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RECENT SAND SEDIMENTS GRAIN-SIZE DETERMINATION BY IMAGE ANALYSIS

Maurizio Bonardi* and Luigi Tosi*

* Consiglio Nazionale delle Ricerche, Istituto per lo Studio della Dinamica delle Grandi Masse, San Polo 1364, 30125 Venezia (Italy)

Abstract

Presented in this study is the application of the Image Analysis (I.A.) technique as alternative to the traditional mechanical sieving methods for grain size determination (Bonardi & Tosi, 1994a).

The application of Image Analysis technique to study the grain size of recent sand sediments has produced analytical data that are comparable to those obtained by conventional methods.

Furthermore, the use of the Image Analysis has provided additional morphological parameters such as grain elongation, shape and roundness that can be useful clues to depositional environment reconstruction.

Introduction

Image analysis technique has been successfully applied to the study of Late-Quaternary sand sediments from the Venetian Lagoon. The technique represents a new approach to grain size determination of sand sediments (Allen *et al.*, 1981). and provides new and useful parameters for the understanding of sediment transportation, sedimentation and environmental conditions.

Materials and methods

The first 30 meters of subsoil sediments along the littoral bar that separates the Venice Lagoon from the open Adriatic Sea are composed mainly of sand, clay, silt and peat (Bonardi & Tosi,1994b). They carry the imprinting of climatic fluctuation and sea level variations that the northern Adriatic basin experienced during its formation in the Late-Quaternary.

It is therefore important to be able to recognise all those mineralogical, textural and granulometric parameters (Ehrlich *et al.* 1980), that may contribute to a better understanding of the evolutional processes that have affected the formation of the lagoon of Venice.

Image Analysis is defined here as the technique that uses numerical values to characterise and classify images and their properties (Joyce-Loebel, 1985). An IBAS 2000 KONTRON image analyser was used for this investigation of recent sand deposits.

The conventional sieving method have been emulated by choosing similar diameter measurement intervals; while the percentage of grains for each interval, has been considered instead of the weight percentage.

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Results

The cumulative curve obtained by I.A. for a sample with at least 200 grains is reported and compared with the cumulative curve obtained by simulating the conventional mechanical sieving (Fig. 1).

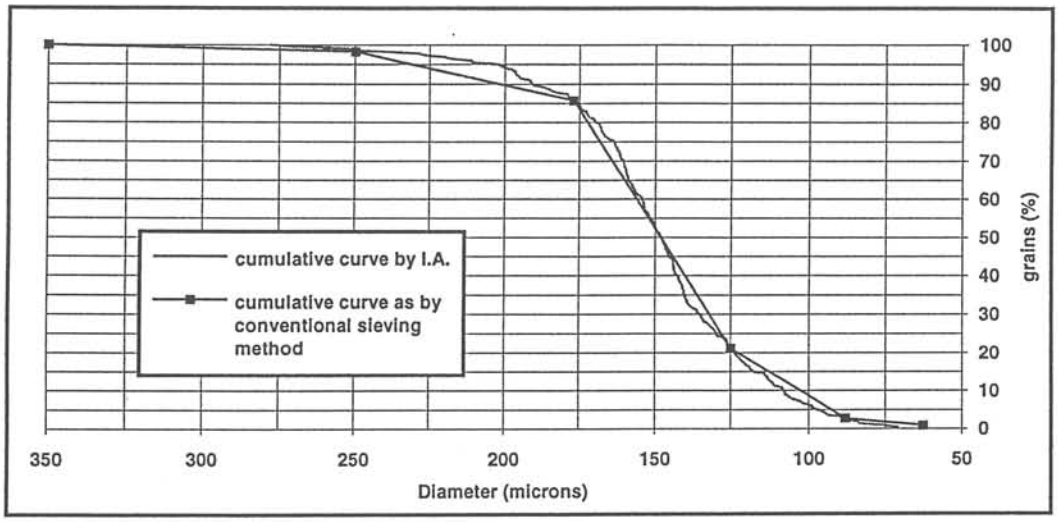

Fig.1. Comulative curve of a sand sample obtained by Image Analysis and by simulating mechanical sieving.

The application of the Image Analysis technique to the sedimentological study of a core is shown in figure 2 where the granulometric data of samples, taken at increasing depth, are represented by convetional cumulative curves.

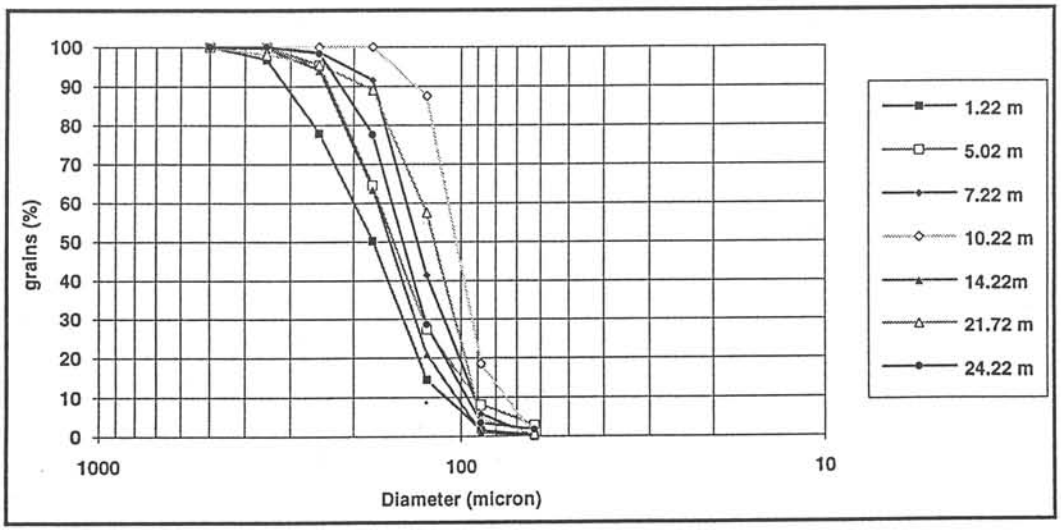

Fig.2. Cumulative curves (I.A. data) for sand samples taken at increasing depth from a core from the Venetian Littoral.

Correlation between average mineralogical composition variations (Fig.3) and granulometric parameters (Fig.4) obtained by I.A. for sand samples taken at increasing depth from a core from Venetian Littoral.

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The compositional and granulometric variations of the sand samples are related to climatic and sea level changes (Bonardi & Tosi, 1994c).

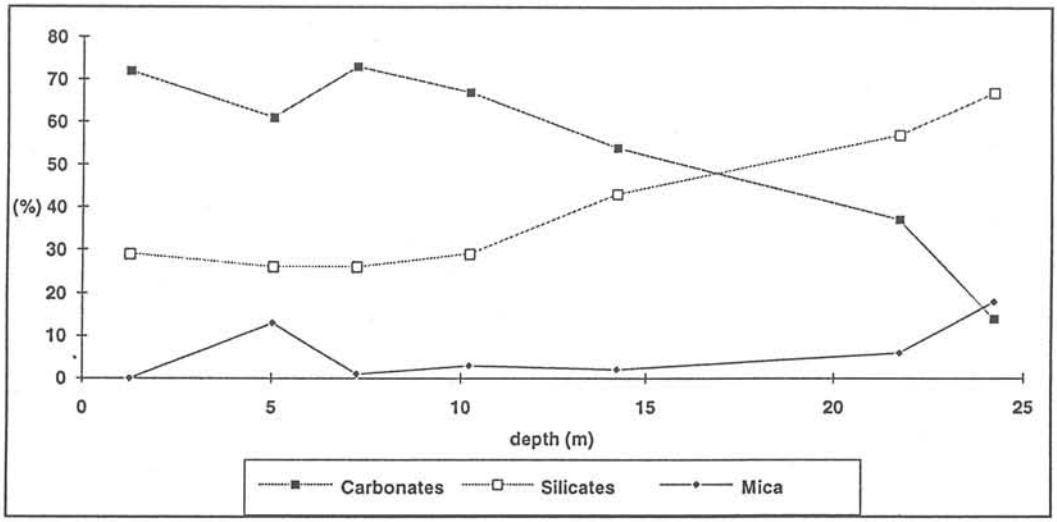

Fig. 3. Mineralogical composition variations with depth

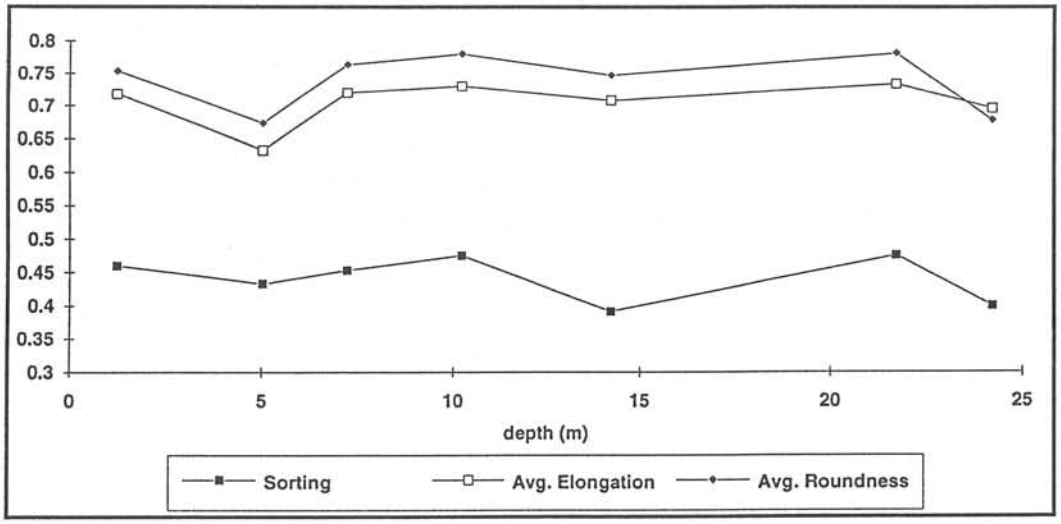

Fig. 4. Sedimentological parameters variation with depth.

Conclusions

Image Analysis tecnique used for sedimentological investigations offers several advantages:

- the granulometric investigation by Image Analysis technique produces analytical data that are comparable to those obtained with the traditional sieving method.
- very limited quantity of sample is required for the analysis.
- the granulometric measurement is fast and not destructive.
- average grain size measurement is more accurate than the measurent by mechanical sieving.
- the cumulative curve is obtained by interpolation of the diameter values of all grains.

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- additional morphological parameters such as elongation and roundness are provided.
- it is possible to improve and change the grains classification at any time, by changing the diameter intervals with the rielaboration of the data, whereas, with the conventional method, the measurements must be repeated every time the set of sieves has been changed.
- the granulometric investigation can be adapted to the different types of sedimentological investigation.
- simultaneous granulometric, chemical, mineralogical and morphological analyses of each grain are possible when the image analyser is used on-line with modern SEM or EMP.

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