

## Sedimentological and macrobiological characterization of an area south of Po River Delta, Adriatic Sea, Italy

M.C. BERGAMINI, A. CASTELLI\*, R. CREMA\*, F. FRASCARI, E. IORI, L. MARINANGELI, S. MISEROCCHI, D. PREVEDELLI\* and G. ROSSO

Istituto Geologia Marina, CNR, BOLOGNA (Italy)

\*Dipartimento Biologia Animale, Università MODENA (Italy)

A sedimentological and macrobiological characterization of an area in the Northern Adriatic Sea is presented. The study area does not include nearshore environments. Sedimentary input is mainly due to the Po river; other rivers of Emilia-Romagna give minor contributions (BORTOLUZZI *et al.*, 1986).

The sedimentological and macrobenthic characteristics in the top 20-30 cm of sediments sampled by 8-replicas box-corers were examined. In particular we considered: grain size distribution; sedimentological structures; water content and redox conditions at different levels; type, degree and depth of influence of biological populations (CREMA *et al.*, 1991). Three main facies were identified (Fig. 1).

**Facies A** evidences an irregular, but continuous belt from the submerged beach to the 12-18 m isobath. It is mainly composed of silts, generally oxidized at the surface; although, in places, some sand is present. In front of river mouths - proximal prodelta zones (facies A') - sediments are reduced, finer, and richer in flocculated materials. In general, erosion surfaces characterized by discontinuities and by layers or lenses of reworked shells frequently occur. The degree of colonisation is variable, usually very high. Macrobenthic faunas are not homogeneous: at shallower depths they mainly include *Owenia fusiformis*, numerous Amphipoda and Bivalves (especially *Corbula gibba*) with varying proportions; at relatively deeper depths Polychaetes (*Nephtys incisa*, *Sternaspis scutata* and *Lagis koreni*) and Mollusks (*Nucula nucleus*) prevail. These macrobenthic associations are typically found in sediments with high inputs of organic and inorganic detritus, that are subject to very strong reworking by waves and currents.

**Facies B** can be divided into three subfacies (B', B'', and B'''). In general, it includes all offshore deposition areas of river-borne fine materials, especially from the Po, and reaches 30-35 m depth. Grain size ranges from silt to clay. Macrobenthic populations feature muddy sea bottom species. The *Corbula gibba* bivalve and many species of Polychaetes - among which *Prionospio malmgreni*, *Aricidea claudiae* and *Aricidea assimilis* - prevail in surface layers, whereas polychaetes such as *Maldane sarsi* or *Glycera rouxii* dominate in deeper layers. Density of peuplement differ in the three subfacies.

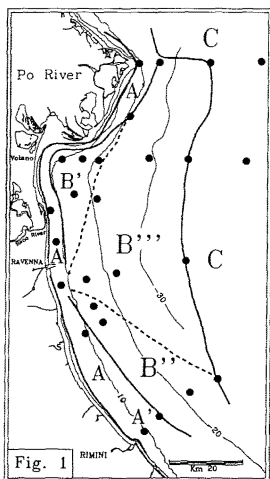
**Subfacies B'** is located south of the Po delta and it spreads from facies A to 20-22 m depth. Sediments have grain sizes from fine silt to clay; at the surface they are highly hydrated and not always oxidised, whereas in depth they are always highly reduced and present very few discontinuity surfaces. In some cases lenses of decomposed Bivalves occur. In addition there is a low density of benthic fauna.

**Subfacies B''** extends south of Ravenna and reaches 20-22 m depth. Sediments are mostly composed of silt, with clay and rare sand interbeds. Their colour indicates a general oxidised condition not only at the top. Discontinuities, shell debris deposits - even in lenses - and, in general, structures that indicate high energy on the bottom are frequent. The degree of macrobenthic colonization is medium-high to high. The peuplement is more varied in deeper layers, with the polychaete *Sthenolepis yhleni* associated to the above-mentioned species.

**Subfacies B'''** features offshore fine deposit areas. They are mainly composed of highly hydrated, dark green clays including some shell debris layers and fecal pellet lenses. The degree of macrobenthic colonisation is medium-high. This is an area where finer sediments, either resuspended at shallower depths or from large Po floods settle.

**Facies C** includes sea bottoms offshore 32-33 m. In this area relict sands of nearshore facies emerge. They were generated during sea level changes in the last Eustatic cycle. The ochreous or light grey colour, and the large colonisation mainly due to *Ophiura* indicate a strongly oxygenated environment which is undoubtedly affected by general Adriatic circulation currents.

It is important to emphasize that transition facies with heterogeneous benthic populations and lithological types are present between all the above-mentioned facies.



In conclusion, we have been able to point out:

- a sharp definition among areas that do (A, B) and do not (C) receive modern river-borne material;

- a further distinction among facies that experience direct fluvial deposition (including also flocculated material) (A), and facies that are mainly influenced by eroded and redeposited, or lengthy transported fines (B);

- a third distinction within facies B sea bottoms that:

- are protected by the Po delta from general current circulation and N and NE storms and receive high input from rivers (B');
- are characterized by higher (B'') and lower (B''') impact of Po river fines;

- that benthic species are more sensitive to differences in lithology of substrata, rather than to differences in depth variations or chemical-physical conditions; on the contrary, population density is highly affected by the average oxygenation of sea bottoms.

## REFERENCES

- BORTOLUZZI G., FRASCARI F., FRIGNANI M., GIORDANI P., GUERZONI S., ROVATTI G. & TURCI C., 1986.- Influenza del Po e dei fiumi minori sul contenuto di sostanze nutrienti nei sedimenti marini dell'Emilia Romagna. *Mem. Soc. Geol. It.*, 27, 483-498.
- CREMA R., CASTELLI A. & PREVEDELLI D., 1991.- Long term eutrophication effects on macrofaunal communities in Northern Adriatic Sea. *Mar. Poll. Bull.*, Vol. 22, 10, 503-508.