The geological structure of a Peri-Tyrrhenian basin off the gulf of Naples as detected by the MEAS (Multispot Extended Array Sparker)

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The high resolution, single channel seismic reflection profiles presented are a minor part of a marine geophysical survey (about 2,000 km of seismic profiles) (Fig. 1) conducted in 1989 and 1990 in the whole submerged area of the Gulf of Naples (Southern Italy) with the CNR owned R/V *Bannock*. The purpose of the research is the investigation of the shallow geological structure and relationships between volcanism and sedimentation in the Gulf of Naples. During the 1990 campaign we collected a few profiles off the gulf in order to test the capability of the MEAS system in a deep basinal setting where deeper penetration was expected.

The MEAS system, designed by L. MIRABILE, is made by a planar square array of 36"Sparker" type electrodes. The array is related to several accumulators, energizing the electrodes (14-16 kJoules). Energy, accumulated in condensers, is discharged in marine water through the electrodes, producing one vapour bubble for each electrode. Frequency signal of MEAS system is a wide one, having significant energetic contents up to a limit ranging between 500 and 1,000 Hz. Maximum of energy is concentrated around 200 Hz.

Reflections from seaflour and sub-seafloor are picked up by an idrophonic array, tranformed into electric signals and sent to a registration unit. Here they are registered on a VCR magnetic type and on electrosensible paper, after a process of filtering and amplification.

The Gulf of Naples is a peri-Tyrrhenian basin affected by extensional tectonics related to the opening of the Tyrrhenian Sea. The graben like depression which has formed is bordered to the South by the narrow, anti-apenninic trending Sorrentina Peninsula horst and to the North by the Plio-Quaternary volcanic area of Phlaegrean Fields and Procida and Ischia Islands. Consequently, the Gulf of Naples is of particular interest to detect the interaction between the horst and graben structure of the western Apenninic margin and the recent and actual volcanic activity of the area (FUSI *et al*, in press).

The three seismic profiles presented here are located on the confluence between the Napoli Canyon and the Salerno Valley (International Bathymetric Chart of the Mediterranean) or Capri Depression (Carta Geologica d'Italia), a flat floored sedimentary basin at 1000-1200 m water depth. E-W trending profile TIR-1 is located entirely on the sedimentary basin ; NNE-SSW trending profile TIR-2 connects the western edge of the basin to the Ischia volcanic complex; NNW-SSE trending profile ISH-1 connects the eastern edge of the basin to the Ischia volcanic complex across the Banco di Fuori horst.

The deepest penetration recorded is of 1450 ms (TIR-1) (Fig. 2) with the entire reflection free of multiples. This result is of particular interest if it is compared to the average 500 ms penetration obtained in the Gulf of Naples, where multiples of the seafloor also disturb the reflection.

The acoustic basement of the deepest parts of our profiles is interpreted as the Mesozoic carbonates (K horizon of FINETTI and MORELLI, 1974). Near Ischia the acoustic basement is produced instead by volcanic deposits (TIR-2 and ISH-1). A number of acoustic units from the Pleistocene to the Tertiary can thus be identified, including the clastic Messinian facies in the eastern portion of profile TIR-1. The Plio-Quaternary sediments filling up the basin show origin from a delta system identified in the Gulf of Naples and from the volcanic Ischia system.

The structure of the basin is identified by extensional faults producing an overall horst and graben style. Tentatively, a listric fault can be identified on profile TIR-1. The timing of faulting appears as pre- or sin-Messinian in the eastern sector of TIR-1. The deepening of the western sector of the basin, near Ischia, is instead related to the post-Messinian subsidence induced by the growth of the volcanic complex and to the higher volcanic sedimentary input. Of particular interest is the finding of the southern rim of the Ischia volcanic complex 25 km offshore the island (TIR-2).

I summary, the MEAS system has proved to be a powerful and simple tool allowing both high resolution investigation of acoustic units and identification of major geological structures of the Tyrrhenian margin.

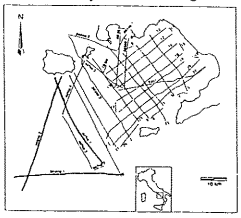

Fig. 1 - Location of seismic profiles

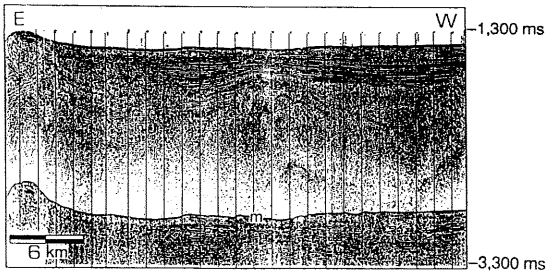

Fig. 2 - Uninterpreted seismic profile TIRR-1. m=multiple

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Implementation of Geographic Information System and Remote Sensing Techniques to Assess the Socio-economic Impact of Sea Level Rise over Alexandria Coastal Region

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Alexandria governorate is located on the western edge of the Nile delta coast. From a geomorphological perspective, it is expected to be less vulnerable to Sea Level Rise (SLR) than the delta proper. However its high population, variable topography and enhanced socioeconomic activities make the impact of accelerated SLR of particular concern. The water front of Alexandria extents for over 42 km from Abu Quir bay to the east to Agami to the west. The city is the most important import/export link between Egypt and Europe.

In order to estimate accurately the impact on the lowlands, Geographic Information System (GIS) and Remote Sensing (RS) analysis have been applied (PARKER, 1988). Data over the governorate of Alexandria were digitized manually for each district and topographic map and fed to a microcomputer (IDRISI version 3.2 software). A Multi-Spectral Scanner (MSS) satellite image has been classified for landuse classes and compared to latest available information on landuse data.

Digitized files were transferred from vector to raster form (HOGG *et al.*,1986 ; VALENZUELA *et. al.*, 1986). Images were then scaled, registered and checked for ground truth observations. A number of control points were used for careful verification. Analysis and interpretation were done using the GIS display for each individual information.

A socioeconomic questionnaire is designed for inhabitants of the lowlands, to measure their awareness and to obtain information on the response, hence a better feeling of the extent of the loss due to SLR could be reached at. The preliminary questionnaire is carried out based on person to person interviews.

An estimate of the impact is obtained based on GIS analysis of the topographic map. It is concluded that all Alexandria beaches are vulnerable to 1m SLR. In addition, three zones are found to lie below sea level : Ameria district lies between 0 and -2m contour, Montaza district lies between 0 and -1m contour, Center district lies between 0 and 1m contour. In addition, lake Mariout lies between -1m and -3m contour levels (Hydraulic pumps are continuously operating to keep the level of water in the lake below 2.8m under sea level, so as to reduce inundation and salt water intrusion caused by rise of lake level).

In order to assess the impact of SLR on industrial and agricultural activities, landuse maps were overlain on topographic maps. It is concluded from the analysis that a large percentage of the area of the governorate lies below the sea level and a population of about 2.0 millions live below the 1m contour elevation. In addition, the agriculture, industrial, and residential sectors are most vulnerable to inundation due to SLR respectively. However, the value of the potential loss in industrial and residential sectors may exceed that of the agriculture sector.

An estimate, based on GIS analysis of population landcover, and landuse is obtained. It shows that the total vulnerable area to 1m SLR is of the order of 1300 km2 and a population of about 2 million people will be directly affected. A population exceeding 8 million people is predicted for Alexandria in the year 2030. Results indicate that, a population of over 4 million will be directly at risk due to SLR in the year 2030 (if no action is taken).

An investigation of the awareness and response of population to SLR over vulnerable area has also been carried out. Preliminary results, based on interviews with 200 random sample of people, indicate that less than 20% of the inhabitants will be willing to move away from the area.

Periodic nourishment and building of some dykes in location vulnerable to saltwater intrusion is believed to be best choice for saving Alexandria beaches and lowlands.

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