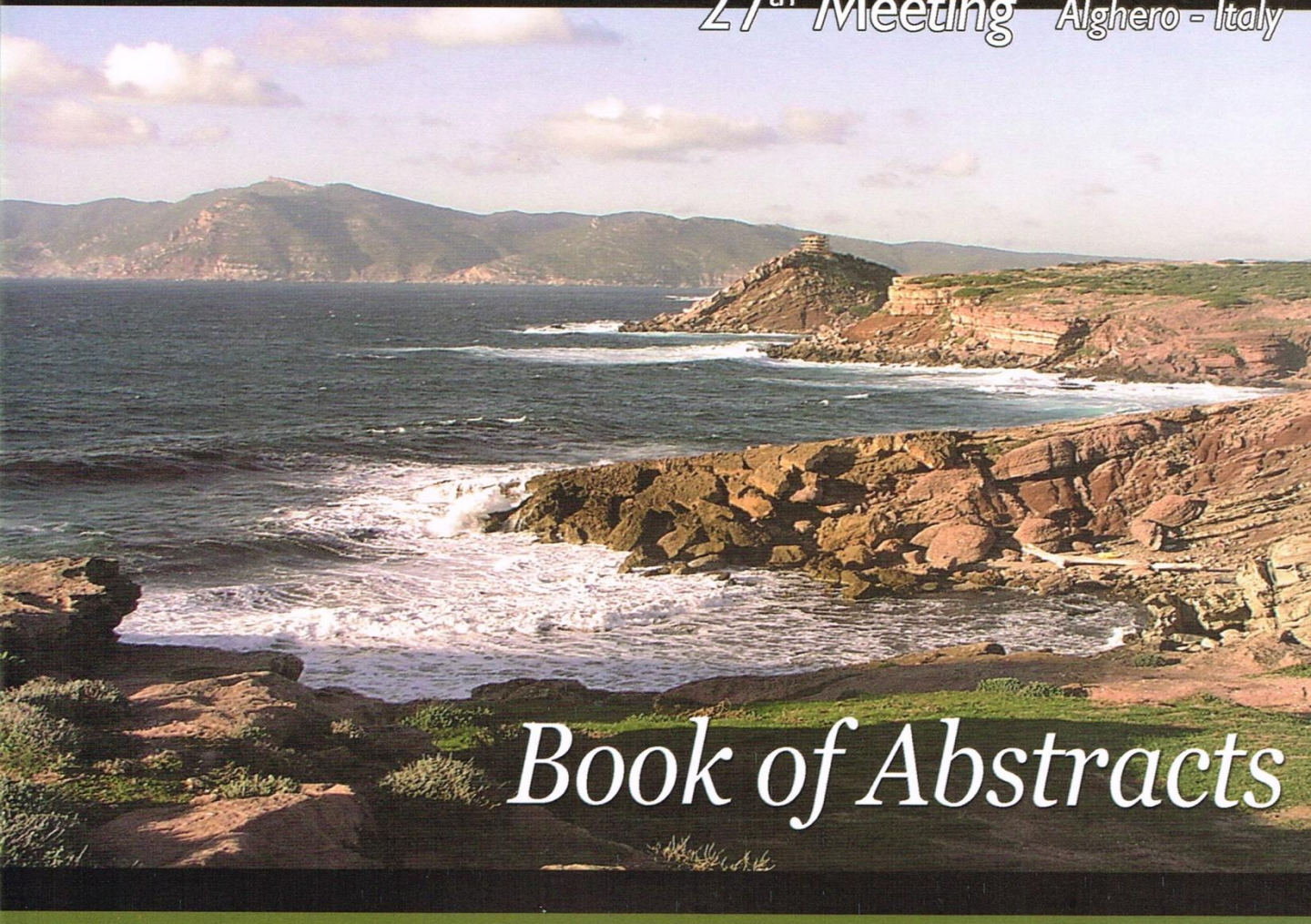
IAS 2009

27th Meeting Alghero - Italy



Book of Abstracts

20 - 23 September 2009

Sedimentary environments of Mediterranean Island(s)

edes

HYDRODYNAMIC FACTORS AFFECTING SEDIMENT DISTRIBUTION IN THE LAGOON OF VENICE

M. GHEZZO*, E. MOLINAROLI** , A. SARRETTA* & S. GUERZONI*

*CNR, Istituto di Scienze Marine, Venezia, Italy (michol.ghezzo@ismar.cnr.it)

**Dipartimento di Scienze Ambientali, Università Cà Foscari, Venezia

Variables relevant to both the hydrodynamics and the transport time scales of the Lagoon of Venice were compared with sediment distribution inside the basin. The numerical grid of the Lagoon of Venice developed for the present study was of a higher resolution than the one used in previous studies, increasing the spatial definition of the calculated variables and the salt marshes. This grid is made up of ~20,000 nodes and ~40,000 elements and includes only the Lagoon area. The simulations were carried out under realistic forcing conditions with wind and level data from the year 2005, which was quite similar to an average year from the meteorological point of view.

The model was used to calculate the circulation of water masses in the lagoon, the dispersion of a passive tracer and the evolution of the wave field as an effect of wind. Analysis of the model's results made it possible to evaluate the mean residence time, root mean square velocity and mean bottom stress over the course of a year. Bottom stress was differentiated into two distinct parameters, one produced by current and another by waves.

Sediment samples were collected from shallow lagoon beds during a campaign carried out in 2002 throughout the Lagoon of Venice. A textural classification of more than 150 samples was performed, with the aim of building on preliminary results reported in an earlier paper. The surficial sediments of the lagoon consist predominantly of clayey silts (mean mud content = 68% dry weight) and the silt fraction dominates over other fractions.

The water residence time (WRT) ranges from 1 to 25 days and represents the time taken by the water mass to be entirely substituted by new water. The RMSV is an expression of the mean hydrodynamic activity, with values reaching 70 cm s^{-1}. The sum of wave- and current-driven bottom stress ranges from nearly 0 to 1 Nm^{-2}, with the wave component accounting for between 30 and 100 % of the total (average 75%).

The distribution of the various sediment types was described by Principal Component Analysis (PCA), applied to both grain-size (21 variables) and hydrological parameters (5 variables).

PCA extracted two principal factors and formed six groups of clustered samples.

Fine-grained sediments (< 22 μm) were found to be correlated with residence time and with wave-driven bottom stress, whilst root mean square velocity and bottom stress caused by tidal currents were correlated most strongly with the distribution of sand (>63 μm).

When the samples were plotted in Flemming's classification diagram, the reduction in deposition energy from group 1 towards group 6 was clearly evident.

In order to map the spatial distribution of different hydro-sedimentological groups throughout the lagoon and to simplify the patterns, Factor analysis (FA) was applied to the same 26 variables used in the PCA.

Three factors were extracted, which explained 91% of the variability. Factor 1 (47%) represents mud and slightly sandy mud and consist of samples located mainly in the northern and central lagoon basins and near the landward shore. Factor 2 (20%) is composed of sand and slightly muddy sand, representing samples located mainly near the three inlets and in areas with high bottom energy. Factor 3 (30%) consists of muddy sand and sandy mud; the samples in these groups correspond to a wider energy range and are located in the northern basin, around the city of Venice and also in the southern basin.