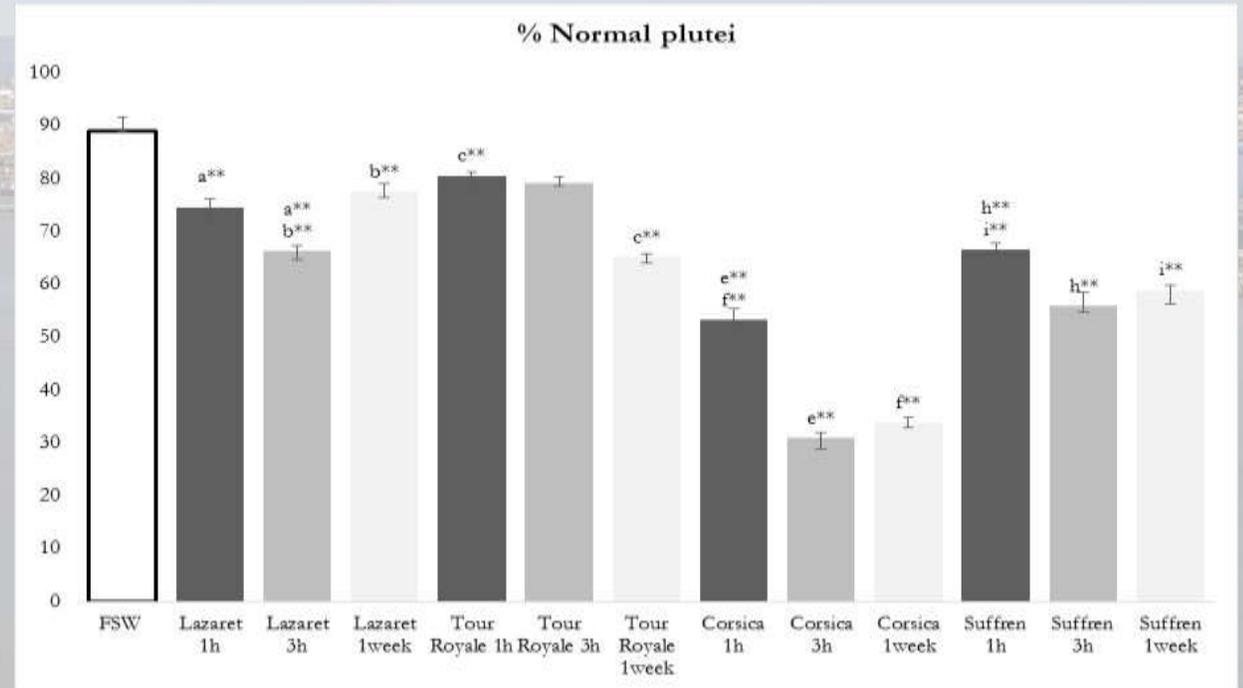
Heavy metals & Granulometry



The trend of the silt is strongly correlated with the concentration of some heavy metals (Pb, Cu, and Zn). Corsica and Suffren sites are the most impacted in terms of heavy metals pollution (Zn, Pb, Cu, and Hg).

The origin of this contamination is related to the sinking and subsequent removal of the wrecks of the French Navy fleet during the WWII (Tessier et al., 2011).

P. lividus bioassay

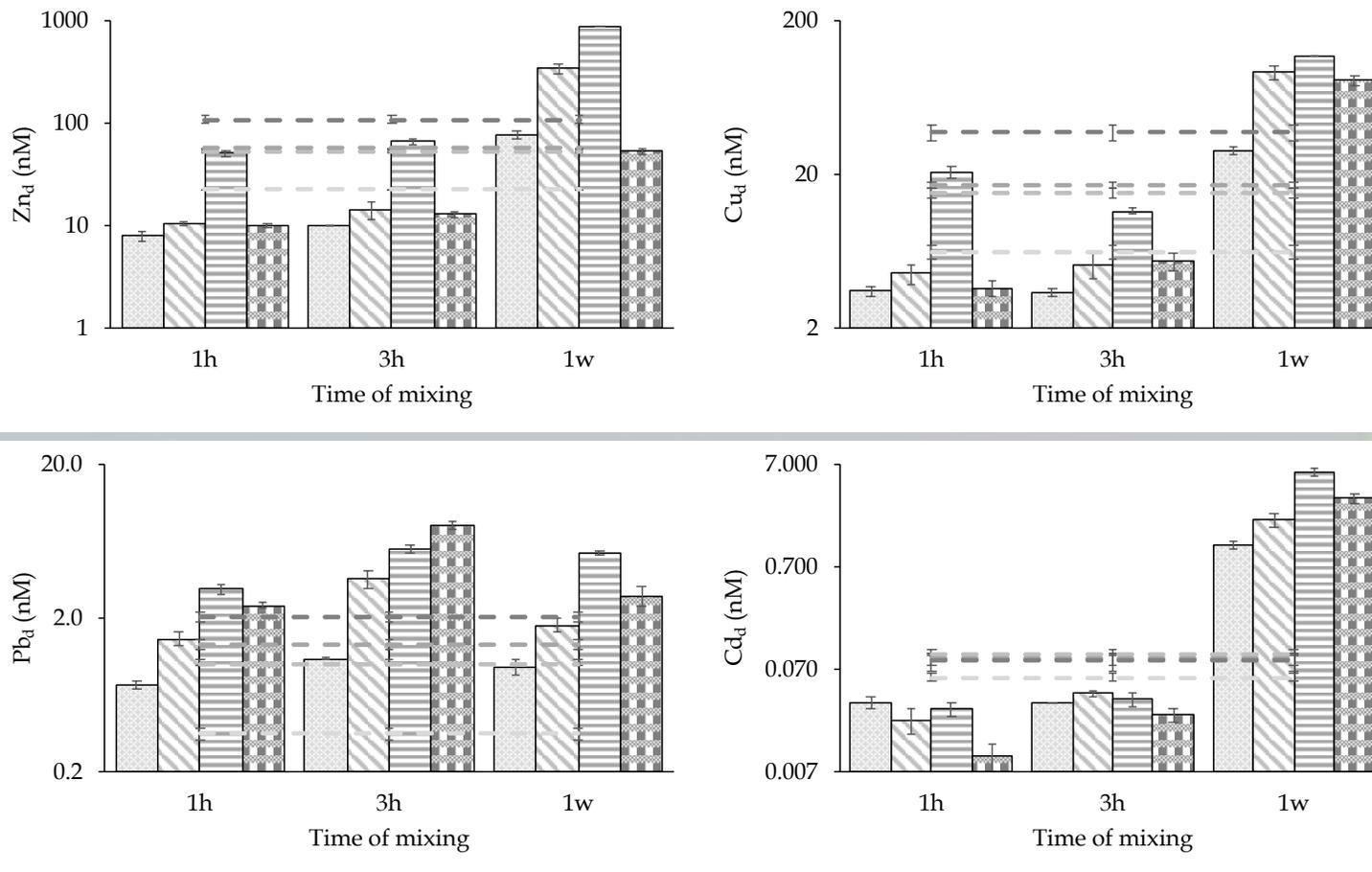


P. lividus (elutriates) showed a significant increase of toxicity with the increase to 3h of stirring time in elutriate preparation.



Greater extraction capacity of hydrophilic compounds with increasing mixing time ?

DPASV results



Dissolved Zn concentrations increased with stirring times for all sites. After one week of stirring, dissolved Zn concentrations were higher than the initial concentration measured in the sampled seawater for three of the four performed experiments (Lazaret, Tour Royale and Corsica) by a factor 3, 6 and 16, respectively. After three hours of stirring, dissolved Cu concentrations were still lower than the concentration measured in the sampled seawater. After 1 week of mixing, the dissolved Cu concentrations in the four experiments significantly increased (by a factor 7; 5; 2; 6 for Corsica, Lazaret, Suffren and Tour Royale respectively).

The dissolved Pb concentration in elutriates was significantly higher than in the initial sampled seawater. After one week of mixing, dissolved Cd concentrations were higher than the initial concentration measured in the sampled seawater.

Conclusion



- *The sediment concentration is a good proxy for elutriate toxicity? The answer is not always unambiguous!*
- *The transfer of trace metals from the sediment to the aqueous phase, during elutriate preparation, was strongly influenced by the stirring time;*
- *The trend of concentrations in solution as a function of time varies in consideration of the contaminant investigated;*
- *It would make good practice the characterization of the contamination of the elutriate!*