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The mechanisms of production of suspended matter are widely recognized to be related mainly to the riverine supply and to the biological activity, especially in a basin like the Adriatic.

In the northern part of the Adriatic Sea, the predominant suppliers of suspended matter are the rivers, and, among these, the Po River is undoubtedly the main.

In some periods of the year, when the environmental conditions are favourable, the particulate matter supplied by the rivers is accompanied by the products of the biological activity that in some conditions can be very relevant.

The present paper refers about a study on particulate matter carried out from March 1990 to November 1991 in the Gulf of Venice.

An example of the distribution of particulate matter at a basin scale is the result of a survey done in May 1990, that showed the typical features of the suspended matter distribution at the beginning of the stratification period, in which the Po River plume is well developed and north-eastward deflected, with concentration values at the plume front of the order of 10 mg dm⁻³ at the surface, 15 nautical miles off of the river mouth.

The observations on suspended matter were carried out on three stations in the Gulf of Venice, with monthly frequency, and deal with the Total Suspended Matter (TSM) concentration, the content in Particulate Organic Carbon (POC) and Particulate Nitrogen (PN), together with the measurements of standard hydrological properties.

In Tab. I the average values, at different depths, for TSM (expressed as dry weight, DW), organic and inorganic fractioning, POC and PN are reported, taking into consideration the same periods of the two years of observations, to allow a better comparison.

In the summer 1991 appeared in the Northern Adriatic Sea a noticeable amount of gel-like aggregates; on the contrary, in the previous year, these were not observed.

In our data this is evidenced by the increase of the total amount of suspended matter and particularly of the organic carbon. Looking at the data in detail, we can observe that this increase was particularly striking in the layer from surface to 20 m (about 2 times), whereas at the bottom the POC concentration remained substantially unchanged. These differences could also be due to the different meteo-hydrological regimes that took place in 1990 and 1991.

During the 1991 we realized some preliminary measurements of sedimentation fluxes, utilizing two fixed sediment traps located in the Gulf of Venice. We chose one station in the transition area between the coastal zone and the open waters, 17 m deep (Station 1), and a second one in open waters, 28 m deep (Station 2).

The preliminary results on sedimentation rates for suspended matter (DW), Organic Carbon (OC) and Total Nitrogen (TN) are reported in Tab. II.

These data, in the period from April to September 1991, suggest that the sedimentation conditions are homogeneous in the two stations, with the same variations of sedimentation rates in time. The unique constant difference is related to the content of organic carbon, that always appeared to be higher in the station closer to the coast.

	DEPTH m	DW mg/dm ³	INORG mg/dm ³	ORG %	POC ug/dm ³	PN ug/dm ³	C/N	SAMPLES n
June-October 1990	0.5	2.34	1.49	43.24	158.9	21.0	9.0	16
	5	2.04	1.30	43.28	160.3	20.7	9.2	16
	10	1.92	1.25	46.46	143.9	20.2	8.6	16
	20	2.28	1.44	46.07	176.4	26.1	8.4	8
	>20	2.10	1.40	40.24	161.0	26.1	7.7	12
June-October 1991	0.5	2.73	1.50	49.14	315.1	40.9	9.0	15
	5	2.40	1.10	51.34	316.4	40.4	8.9	14
	10	2.52	1.40	49.35	315.7	40.8	9.0	15
	20	3.26	1.86	46.83	210.0	31.7	7.8	9
	>20	3.65	2.52	33.23	168.0	26.5	7.6	9

TAB. I

STATION	PERIOD	DAYS	DW g/m ² /day	OC g/m ² /day	OC %	TN g/m ² /day	TN %
1	Apr-Jul 91	84	23	0.56	2.39	0.06	0.28
2	Apr-Jul 91	91	25	0.48	1.92	0.06	0.23
1	Jul-Sep 91	59	4	0.17	4.24	0.02	0.55
2	Jul-Sep 91	56	3	0.13	3.68	0.01	0.43

TAB. II

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The study of benthic Foraminifera, carried out in eight cores collected in the middle Adriatic Sea, allowed to follow the sea level changes occurred during the last Deglaciation. For dating the variations occurred in the time space under investigation, the planktonic Foraminifera biostratigraphy of BORSETTI *et al.* 1992 (present issue) has been used.

In the high morphological features (Tremiti Islands) a true shoreline is present at the bottom of two cores (Ad 85-33 and Adr 88-12). In the other cores a sea level change is testified by the variation of the assemblages, when deep indicators are substituted by the shallower ones.

On the basis of planktonic assemblages in three cores from the "Depressione Meso Adriatica" (DMA) IN 68-21, Ad 85-30 and in 68-16, the last de-glacial (to 15,000 yrs B.P.), the Younger Dryas (11,000-10,000 yrs B.P.) and the Holocene have been recognized. Cores IN 68-22, Adr 88-12 and Ad 85-33 contain only Holocene sediments as testified by the high frequency of *Globigerinoides ex gr. ruber* and by the *Globorotalia inflata* peak. In fact these two bioevents are characteristic of Holocene in Adriatic Sea (BORSETTI *et al.* 1992, present issue). Ad 85-33 and Adr 88-12 present a shoreline at the base. Finally Holocene sediments are present only in the upper part of Ad 85-34 and Adr 88-13.

In the DMA core, during the de-glacial period, benthic fauna is characterized by a circalittoral (depth >50 meters) assemblage (*Uvigerina* spp, *Cassidulina laevigata carinata*, *Hyalinae balthica*, *Trifarina angulosa*, *Cibicides pachyderma*, *Bulimina* spp and *Miliolids*); during the Younger Dryas time a shallower environment is testified by the disappearance and/or strong decrease of the deeper species and the occurrence of *Elphidium decipiens*. In the Holocene (COLANTONI *et al.*, 1989) the circalittoral assemblage replaced again the Y. D. one.

In the core IN 68-22 almost entirely circalittoral fauna is present. A slight shallower environment is detected by the occurrence of *Elphidium* spp at the base of the core only.

In the lower part of Ad 85-33 and Adr 88-12 cores we can recognize a true coastline (coarse mollusk remains and little pebbles). A deepening of environment from bottom to top of both the cores is demonstrated by the appearance of an infralittoral (depth < 50 meters) association (*Asterigerinata mamilla*, *Elphidium crispum*, *Ammonia beccarii*, *Nonionella turgida*, *Buccella frigida*) followed by a circalittoral one (*Uvigerina* spp, *Cassidulina laevigata carinata*, *Cibicides pachyderma*, *Bulimina* spp and *Brizalina* spp).

Finally Adr 88-13 and Ad 85-34 present an alternance of circalittoral and infralittoral environments and only the uppermost circalittoral assemblage in each core corresponds to the Flandrian transgression.

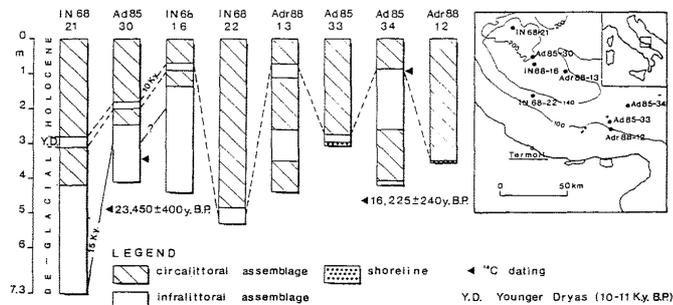
Therefore we can propose the following evaluations :

1) a sea level rise during the de-glacial interval (15-11,000 yrs B.P.) is testified only in MAD cores, but a shoreline did not form in the sites where cores have been collected

2) the Younger Dryas shallower deposits are recorded in the MAD cores, indicating a sea level fall during this time interval. In the other cores, these sediments are missing (Ad 85-34 and Adr 88-13) or not surely identified (Ad 85-33 and Adr 88-12). Reworking phenomena and sediments transfert occurred during the Flandrian transgression processes, may be responsible of these sedimentary hiatuses (ASIOLI and BORSETTI, 1989)

3) in every cores Holocene sediments are present and benthic Foraminifera content is indicator of the circalittoral environment.

4) The tectonic activity still in the Adriatic sea (COLANTONI *et al.*, 1989) does not allow to extrapolate site by site the shoreline records. Many more data are needed in order to identify and to date the Holocene shoreline in the Adriatic sea.



REFERENCES

- ASIOLI A. and BORSETTI A.M., 1989.- Sea level changes as evidenced by benthic Foraminifera associations in the Adriatic Sea. *Boll. Ocean. Teor. Appl.*, vol. VII, n. 4, pp. 375-45.
- BORSETTI A.M., ASIOLI A., CAPOTONDI L. and VERGNAUD-GRAZZINI C., 1992.- High resolution biochronology for the last deglacial period in the Adriatic Sea, based on planktonic Foraminiferal associations and isotope stratigraphy (present issue)
- COLANTONI P., ASIOLI A., BORSETTI A.M., CAPOTONDI L. and VERGNAUD-GRAZZINI C., 1989.- Subsidenza tardo-pleistocenica ed olocenica nel medio Adriatico evidenziata dalla geofisica e da ricostruzioni paleoambientali. *Mem. Soc. Geol. It.*, vol. 42, pp. 1-12.