Benthic respiration in the Adriatic Sea and its effect on nutrient exchange at the sediment-water interface

Paola GIORDANI[1], Willem HELDER[2], Tom TAHEY[2] and Peter A.W.J. DE WILDE[2]

[1]Istituto per la Geologia Marina del C.N.R., BOLOGNA (**Italy**)
[2]Netherland Institute for Sea Research (NIOZ), TEXEL (**The Netherland**)

In order to estimate sediment efficiency in recycling nutrients within a marine basin, benthic fluxes and diagenetic reactions have to be assessed.

A joint Italian-Dutch investigation was carried out in western north central Adriatic in the period March 9 - 23, 1992, based on direct measurements and calculated estimates of oxygen consumption and nutrient regeneration rates at the sediment-water interface. This cruise was part of an EEC-STEP programme about the trophic problems of the Adriatic sea.

Earlier investigations (1,2) carried out in different hydrodynamic conditions, showed some evidence about the effect of sediment texture and accumulation rates of land derived fine materials on burial and recycling efficiencies of nutrients.

Accordingly, 8 stations were selected along the main sedimentary pathway of the Po river discharged load southwards, down to the continental slope (Fig. 1). The four stations in the NW area match some of the ones already studied, therefore some comparison in relation to different oceanographic regimes is allowed in order to infer more accurate estimates about nutrient budget on an annual scale.

At each station the following operations were carried out:

1) CTD profiling and sampling of the water column for on board analyses of dissolved oxygen and nutrients;

2) deployment of benthic chambers built in a free-falling vehicle (lander) for the estimate of sediment oxygen consumption and sediment-water exchange of nutrients;

3) deployment of an "in situ" oxygen profiling lander (TROL);

4) box-coring for squeezing of porewaters for the analyses of nutrients and total CO^2, and analyses of org. carbon and nitrogen, biogenic silica in the solid phase; oxygen penetration was measured in a subcore with a microelectrode device at the sea bottom temperature;

5) oxygen consuption rates from whole-core deck incubations;

6) qualitative and quantitative assessment of sediment fauna.

While the results for nutrient chemistry are still incomplete and of preliminary character, oxygen measurements gave interesting indications which can be summarized as follows.

Oxygen concentrations in the bottom waters were lowest at the northern stations (160 - 175 uM) and highest in the southern stations (260 - 280 uM). If compared to previous measurements, carried out in different hydrological regime (i.e. stratification) they are 10 % higher.

The penetration of oxygen into the sediment as measured with microelectrodes, both in-situ with the oxygen profiler (TROL) and in the lab are consistent. Smaller penetration depths (2 - 3 mm) were measured in Stat. 1 and 2, highest (15 mm) at Stat. 10, 250 m deep. Fig. 2 shows an example of "in situ" oxygen profile at Stat. 3. The presence of animal burrows, enhancing local increase of oxygen concentration is clear.

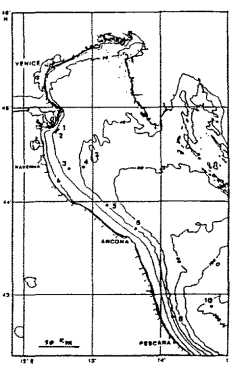

Fig. 1 - Map of the stations

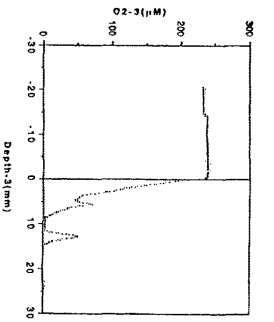

Fig. 2 - In-situ oxygen micro-electrode profile, made with TROL at stat.3. The presence of animal burrows is seen at 6 and 12 mm depths.

Oxygen consumption rates at different stations measured both by deck incubations of whole cores and by "in situ" benthic chambers and those calculated by diffusion modelling from the TROL profiles show relative good correlations. Compared to the "in situ" incubation technique (benthic chamber deployment) diffusive fluxes result somewhat lower, indicating the effect of bioturbation on the experimental fluxes. Data from this field trip are comparable to previous results, pointing out that different oceanographic conditions do not seem to affect benthic respiration in the studied area.

REFERENCES

1. HAMMOND D.E. *et al.*, 1984.- Benthic flux measurements in NW Adriatic coastal waters. *Mem. Soc. Geol. Ital.*, 27, 461-467.
2. GIORDANI P. *et al.*, 1992.- Nutrient budgets for sediments in the Northern Adriatic sea: burial and recycling efficiencies. *Sci. Total Environ.*, in press.

X