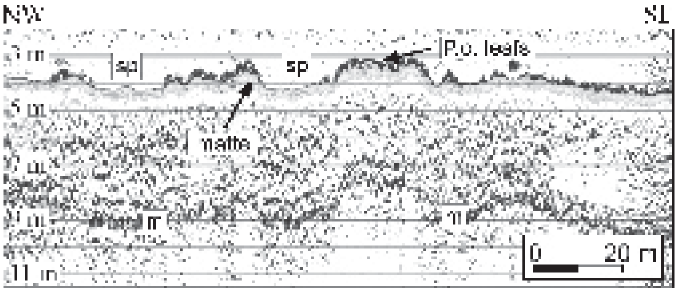


Figure 3: Seismo-acoustic record N. º 8 showing the different seismic facies recognized in the area. P.o: Posidonia oceanica; sp: sand patches; m: multiple

4. Conclusions

The application of seismo-acoustic methodologies revealed a reliable method in the study of the internal structure of P. oceanica. However, the dispersion and masking of the acoustic signal through the P. oceanica did not allow to totally detect the base of the matte. Preliminary results allow us to conclude that in Port Lligat Bay P. oceanica probably developed on gravely sediments, mainly constituted by less fragmented gastropods and bivalves, and probably deposited in a very shallow coastal setting, characterized by moderate hydrodynamic energy. Given the high spatial variability of matte accretion rates observed in the bay, the forthcoming radiocarbon dating of the bioclastic gravel deposits will be essential to relate their actual position and age with the geological moment during which the P. oceanica meadow established in the bay as the sea begun to invade it.

5. Acknowledgements

The authors acknowledge the support of CARBOMED Project (Magnitud del sumidero de Carbono asociado a la fanerógama marina Posidonia Oceánica y potencial en Paleoecología - Proyectos Intramurales de Frontera (PIF)-2005, CSIC, Ref. 200530F0232). We thank Oscar Serrano and Laura Serrano for their support during the seismic survey. We also thank the captain of the R/V "Dolores" Ferran Crespo and the INNOMAR technician Hans Jorn Korsgaard.

6. References:

[1] L. Guasch, M.A. Mateo, C. Lo Iacono, E. Gràcia, R. Carbonell, First attempt to evaluate the size of the peat-like deposits formed by the seagrass Posidonia Oceanica using high resolution seismics, European Geosciences Union (EGU) General Assembly, Wien, 15 – 20 April, 2007

[2] MA Mateo, J. Romero, M. Pérez, MM. Littler, DS. Littler, Dynamics of millenary organic deposits resulting from the growth of the Mediterranean seagrass Posidonia oceanica, Estuarine Coastal and Shelf Science, 44: 103-110, 1997

[3] MA. Mateo, P. Renom, R. Julià, R. Michener, Carbon under the meadow, Oral presentation. 7th International Seagrass Biology Workshop. Zanzibar, Tanzania. 10-16 September, 2006.

FIRST HIGH RESOLUTION MULTICHANNEL SEISMIC EXPERIMENT ON THE RV HESPERIDES: PROCESSING AND APPLICATION TO THE CARBONERAS FAULT ZONE OFFSHORE (ALBORAN SEA)

Ximena Moreno (1,2), Eulàlia Gràcia (1), Rafael Bartolomé (1), Eduardo Rubio (1), Abel Zahinos (1), Manuel J. R. Alpiste (1), Eulàlia Masana (2), Juanjo Dañobeitia(1) and IMPULS Team

1Unitat de Tecnologia Marina, Centre Mediterrani d'Investigacions Marines i Ambientals, CSIC, 08003 Barcelona, Spain

2 Grup de Tectónica Activa i Paleoseismología, Facultat de Geología, Universitat de Barcelona, 08028 Barcelona, Spain

1. Introduction

The IMPULS project is based on a multidisciplinary and integrated onshore-offshore neotectonic and paleoseismological study of the Carboneras Fault Zone (CFZ) at the SE margin of the Iberian Peninsula. Recently published marine geophysical data from the HITS 2001 cruise [1] reveals the seafloor morphology along the offshore Carboneras Fault segment as an upwarped 5-10 km wide deformation zone bounded by subvertical faults. With the purpose of studying the paleoseismological parameters of the CFZ offshore we carried out a marine cruise in 2006 onboard the RV Hespérides. The main goals were to image the internal geometry of the offshore continuation of the Carboneras Fault Zone, to estimate a Late Quaternary slip rate of the marine segments and to calculate the recurrence interval. High-resolution marine geophysical methods are crucial in paleoseismological studies because of the need to focus on the upper meters below the seafloor to accurately calculate the paleoseismological parameters of the fault during the Late Quaternary. In order to obtain the resolution required to study the vertical geometry of active faults in South Iberian Margin (e.g the Carboneras Fault) we tested a new high-resolution multi-channel seismic system onboard the RV Hespérides.

2. The IMPULS 06 cruise: High-Resolution MCS experiment

During the IMPULS cruise, we implemented new technologies on board the RV Hespérides, such as a high-resolution multi-channel seismic acquisition. The source, a 10 m long airgun array, was specially designed to favor high frequencies, comprising eight guns, four Bolt, model 900LLX-T, and four Sleeve Guns I. The configuration (2x40, 2x55, 2x30 and 2x20 cubic inches) equals an array of 4.75 liters of volume. Gundalf software was used to specially design the gun array to provide with an adequate signal for the IMPULS survey. The energy peak obtained is larger than the one obtained with the classic cluster Sleeve Gun array, and the band width reaches even higher frequencies, up to 300 Hz. To trigger and synchronize the gun array, we have used the Minipulse gun controller (Hydrasystems) able to work with a total of 8 guns.

To record the high-resolution multichannel seismic data, a "GeoEel" Geometrics (USA) digital streamer was rented funded by the Acción Especial STREAMER (MEC). The streamer is 573 m long, with 300 metres of active section (6 active sections of 50 metres each). Each of the active sections is configured to form 8 channels, totalizing 48 channels separated of 6.25 m. The distance from the aft of the vessel until the first active section is of 93 m.

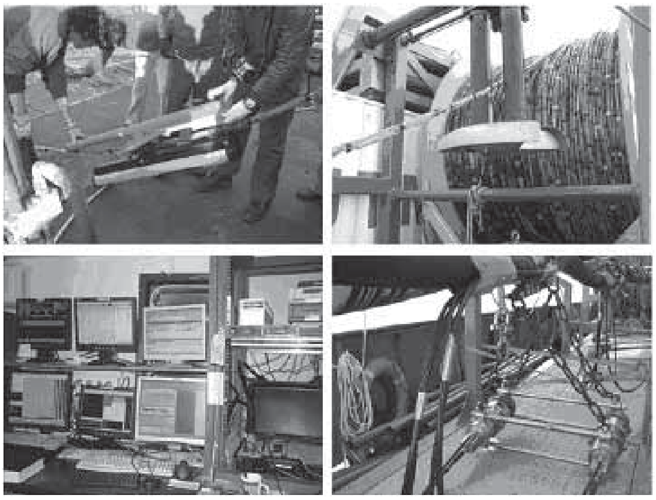


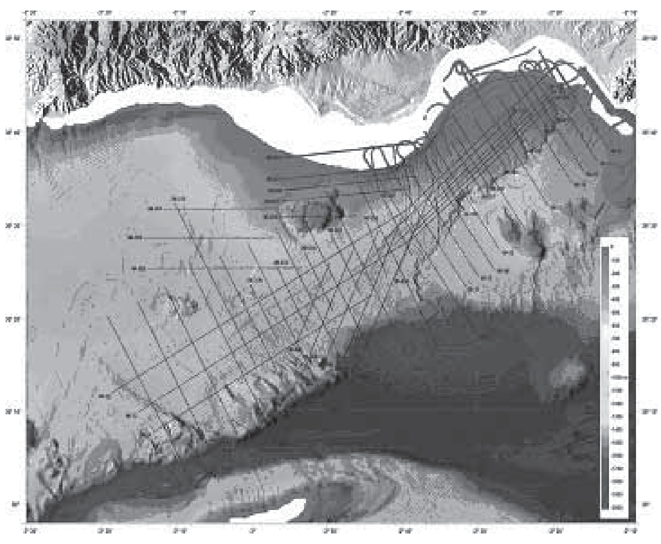
Figure 1 (next page): Images of the high-resolution multi-channel seismic acquisition on board the RV Hespérides. From top to bottom and from left to right: 1) Depth controls (bird) on GeoEel streamer, 2) GeoEel streamer, 3) Acquisition system and quality control of seismic data, 4) View of the gun array spatially designed for the IMPULS cruise.

The streamer was towed at 2 m depth. The GeoEel acquisition system is based on portable equipment. The opening of the acquisition window is generated from the gun controller triggering, with a very small delay. The data from each digitizing system arrive to the system trough an ethernet protocol, in which each digitizer is identified by a private IP address. The acquisition PC gathers and saves the data simultaneously in a hard disk and DAT tapes. The acquisition software is GeoEel Marine NX Controller. During the IMPULS cruise, sampling rate was at 1 ms (1 KHz), source. In few profiles, mainly corresponding to deeper areas, triggering was every 10-12 s (25 m) with a record length of 8000 ms. An amplification of 18 dB was applied to each channel. The signal is recorded in a SEG-D Revisión 8058 format.

3. High-Resolution MCS processing

A total of 47 high-resolution MCS profiles were acquired and processed using the PROMAX system. In a first processing step, and after re-sampling from 1 to 2 ms in order to half the size of the datasets and pick the top mutes, a FK filter (between 20 and 200 Hz) was performed with the aim of reducing spatial aliasing, and a bandpass filter minimum phase (20-25-170-200) was imposed. The NMO correction was applied with a constant velocity of 1700 m/s as there were no appreciable differences compared with a velocity change on depth NMO due to the shortness of the streamer

[Fig 2]



i

Figure 2: Swath-bathymetry compilation of the Almeria Margin and location of the IMPULS high-resolution seismic profiles

In a second phase, a preliminary constant velocity Stolt migration was applied to stack profiles for better constrains the geometry on depth. Three main seismostratigraphic units were identified: Neogene basement, lower, and upper sedimentary units, in coherence with the previous works. These units have been distinguished from the geometrical relationship and seismic facies of the reflectors. An analysis of commercial seismic lines velocities helped to assign the velocity range to each of the seismic facies for the final Fast Explicit migration.

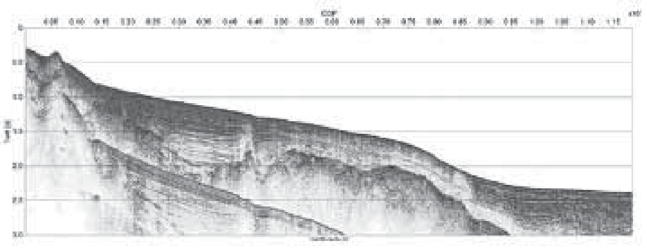
4. Interpretation and Future work

High-resolution multichannel seismic profiles illustrate the shallow geometry and structure variability along the CFZ. Preliminary observations of the succession of seismic profiles from shelf to the basin denotes morphostructural changes along the main trace of the fault: positive flower-structure morphologies in the shelf zone, underlapping restraining step-over in the central segment, and buried pressure ridges towards the south segment. The CFZ affects all the seismic units, as observed in most of the profiles. The exception is with the upper unit, which, on the southern profiles is not displaced by the fault.

Sampling of the recentmost units (Holocene to Late Pleistocene) will give us a sediment rate and a fine chronology for specific horizons. This will allow us to calculate a Late Quaternary vertical slip rate of the marine segments of the CFZ and estimate a recurrence interval of past earthquakes. These parameters are of paramount importance to assess seismic hazard models in the Iberian Peninsula, especially when considering high magnitude earthquakes and long recurrence intervals (104 years).

Figure 3: High-resolution multichannel seismic profile IM-08 crossing the Carboneras Fault

5. Acknowledgements



This work is funded by the Spanish national Project IMPULS (2003-05996MAR), the Acción Especial STREAMER (CTM2004-21203-E) and the Spanish national project EVENT (CGL-2006-12861-C02-02). We thank the captain, crew and technical staff on board the R/V Hespérides for their assistance throughout the data collection.

6. References

[1] E. Gràcia, R. Pallàs, J.I. Soto, M Comas, X. Moreno, E. Masana, P. Santanach, S. Diez, M. Garcìa, JJ. Dañobeitia, Active faulting offshore SE Spain (Alboran Sea): Implications for earthquake hazard assessment in the Southern Iberian Margin, Earth Planet. Sc. Lett. 241, 734-749, 2006.