RELATIONSHIPS BETWEEN POCKET PENETROMETER RESISTANCE AND BOTTOM SEDIMENT TEXTURE IN THE NORTHERN ADRIATIC SEA

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Abstract

Measurements of pocket penetrometer resistance on box-corer sampled sediments of the Northern Adriatic Sea have been carried out. Analytical relationships between resistance values and sand percentages point out interesting aspects of the variability of the two parameters.

Knowledge about the mechanic characteristics of the upper layers of bottom sediments of the Adriatic Sea is altogether scarce. By taking sea-bed samples with a box-corer, during two short sedimentological surveys (March 5-7 and July 28-31, 1981), resistance data were rapidly acquired using an Italian ST 308 Effegi type pocket penetrometer. The study refers to six transects orthogonal to the coastline (fig.1) off-shore from Pesaro, Cervia, Porto Corsini, the River Po delta, Malamocco (Venice) and Ieolo. These intercept the belts of the textural distribution of the bottom sediments shown by CIABATTI and COLANTONI (1967), BRAMBATI (1968) and CO-

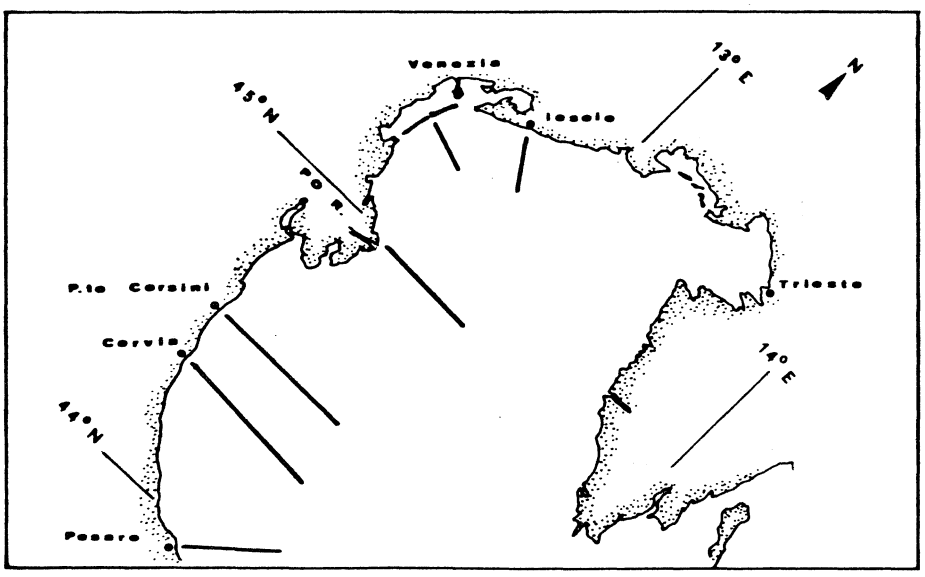

FIG.1- Sketch-map showing the box-corer sampling transects in the Northern Adriatic Sea.

LANTONI and GALLIGNANI (1978).

Within the first 5-7 cm of sediment, vertical resistance (q_v) and horizontal (q_h), expressed in kg/cm^2, as well as mean resistance q_m = = $(q_v + q_h)/2$ were obtained by taking numerous field measurements for each single sample. The relationships between q_m and the textural composition of the sediments, defined on the basis of the binary classification of NOTA (1958), are explained below. This interesting theme will be dealt with in greater depth in the near future.

The diagram q_m versus the percentage of sand (s) (fig.2) shows that the samples collected do not cover the whole spectrum of the distribution of the sandy component, in a homogeneous manner. In fact samples with a high percentage of fine sediments dominate. Furthermore, with an increase in s, the dispersion of the values of q_m increases significantly. Despite the limited number (38) of samples available, an attempt has been made to find an analytical expression of dependence between q_m and s. This could explain the mean trend of the phenomenon which would be a preliminary contribution in the study of the problem in the area chosen.

The data underwent various attempts at linear and non-linear analysis with elementary functions. The function $q_m = 0.137\ e^{0.0146\ s}$, made linear by means of a logarithmic transformation (fig.2) offers a mean rappresentation of the dependence of q_m on s which is both simple and significant (r = 0.68; std. error = 0.18).

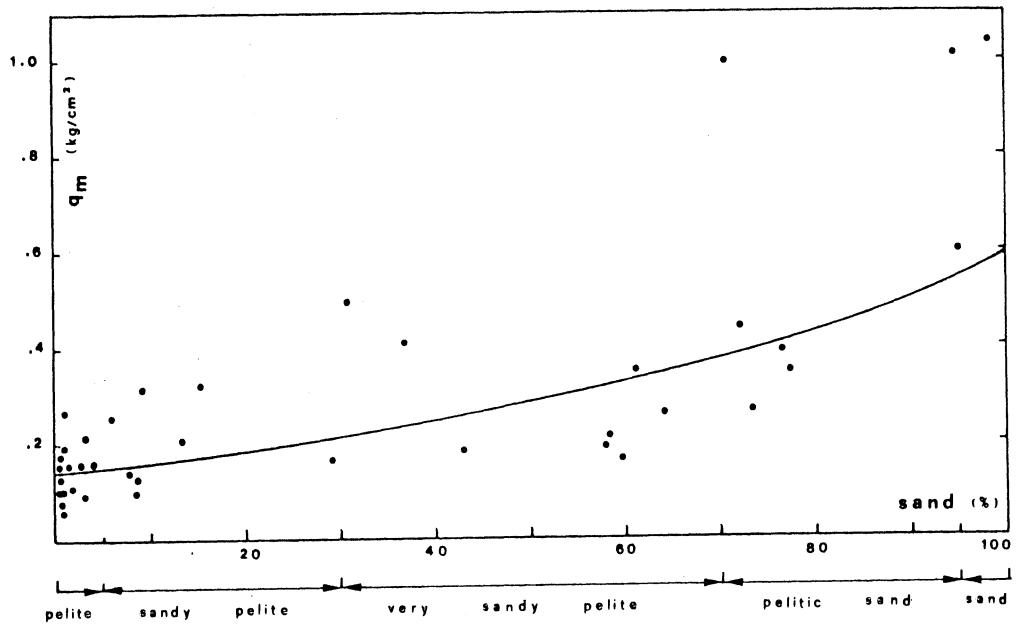

FIG.2- Mean pocket penetrometer resistance (q_m) vs. percentual sand content (s) in the bottom sediments of the Northern Adriatic Sea. Textural classes of Nota (1958) are also indicated.

The notable dispersion of the measurements of q_m for high sand percentages could be caused by either particular experimental conditions of evaluation or, rather, by the influence of some physical factor not yet singled out. Attempts to fit the percentages of silt and clay into a multiple, linear or exponential regression model (being at present improved) do not seem to contribute to a significant increase in the explained variation of the approximation function.

The same statistical analyses explained above have been carried out on q_v and q_h which result as being highly correlated ($r = 0.91$).

In conclusion, from the preliminary results, the following can be inferred.

(i) There is significant positive correlation between q_m and s;

(ii) the experimental method has shown itself to be rapid and simple;

(iii) high values of q_m (> 1.0 kg/cm^2) can be observed only with sand percentages over 65-70%. It is significant that this happens around the limit between very sandy pelites and pelitic sand of Nota's classification. This fact is a point in favour of the validity of this classification, even from a technical point of view and not just sedimentological in the strict sense, at least for newly deposited sediments.

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