Macro and meiobenthic responses to oxygen depletion in the Gulf of Trieste (Northern Adriatic Sea, Italy). Preliminary results

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Previous researches carried out in the 70ies showed that some areas of the Gulf of Trieste suffer periodic hypoxic and anoxic crises. Then in 1986 began a research program in order to discover causes and consequences of oxygen depletion on the benthic communities (ALEFFI *et al.*, 1992 in press).

During 1990 and 1991, within the Alpe-Adria Project, grab macrobenthic and corer meiobenthic samples have been collected on three stations. In this paper are considered the results of the station located in the middle of the Gulf, that usually presents, at the end of the summer, low oxygen levels. This station (45°39'80 N, 13°35'40 E) is 22.5 m deep and characterized by sandy pelitic sediments (BRAMBATI *et al.*, 1983). The macrobenthic fauna belongs (according to PERES et PICARD, 1964) to the VTC biocoenosis with DC and DE elements (OREL et MENNEA, 1969). This area, since the end of August to September 1990, suffered anoxic stress accompanied by mortalities of benthic organisms. In the 1991 the oxygen level lowered gradually during the summer, reaching a minimum in October (Fig.1) but mortalities were recorded only in a near deeper area (BRIZZI and VIO, pers. comm.). The analysis of the macrobenthic samples shows a decrement in species and individuals numbers after the crisis of September 1990 (Fig.2). Further depletion in species number was discovered in July 1991 but the individuals number increased. In November 1991 a greater number of species and individuals was observed, indicating a probable recovery of the system. During all the considered period the more abundant species were *Corbula gibba*, *Maldane glebifex* and *Eunice vittata*, that seem so coping with low oxygen levels. These species also became greater in number, lowering the Shannon index (H) till November 1991 (Fig.2). On the other hand *Amphiura chiajei* and the other less abundant Echinodermata disappeared after the anoxic event of September 1990, confirming a lesser resistance of these animals to this stress (STACHOWITSCH, 1991).

The meiobenthic fraction (only major groups were counted) followed the macrobenthic trend in relation to the number of sampled specimens. In fact, after the anoxic crisis in 1990, the abundances dropped except for the increase of Nematoda (Fig.3), while in 1991 the whole community was reduced in number.

Finally the chi-square test calculated on the distribution of the three more abundant macrobenthic species showed highly significative differences among the four samples (Tab.1). In the same way the distribution of individuals in the major meiobenthic taxa (Nematoda and Copepoda), sampled before and after oxygen depletion in the two years, was significantly different (Tab.1).

Then the oxygen level seems to be one of the main factors influencing the evolution of both macro and meiobenthic fauna.

	Jun.	Jul.	Aug.	Sept.	Oct.	Nov.
1990	4.65	4.09		0.37	4.70	
1991	4.37	2.63	2.20	1.63	1.28	5.35

Tab. 1 - Bottom oxygen level

	3/90	9/90	7/91	11/91
H	3.573	3.088	1.398	2.195
H max	5.392	4.644	4.170	5.087
specimens	300	145	430	463
species	42	25	18	34

Tab. 2 - Diversity

6/90	7/90	9/90	10/90	6/91	7/91	9/91	10/91	11/91
2.03	3.26	7.13	26.77	11.69	7.51	4.57	2.74	7.93

Tab. 3 - Meiobenthos - Nematoda/Copepoda ratio in 1990-1991

Macrobenthos		Meiobenthos
3/90 vs 9/90 = 33.07** 2 dgf		9/90 vs 10/90 = 76.33** 1 dgf
3/90 vs 7/91 = 42.99** 2 "		10/91 vs 11/91 = 124.72** 1 "
3/90 vs 11/91 = 14.43** 2 "		10/90 vs 11/91 = 71.90** 1 "
9/90 vs 7/91 = 130.8** 2 "		
9/90 vs 11/91 = 83.01** 2 "		* = p< 0.01
7/91 vs 11/91 = 11.64 * 2 "		** = p< 0.001

Tab. 4 - Chi-square values between samples

REFERENCES

ALEFFI F., OREL G., DEL PIERO D. and VIO E., 1992.- Oxygen conditions in the Gulf of Trieste (High Adriatic). In *Science of the Total Environment*, Elsevier Science Publishers B.V., Amsterdam (in press).

BRAMBATI A., CIABATTI M., FANZUTTI G.P., MARABINI F. and MAROCCO R., 1983.- A new sedimentological textural map of the Northern and Central Adriatic Sea. *Boll. Ocean. Teor. Appl.*, 1 (4) : 267-271.

OREL G. e MENNEA B., 1969.- I popolamenti bentonici di alcuni tipi di fondo mobile del Golfo di Trieste. *Pubbl. Staz. Zool.* Napoli, 37, 2° suppl.: 261-276.

PERES J.M. et PICARD J., 1964.- Nouveau manuel de bionomie benthique de la mer Méditerranée. *Rec. Trav. St. mar. Endoume*, 31 (47) : 1-137.

STACHOWITSCH M., 1991.- Anoxia in the Northern Adriatic Sea : rapid death, slow recovery. In *Modern and Ancient Continental Shelf Anoxia*, R.V. Tyson and T.H. Pearson eds., Geological Society Special Publication.

Living benthic foraminifera in Po Delta River (Italy) : a research in progress

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In this paper we present a lagoon foraminiferal study in progress in the Istituto per la Geologia Marina-CNR, Bologna. Six stations in one of the Po Delta lagoon (Sacca del Canarin) have been selected and sampled at spring-fall time and at autumn-fall time during 1991. The samples have been collected by a Van Veen grab. On surficial and bottom waters the measured parameters were pH, salinity, temperature, Eh, O_2. Their values do not show significant variations, whereas the microfaunas vary quantitatively from one station to another the stations; therefore other parameters, such as $CaCO_3$ and nutrients content, should be responsable of these differences.

The uppermost one cm has been sampled and directly stained with a Rose Bengal/ethanol mixture. In laboratory the samples were washed and replaced in ethanol. Foraminifera were determined under a light microscope: 300 specimens (stained and not) were counted to gain the total population, then the count continued only for living (=stained) Foraminifera until 300 where possible, to obtain the living population; their frequencies are reported in Fig. 1. Because of the scarce availability of data, only the following general valuations can be proposed:

a) noteworthy differences are often present between living and total populations (e. g. St. 3 and St. 4 at spring-fall; St. 4 at autumn-fall). For each station the living/total ratio was calculated and reported in Fig. 1. The range of these values varies from 0 to 0.54. This fact is coerent with data reported in literature (SCOTT and MEDIOLI, 1980)

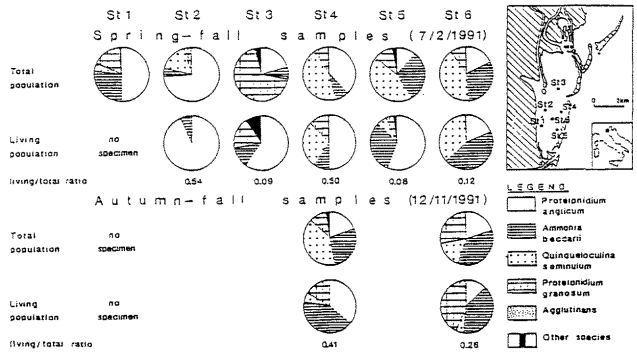
b) there is a strong quantitative difference in the living populations collected in the different stations; they may indicate lateral changes of some parameters at short distance also

c) at this moment of the research, it is hazard to compare the two seasonal samplings; the living populations vary quantitatively in the same station (e. g. St. 4: in autumn-fall, *A. beccarii* frequency increases in comparison with the spring-fall sampling. At the contrary, *Q. seminulum* shows a strong decrease). This fact may be due to environmental instability tipical of a lagoon.

These preliminary results encourage to continue this study wich looks to be pioneer in Adriatic sea. In fact the only study comparable with the present one, is related to Gulf of Trieste (HONEGGER *et al.*, 1989), but it differs in the methodology.

We intend to continue the seasonal sampling in order to obtain two main results:

1) to investigate the present environment
2) to recognize the changes induced by human activity
3) to reconstruct paleoenvironmental situations in Northern Adriatic Holocene sedi-ments.



REFERENCES

HOHENEGGER J. *et al.*, 1989.- Reasons for spatial microdistributions for Foraminifers in an intertidal pool (Northern Adriatic Sea). *Marine Ecology*, vol. 10 (1), pp. 43-78.

SCOTT D.B. & MEDIOLI F.S., 1980.- Living vs. total foraminiferal populations : their relative usefulness in paleoecology. *Journ. Paleont.*, v. 54, n.4, pp. 814-831.

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