HIGH-RESOLUTION SEAFLOOR MAPPING AND TOBI 30 KHZ BACKSCATTER VARIABILITY OF THE ALMERÍA MARGIN (ALBORAN SEA)

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1. Introduction

The Almería Margin, located in the eastern Alboran Sea, is characterized by a complex physiography. Successive marine geophysical surveys carried out in the area revealed the presence of the Almería Turbidite System [1], a system of tributary valleys [2], the Carboneras strike-slip fault system and small scale landslides [3] and Miocene-age volcanic banks [4]. This work aims to recognize and describe the sedimentary and tectonic features that shape the Almeria Margin at a very high resolution, and to explore the surface and subsurface seafloor parameters that characterize its acoustic signature. The study has been carried out by means of an integrated dataset, comprising deep-towed TOBI sidescan sonar, swath-bathymetry, TOPAS high-resolution seismics, and sediment gravity cores.

2. Results and discussion

The morpho-sedimentary and morpho-structural elements observed are: the Almería canyon/channel turbidite system, the Dalías tributary valley system (DTVS), landslides, faults and folds, volcanic banks (Fig. 1).

Despite the strong variability of these environments, the acoustic signature of the Almería Margin shows a low average backscatter value of 32 DN, reflecting the diffused draping of hemipelagic sedimentation occurring in the area. The influence of subseafloor properties in the acoustic signature of the area was revealed by backscatter–grain size correlations, which were carried out for different depth intervals in the cores collected at the Almería Turbidite System. A poor relationship was found between backscatter and surface silty sediments of the area, while a higher correlation resulted for sediment thickness up to 50 cm.

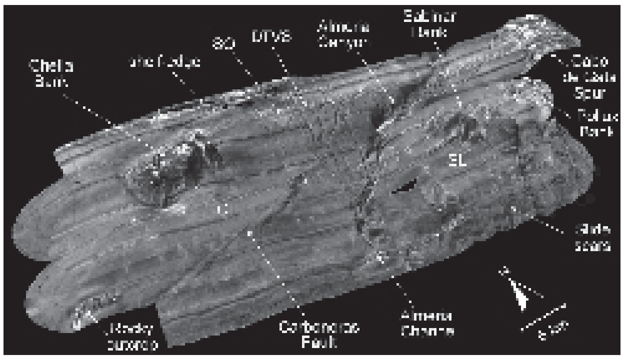

Figure.1: TOBI sidescan sonar overlapped on a 3D DTM model. Main morphological features are illustrated. DTVS: Dalías Tributary Valley System; SO: sediment overflowing; CL: Chella landslide; SL: Sabinar landslide.

The presence of subsurface turbidites in the cores associated to the higher backscatter values addresses volume scattering of these sandy layers as a controlling factor of the acoustic signature obtained in the Almería Margin. On the other hand, in rough settings, such as that of the tributary valleys, topographic relief of up to 1-1.5 m strongly interacted with the TOBI acoustic pulse, suggesting the need to consider large-scale roughness as a further seafloor parameter characterizing the acoustic strength of the area. Extremely high reflective patches, punctually distributed along some of the volcanic banks (Chella and Pollux Banks) for depths ranging from 230 to 470 m, coincide with areas where carbonate cold water coral mounds develop. In the TOBI image, coral facies reach the maximum value of 255 DN, probably related to the rough morphology of coral ecosystems (Fig.2). The position of coral mounds in the banks suggests that the occurrence of strong bottom currents and reduced sedimentary fluxes are environmental factors suitable for their development in the Almería Margin.

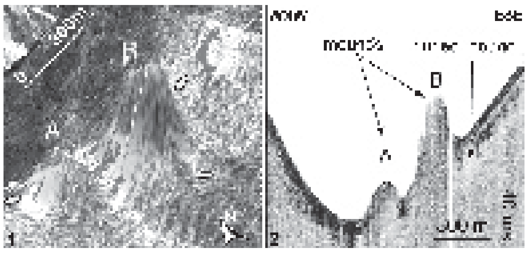

Figure 2. TOBI (1) and correspondent TOPAS records (2) of isolated carbonate mounds at the top of Chella Bank. Yellow lines on the TOBI images indicate the track of the TOPAS profile. Yellow dots on the TOBI images indicate sediment sampling points. Red patches in (1) indicate extremely high reflective areas.

3. Conclusions

The integration of different marine geophysical methods (swath-bathymetry, deep-towed sidescan sonar TOBI and high-resolution seismics), supported by ground-truthing calibrations, permitted to recognize in detail the morphological and sedimentary features that shape the Almería Margin and to relate their geologic characters to the correspondent acoustic signature. Insights were provided on the relationship between seafloor and backscatter strength in a complex depositional system, characterized by the occurrence of turbidite fluxes and active tectonics. Coarse sediment layers recognized in the sub-seafloor and seafloor irregularities observed along the DTVS strongly affects backscatter variations of the area and supports volume scattering and large scale roughness as important controlling factors in the seafloor acoustic strength of a long-range sidescan sonar system. Analysis of backscatter images turned out fundamental in mapping deep coral mounds of the Almería Margin. Unusual very high backscatter facies have been identified on the coral mound areas, corresponding to the maximum scale value of 255 DN. Very high acoustic strength could be related to the roughness of coral colonies or to associated sediments.

4. Acknowledgements

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5. References

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APPLICATION OF HIGH-RESOLUTION SEISMO-ACOUSTIC METHODOLOGIES IN THE STUDY OF THE SEAGRASS POSIDONIA OCEANICA (L.) DELILE

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1. Introduction

The distribution of the Mediterranean seagrass Posidonia oceanica has been widely assessed using acoustic methodologies. However, informations on P. oceanica internal structure obtained with seismic methods are still very rare. In the framework of the multidisciplinary project CARBOMED (Proyecto Intramural de Frontera, PIF-2005, CSIC, Ref. 200530F0232), a seismo-acoustic survey was carried out in Port Lligat Bay (Catalonia, NE Spain) with the aim to assess the volume potentially occupied by P. oceanica organic deposits (known as "matte"), detect its internal structure and highlight the morphological and sedimentological characters of the study area (Fig. 1). A first calculation of the potential volume of P. oceanica deposits in Port Lligat Bay was estimated in about 175.000 m3 [1].

Figure 1: Navigation tracks of the seismo-acoustic records acquired in Port Lligat Bay during the Carbomed Project. Track in red: profile 71 (Fig. 2). Track in yellow: profile 8 (Fig. 3). Red dot: core site

2. Data and Methods

The high resolution parametric echosounder "Innomar SES 2000 compact" was used to acquire 75 seismo-acoustic records spaced from 5 to 40 m each others, for a total length of about 7.5 km. The positioning system was a differential GPS (DGPS) Trimble AGP 132. The echosounder was characterized by a primary frequency of 100 kHz and secondary frequency ranging from 5 to 12 kHz. Pulse Repetition Rate was up to 30/sec and the beamwidth of ±1.8°. Each seismo-acoustic record has been acquired twice, using secondary frequencies of 10 and 6 kHz. The lower secondary frequency (6 kHz) gave the best result because of its higher resolution and relatively higher penetration, and the records obtained with this configuration were used for this study. The shallow water of the study area (depth from 3 to 6m) produced high amplitude multiples.

3. Results and discussion

Here we present an interpretation of seismo-acoustic records and of data from a core collected in the matte of Port Lligat bay with the final aim of reconstruct the dynamics of P. oceanica since it was established in the study area. The acoustic masking of the internal structure of the seagrass and the presence of multiple reflectors due to the reduced depth of the area (maximum 4 m) did not allowed to associate a specific seismo-acoustic facies to the matte of P. oceanica. Nevertheless, in some sectors it was possible to detect a strong reflector, from 2 to 6 m depth, that was interpreted as the initial substratum where the seagrass established for first time (Fig. 2). Also, sporadic sandy areas, apparently no more than 4 m thick, were identified interlayered with the P. oceanica matte (Fig. 3).

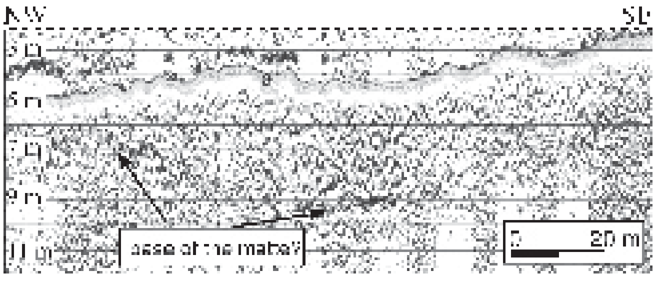

Figure 2: Seismo-acoustic record N. º 71 showing the potential base of the matte, on which P .oceanica established.

A core collected on the P. oceanica meadow showed the presence of a dense matte for the first tens of centimeters downcore, degrading to sandy sediments with rhizomes and leaf sheaths for a total depth of 6 m. The base of the core presented gravely bioclastic sediments and its depth correlates, in a seismic record near the core location, to the reflector interpreted as the base of the P. oceanica matte. Assuming a growth rate of P.oceanica of 1.3 to 4.1 mm y-1 [2,3], the gravel deposits observed at the base of the core may be aged between ca. 1500 and 4500 yrs BP.