HEAVY METALS DISTRIBUTION IN GRADO LAGOON SEDIMENTS

Bottos D*, Mao A, Manente S, De Pieri S, Perin G**

Department of Environmental Sciences, Ca' Foscari University of Venice

Dorsoduro 2137, 30123 - Venice (Italy)

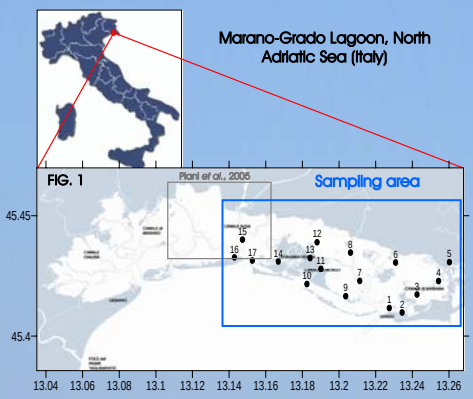
*danielabottos@unive.it **guiper@unive.it

Ecotoxicology

ABSTRACT

Grado lagoon is the eastern part of the larger Marano and Grado transition environment, located in the North Adriatic Sea (Italy). Besides agricultural, fish and mussel farming activities, many industrial activities stand on this sensitive ecosystem, like plant producing cellulose and chlor-alkali, textile industries, steel plants, metallurgical industries.
17 samples of surface sediments were collected and the concentrations of heavy metals (Cd, Cu, Cr, Hg, Ni, Pb, V) were determined by acid microwave digestion. The lowest values of metals concentrations has been found in sediment sampled close to lagoon's inlets where the effect of sea water exchange is higher. On the other hand, seven sample points, set in the inner part of lagoon characterized by deposition phenomena, show the higher metals concentration values. Moreover, the high concentrations of Hg and Ni in whole of sites, point out a probable anthropogenic source. A very strong correlation between concentrations of Ni and V (R^2 = 0,99) and between Ni and Pb (0,83) was found; Further studies should be carried out in order to assess the relationship between anthropogenic activities and sediment quality.

INTRODUCTION



Sediments are repositories for physical and biological debris and sinks for a wide variety of chemicals (Theofanis, 2001), coming from freshwater rivers, air, marine pollution, etc. Sediments are the sinking device for pollutants but also could be a dangerous point of release of contaminants.

Source of pollution affecting Grado Lagoon are various industrial activities like steel plants, metallurgical industries, a plant producing cellulose and chlor-alkali. Besides agricultural, fish and mussel farming activities stand on the basin.

FIG. 2 – Sediments granulometric distribution (modified from Brambati, 1996)

MATERIALS & METHODS

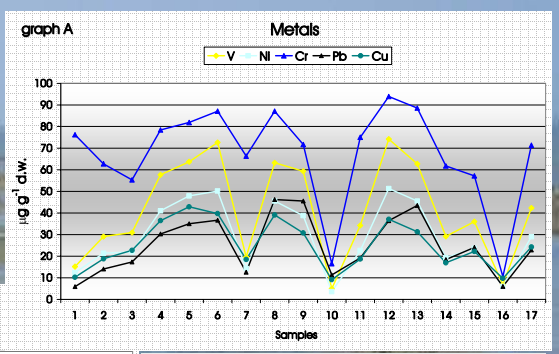
- ✓ 17 sediment samples have been collected (FIG. 1), homogenized and stored at 4 °C , in the dark, until analysis.
- ✓ Sediment has been digested using microwave digester (ETHOS 1600) with 5 mL of milliQ water, 1,5 mL of Hydrofluoric Acid (Riedel de Haën, Germany) and 3 mL of *Acqua Regia* (3:1 HCl:HNO_3, J.T. Baker Instra Analized, U.S.A.).
- ✓ Samples have been analyzed by ICP-MS.

RESULTS & DISCUSSION

- ❑ Cd, Cu and Pb concentrations are low in all sediment samples (FIG. 3 graph A – graph B).
- ❑ Hg concentrations are very high in all the sediment samples: the values are over 2* $\mu g\ g^{-1}$ d.w. except three samples; in five stations the value exceeds 5 $\mu g\ g^{-1}$ d.w. and only in two samples it's below 0,5* $\mu g\ g^{-1}$ d.w.

* *"Protocollo Venezia"* (Law n. 360/1991)

- ❑ Sediment samples n° 10, 16 show the lowest concentrations for all the metals investigated, while samples n° 6, 8, 12, 13 show the highest values.
- ❑ Sample points with low concentration of metals in the sediment are the closest to lagoon inlets, where the ingression of sea water is strong and the sediments are predominantly sandy (FIGs 2 and 3).



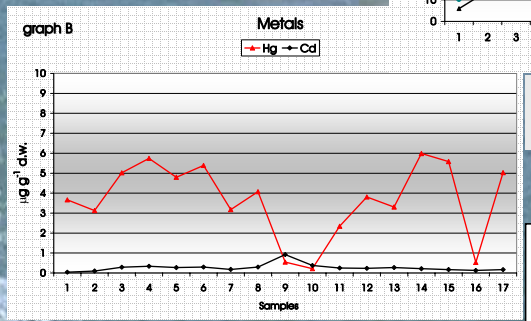
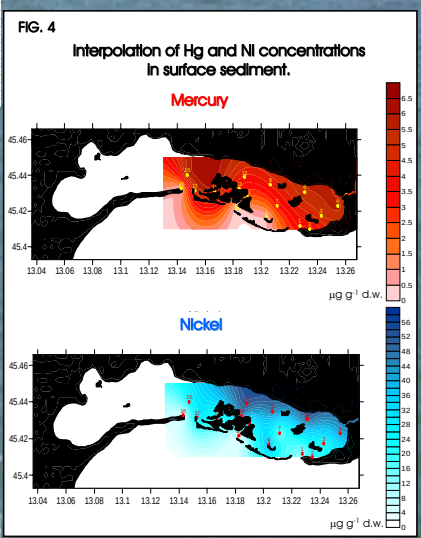


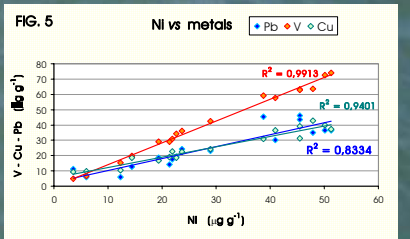
FIG. 3 – Concentrations of metals in sediment samples:
↑ *graph A* Vanadium, Nickel, Chrome, Lead and Copper
← *graph B* Mercury and Cadmium

- ❑ Sample points with high concentrations of metals in sediment are localized in the inner part of the lagoon, characterized by deposition phenomena and fine granulometry (silt and clay) (FIGs 2, 3 and 4).
- ❑ Areas of greater metals accumulation coincide with areas of sediment deposition. Almost of all metals distribution maps show a similar distribution; Hg and Ni maps have been here reported (FIG. 4).
- ❑ Strong correlations exist between Ni and V, Ni and Cu, Ni and Pb concentrations in surface sediment (FIG. 5). It could be an interesting information about anthropogenic activities as source of pollution (e.g. Ni and V are commonly used as alloying addition to iron and steel).



CONCLUSIONS

- ⌘ Inner areas of the basin, characterized by sediment deposition (silt and clay), and the zone influenced by Aussa-Corno river inputs are characterized by the greatest pollution.
- ⌘ The critical problem of Grado Lagoon is Mercury contamination of sediments. It has probably both natural and anthropic origin. Other studies (Piani *et al.*, 2005) identified the presence of both cinnabar and non-cinnabar (usually the chemical form more mobile) compounds in Marano Lagoon (FIG. 1). The spatial distribution of non-cinnabar compounds results influenced by freshwater inputs, in particular Aussa-Corno river; it passes through Torviscosa industrial area where many activities, like chemical plants, are present. High values of Hg in the eastern part of the basin are more probably due to Isonzo river input, coming from Idrija (SLO), a cinnabar mining zone.
- ⌘ Further studies could be useful to clarify Ni *vs* V – Cu – Pb strong correlation.



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Acknowledgments

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