Investigation on Dissolved and Suspended Heavy Metals of the Dese River (Venice Lagoon)

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Rivers and channels of the Venice Lagoon drainage basin collect heavy metals from industrial, agricultural and municipal sources. They successively discharge in the lagoon in correspondence of the estuarine shallow-water areas, where both water chemical-physical behaviour and circulation are often quite difficult to evaluate because of the presence of numerous tidal channels and the complexity of the morphology.

Starting from a general investigation on the yearly pollutant load variations of the eight main tributaries (BERNARDI *et al.*, 1986), a representative test-area for the study of the behaviour of discharged heavy metals was chosen in correspondence of the estuarine system of the Cona Marsh (BERNARDI *et al.*, 1988). This marsh (Fig.1) is directly interested by the Dese River and for its hydrodynamical and water chemical-physical characteristics - is one of the more complex sub-areas in the Venice Lagoon.

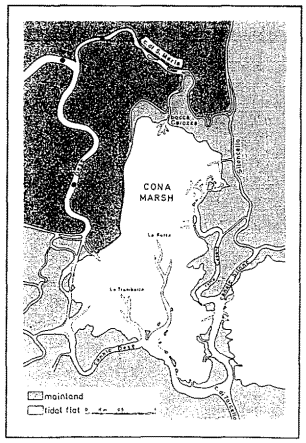

Fig .1 Map of the Cona Marsh.

During the last five years, field measurements were done to evaluate and study the extent and behaviour of water pollution in the marsh. Numerous samples were collected and analyzed for their heavy metals content by P.I.X.E. This multielemental technique (CECCHI *et al.*, 1987) permits to analyse both particulate and dissolved metals through the preparation of suitable thin "targets" from the samples and their exposition to 1.8 MeV proton beam.

Because of the key-role of suspended particles (with diameter up to about 8 microns) in both transport and accumulation in the sediment of this area (GHERMANDI *et al.*, 1991; ZONTA *et al.*, (a) will be published), the filtration through the usual 0.4 microns pore size filter is not adequately descriptive for this kind of study and often produces filtered samples with a very low concentration of some heavy metals. Therefore, aliquotes of sample are submitted to two filtration steps (poly-carbonate 8 and 0.4 microns membranes) and are analyzed both in the sampling state and after each separation. To improve the maintainance of the filter nominal pore size and to reduce filtration time avoiding the clogging, a filtration system was realized, tested (ZONTA *et al.*, (b) will be published) and patented.

On April 1991 an intense sampling scheme was followed, collecting at different depths water samples in three stations (indicated in Fig.1), following the tidal excursion. Samples were filtered twice as aformentioned and the water behaviour was observed during the sampling. Results obtained are presented, showing the occurrence of scavenging, flocculation and resuspension processes. Some insight on the role of water circulation in the marsh are proposed and underlined the need for future research activities.

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A Study on the *Chironomus salinarius* Population in the Sediment of the Venice Lagoon and during the Emergence Period

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The morphology of the Venice Lagoon is characterized by a complex network of channels starting from the three inlets which permit the tidal water exchange with the Adriatic Sea, and delimiting shallow water areas (like marshes and mud-flats) with mean depth of about 50 cm. Due to the continual discharge of pollutants from point sources and the drainage basin, stressed environmental conditions may be established in the shallow-water areas where the hydrodynamics slacks, with harmful effects as intense macroalgae growth, anoxic crisis and reduction of the water quality. This situation favours the establishment in the sediment of a few tolerant species to the detriment of others more sensible to the environmental conditions, so reducing the variety of the benthic fauna.

For this reason, during recent years the population of *Chironomus salinarius* (Kieffer) has strongly increased in the sediment of the Venice Lagoon. A particular type of hemoglobin in the hemolymph - with high affinity to oxygen (NOCENTINI, 1985) - renders the larvae resistant to anaerobic conditions and therefore their presence in the sediment is an indicator of low environmental quality. This demographic explosion produces considerable trouble to human activities and health (MARCER *et al.*, 1990) and problems for traffic and touring (CERETTI *et al.*, 1985) during the summer period, when numerous chironomid adults fly.

The environmental division of the Italian National Research Council, in Venice, in collaboration with the Ecology Department of the municipal government started a study on the *Chironomus* behaviour to program interventions to delimit and control the phenomena in their growth stage and from spreading. The research activity carried out in the three test areas (Fig.1) during the 1991 is presented and it regards the two principal stages (larval and adult emergence) of the *Chironomus* biological cycle.

The larval spatial distribution was determined in the densely populated area A (CERETTI *et al.*, 1985). The significance of the number of larvae counted in sites corresponding to the vertex of a 500 meter-wide grid and the causes of sampling errors were evaluated by counting larvae in 44 sediment samples (ZAGO *et al.*, 1991 a). The second test-area B is subjected to an intense macroalgae growth (*Ulva rigida*) and it was previously studied to determine water circulation, grain-size and redox characteristics of the sediment and heavy metals accumulation (ZONTA *et al.*, 1990). The research was aimed to investigate the relationship between population distribution and sediment characteristics, showing that finer particles constitute a preferential habitat for larvae (ZAGO *et al.*, 1991 a). Further, Scanning Electron Microscopy (SEM) permitted to photograph both external and internal morphology of the *Chironomus* larva (AVIGNONE *et al.*, 1991), also showing the presence in the intestinal apparatus of ingested fine-grained particles and micro-organisms constituting the diet of the larval stage.

Finally, the Chironomid emergences were observed in the test-area C, close to urban centres to which adults are attracted by the lights. During the summer period, samples of flying adults were collected in the evening hours, providing information on both the daily and seasonal trend and density of emergences and showing population peaks over a five-day cycle, that may correspond to a strategy increasing the probability of reproduction (ZAGO *et al.*, 1991 b).

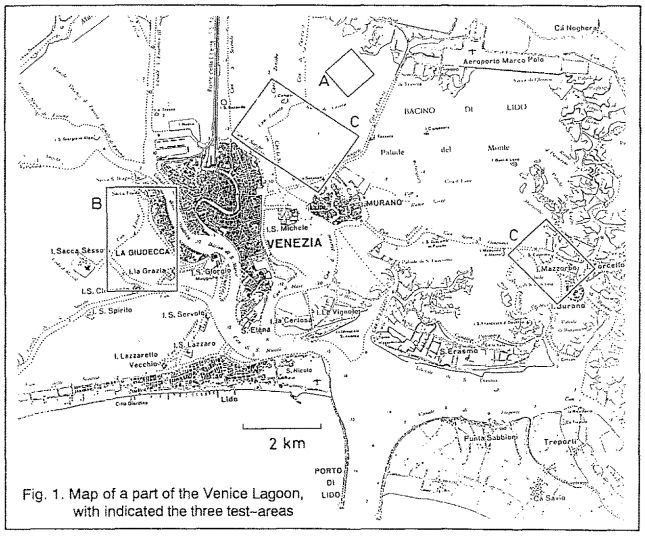

Fig. 1. Map of a part of the Venice Lagoon, with indicated the three test-areas

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