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).

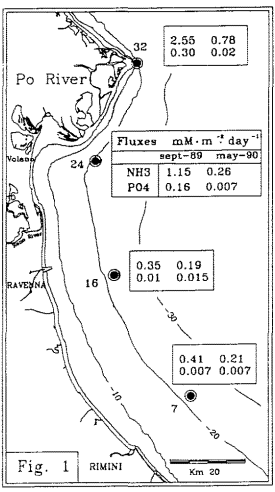

Fig. 1

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.

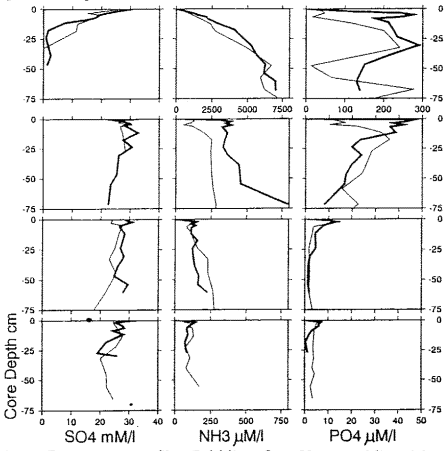

Fig. 2.- Pore waters profiles. Bold lines Sept-89, normal lines May-90.

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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