Early diagenesis and nutrient benthic fluxes in an area South of Po River Delta, Northern Adriatic Sea, Italy

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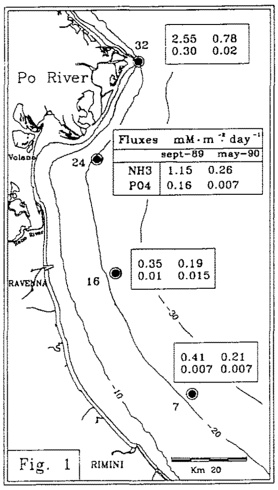
The aim of this study was to determine the early diagenetic processes that control nutrient exchanges at the sediment-water interface along the line of maximum dispersion of fine solid materials supplied by the Po River.

Intact sediment cores were sampled in late summer 1989 and spring 1990 at 4 stations. Their locations, as shown in fig. 1, were chosen by previous studies (BORTOLUZZI *et al.*, 1986; FRIGNANI *et al.*, 1991). Pore waters -after immediate extrusion in inert atmosphere- (pH, Eh, NH3, N03, P04, S04, Fe, Mn, Ca, Mg, and Alk) and sediments (grain size, Tot-C, Inorg-C, Tot-P, P-Fe, P-Ca, Org-P, Fe, Mn) were analysed at 1 cm resolution.

The results outline a clear-cut difference between the diagenetic processes at the station in the proximal prodelta of the main Po River mouth (st. 32) and those of southern stations (sts. 24, 16, and 7).



Station 32 is characterized by anaerobic decomposition of organic matter, in particular by sulphate reduction (ELDERFIELD *et al.*, 1981; VAL KLUMP et al., 1981). In addition Fe and Mn hydroxides reduction processes take place. The pore water profiles (fig. 2) present a large amount of organic matter decomposition products (Tot-C02, NH3, P04), while the precipitation of Fe as sulphide occours in the first 20-30 cm. Below this depth sulphate reduction is no longer present, since all S04 ions have been consumed. Such conditions are due to the fast burial of flocculated river sediments that contain large amounts of very reactive organic matter and inorganic compounds (Fe and Mn hydroxides). In contrast, in stations 24, 16, and 7 aerobic conditions prevail increasing southward. The organic matter is extensively degraded in the first surficial centimetres, as shown by NH3, Tot-C02, and P04 peaks (fig. 2), as well as by S04 values which are approximately constant even down to depth. This is due to:

a) less reactive river-borne organic matter, that was decomposed during lengthy transport in suspension;

b) lower sedimentation rate and frequent resuspensions that cause deposited sediments to experience longer oxic metabolization reactions before their final burial.

The differences found in diagenetic processes are also evidenced by the determinations of nutrient fluxes (P04, NH3) at the sediment-water interface. Fluxes were calculated by FICK's first law from pore water profiles.

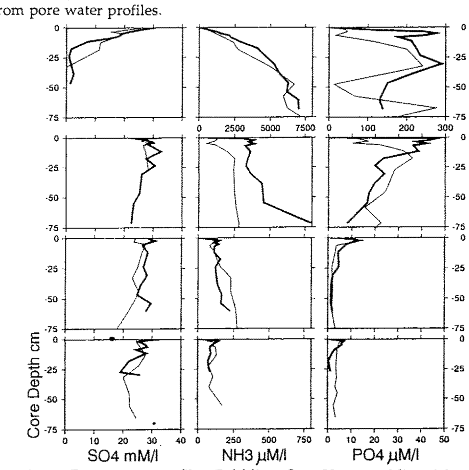


Fig. 2.- Pore waters profiles. Bold lines Sept-89, normal lines May-90.

The results for both seasons show higher flux values in station 32, where subsurficial anoxic conditions result in higher concentration gradients. From stations 24 to 7 fluxes decrease progressively southward. In the late summer period, the high temperature enhances the rate of microbical activity causing the release of large quantities of nutrients into pore waters. This in turn increases flux values at the interface, in particular at stations 24 and 32. At stations 16 and 7 the calculated fluxes are comparable with those calculated in the same area by GIORDANI and HAMMOND, 1985. Station 32, in late summer, shows fluxes similar to those determined in lagoonal environments (Sacca di Goro, BARBANTI *et al.*, 1992).

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Depositional and stratigraphical setting of the recent deposits in Southern Adriatic: Results of AD91 Cruise

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The AD91 Cruise, carried out in the Southern Adriatic Sea, characterized by a complex shelf-slope system and a deep basin (Fig. 1), was held in order to ameliorate the knowledge about the Recent to modern sedimentary pattern of the Apulian margin as well as benthic Foraminifers thanato- and bio-coenoses by University of Bologna and Institute for Marine Geology of the Italian CNR.

Low frequency sub-bottom and high resolution seismic reflection profiles have been recorded. Box cores and gravity cores (distributed in 33 stations) were taken at all 100 m isobaths. At 20 stations the sediment top (5-10 cm) was sliced, and stained with Bengal Rose, for the recognition of living Foraminifers. These samples were preserved in ethyl alcohol.

At 13 stations short sediment cores were sampled with a gravity corer provided with 4 m Or casing. The faunas contained in the top and bottom of each segment (1.20 m in length) or each core were provisionally studied.

The preliminary study of foraminiferal associations and of acoustic data allowed a first step toward the interpretation of the depositional and stratigraphical setting of the most recent deposits. On the whole area, a shelf-wide regional unconformity (U- horizon) overlaid by a thin of modern dei osils is the most prominent recognizable feature (Fig. 2a, b).

On the shelf it marks a sharp erosive surface connected to the last glacioeustatic sea level changes. In the northern sector (Gulf of Manfredonia) the deposits reach a maximum thickness of about 25-30 msec, and they evidence significant variations in the terrigenous input, probably due to climatic changes during the Pleistocene-Holocene transition.

Off the Gargano Promontory, a progradational growth of the margin, with at least three inner clinoform progadational growth, was recognized (Fig. 2b).

In the southern sector (Bari-Brindisi area) the modern shelf deposits are limited to a few meters (Fig. 2c). Active distensional tectonic seem to affect the shelf-slope system, as testified by the morphology and by the Early Pleistocene deposits overlaid by a few centimeters thick Holocence clay cover.

Along the whole margin the sedimentary cover is extensively affected by deformative events of several kinds and amplitude (Fig. 2d), detected also in the basin area, where the sediment accumulation rate estimated to be comprised belween 10 and 40 cm/ky.

Fig. 1.- Bathymetric map of the South Adriatic Sea (data from GIORGETTI and MOSETTI, 1969 and from FABBRI and GALLIGNANI, 1972; modified).
1. isobaths in meters; 2. seismic lines showed in Fig. 2; location of gravity cores (3) and box cores (4).

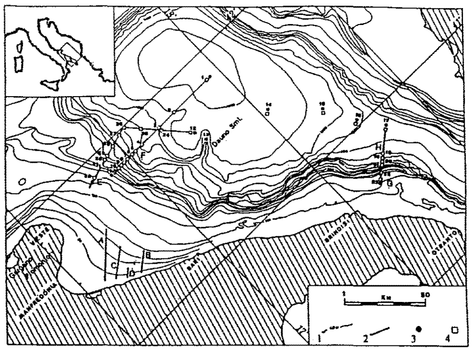

Fig. 2.- 3.5 kHz profiles across the Northern shelf edge (Lines A and B), the basin (Line C) and the Southern outher shelf (Line D) (see Fig. 1 for locations).
U = Last Glacial erosive surface; CL = Late Pleistocene clinoform signmoid sequence; U1 = erosive surface cutting the earlier stage of propagation; W = buried wedge; WP = lens-shaped body acoustically transparent.