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PRESENT AND PAST INPUTS OF MERCURY IN A SPRING RIVER ESTUARINE SYSTEM (AUSSA-CORNO RIVER, MARANO LAGOON, ITALY)

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Introduction and environmental setting

The Marano and Grado lagoon (Northern Adriatic sea) presents high vulnerability due to the great human impact caused by urban settlements and industrial areas located within the Aussa-Corno River system.

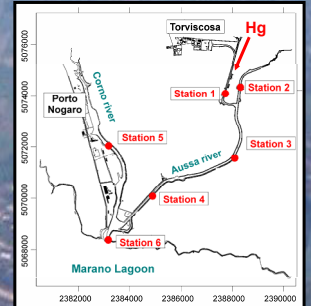
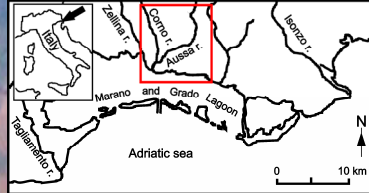
Torviscosa industrial complex has been a source of mercury (Hg) since 1949-50, when a chlor-alkali plant became operative. Hg discharge presumably stopped in 1984 when wastewater treatment systems were installed⁽¹⁾.

A total amount of 186.000 kg of Hg was assessed to be released into the river and, presumably, settled into the estuarine-lagoon environment.

The sediments of this lagoon are also affected by a secondary long-term Hg source providing a significant amount of this metal from the Idrija mine through the Isonzo river inputs^(2,3).

The active input of Hg from the contaminated site into the lagoon system was determined and special attention was paid to investigate partitioning of Hg between dissolved and particulate phases.

Sampling area



Field activity (October 2004)

- ✓ Surface and bottom water samples were collected by Niskin bottle in ebb-tide conditions.
- ✓ Temperature, salinity and turbidity were recorded *in situ* by means of CTD Hydrolab H₂O Multiprobe.
- ✓ Bottom sediments were recovered by a Van Veen grab.

Analyses

- ✓ Total Hg (THg), particulate Hg (PHg) and dissolved Hg (DHg) in water samples were determined by CV AAS after one step gold amalgamation.
- ✓ Total Hg in sediments was determined by CV AAS following EPA 3052 recommended digestion method.
- ✓ Dissolved O₂ concentrations were determined using the Winkler method.

Marano
Lagoon

station 6

Porto Nogaro
industrial site

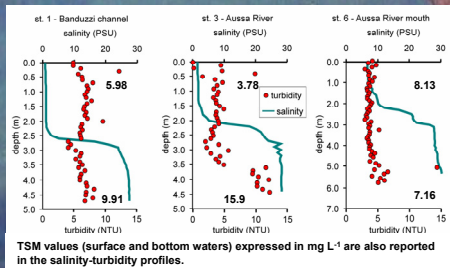
station 5

Corno River

Aussa River

station 4

Chlor-alkali plant
4 km inland



Results and Discussion

Chemical-physical parameters profiles along the water column (turbidity, salinity, and total suspended matter) are reported under figure 1. Thermo-haline stratification and saltwedge system circulation were recognized on the basis of field data. Dissolved O₂ decreased significantly in the bottom saline layer as the saltwedge tip (station 1 and 2) was approached (2).

The highest surface PHg values were detected in station 1 close to the contaminated site (3). PHg contents in surface waters decreased towards the rivers mouth, probably due to dilution effects and progressive mixing of riverine and lagoon waters. This behavior is even more evident if PHg concentrations are expressed on the basis of dry weight basis (4).

Conversely, DHg concentrations were almost similar both along the river course and between surface and bottom samples (5).

The higher log K_d values (4.5-6.0) obtained from surface samples testified that Hg was prevalently bound to riverine fine suspended particulate matter (6) compared to the more saline bottom samples.

Values of THg in sediments ranged between 0.32-5.69 μg g⁻¹ (7). According to the results, Hg prevalently accumulated in station 3 and 4 and not at the river mouth (station 6), whereas the lowest value was found upstream the confluence between Banduzzi channel (passive source) and the Aussa river (station 2). Moderate Hg content found in the Corno River (2.21 μg g⁻¹), not affected by direct metal inputs, indicates possible influence of tidal fluxes in transport and sedimentation processes.

Conclusions

Although direct Hg discharge in the Aussa-River system stopped 20 years ago, a significant input of Hg, in both dissolved and particulate form, was recently detected in surface freshwaters. The source can be undoubtedly identified in the artificial channel connecting the contaminated industrial area and the upper Aussa river course. Contaminated surface freshwaters flowing from this channel are partially diluted with river waters and mixed with the more saline lagoon waters nearby the river mouth. These processes would allow Hg to accumulate not only in the lagoon but also in the lower Aussa River bottom sediments. Further research will focus on Hg speciation and metal availability in river sediments.

References

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