Morphology and Sedimentary environments of the menorca Canyon head

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Los fondos submarinos de las Islas Baleares constituyen un magnifico ejemplo de plataforma carbonatada de mares templados y latitudes medias. La morfologia submarina esta caracterizada por la presencia de varias terrazas,y extensos campos de dunas submarinas.
Se han diferenciado seis comunidades bentonicas responsables de la alta productividad de carbonatos (70g. $CaCO_3$,/m^{-2}/y^{-1}) distinguiéndose cinco grandes tipos de sedimentos, que corresponden a otros tantos dominios sedimentarios.

Keywords : Menorca canyon, sedimentary environments, morphology

The maps, block diagrams and seismic lines illustrating this poster, integrate multidisciplinary coastal and submarine data which should serve as a documental basis to better know, use and protect these environmentally fragile areas.
The balearic Islands offer to the scientific community an excellent example for non-tropical carbonate shelves. Seafloor morphology, benthic communities and sediment types are in fact, strongly interdependent. The south Menorca Shelf and upper slope show these interdependences particulary well.
Seafloor morphology is characterized by several submarine terraces. Extensive sand wave fields develop from the lower limit of seagrass communities to 50 m. deep. Two major sand transport directions appear : A) 110° -140° and B) 190° - 205° ; the first being related to the dominant longshore currents, and the second probably due to weaker helical currents issued from the main flow.
A great variety of mass movement processes, ranging from creep-faults to slide lobes and glided blocks, develop around and on the Menorca canyon headwalls ; each mass movements appears to be concentrated at specific areas.
From coastline to upper continental slope, the benthic communities responsible for carbonate production are :
1) Photophilic algae (0-5 m.)
2) Posidonia Oceanica seagrass meadows (1-30 m.)
3) Sandy communities with the algae Vidalia volubilis (30-45m.)
4) Loose branching calcareous algae "maërl" (35-70 m.)
5) Shelfbreak bryozoans (90-120 m.)
6) Communities of suspension feeders of the uppermost slope.

Overall mean carbonate production in the photic zone (to 150 m.) is around 70 g. $CaCO_3$,/m^{-2}/y^{-1}. Five main sediment types appear in the area of study :
A) Algal sands
B) Bioclastic sands
C) Bryozoans sands
D) Terrigenous sands
E) Pelecypod sands

As a result, five sedimentary domains define the South Menorca continental shelf :
I) Littoral sandy prism (0-5 m.)
II) Seaflor protected by seagrasses (5-38 m.)
III) Sand wave field indicative of tractive transport (38-50m.)
IV) Bypass zone with rough microtopography and submarine terrace development
V) Canyon head cirque.
Inner, medium and outer continental shelf are thus define in terms of sediment types, seafloor morphology including bedforns and sediment dynamics.

Comparing examples of modern Turbidite systems associated with restricted basins in the Western Mediterranean Sea

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The Ebro and Andarax deep-sea depositional systems offer a good opportunity to analyze the Plio-Quaternary growth patterns of turbidite systems developed in morphologically restricted basins. The Ebro turbidite systems are located between the base-of-slope of the Ebro margin and the basin floor of the Valencia Trough, which is confined between the Iberian Peninsula and the Balearic Platform (Fig. 1A). This passive margin of the northwestern Mediterranean was largely structured during the Early Miocene by subsiding grabens parallel to the Iberian margin, which developed a narrow slope, while recent tectonic activity is minor (NELSON and MALDONADO, 1988). Important sediment supply to this system is derived from the Ebro River. The Andarax turbidite system develops between the base-of-slope of the Almeria margin and the basin floor of the Alboran Trough, which is bounded by the Alboran Ridge in the eastern Alboran Sea (Fig. 1B). This area, one of the most tectonically active regions of the Mediterranean Sea, is characterized by compressional tectonic and strike slip-faults, which affect the most recent deposits (WOODSIDE and MALDONADO, 1992). Sediment supply is derived from the Andarax River during major seasonal floods.
Both systems have a similar physiographic setting defined by narrow, steep slopes, the base-of-slope region occupied by turbidite systems, and the gentle sloping basin floor of the restricted trough. These systems reveal, however, significant differences for the overall growth patterns. While the Ebro systems depict many variations in comparison to deep-sea fans, there are similarities in the Andarax system with classical examples (ALONSO *et al*., 1990; ALONSO and MALDONADO, 1992). Differences in growth patterns of Ebro turbidite systems include: (1) the presence of multiple slope canyons, (2) the development of successive Ebro channel-levee complexes from newly created slope canyons, (3) the absence of depositional lobes, and (4) the by-passing of sediments from the Ebro turbidite systems to the distal Valencia Fan deposits (ALONSO and MALDONADO, 1990). The growth patterns of the Andarax turbidite system are, in contrast, more similar to classical submarine fans. Similarities include: (1) a single canyon to levee upper fan, and (2) the development of channel-levee complexes, which evolve distally to depositional lobes located in the basin floor of the Alboran Trough (ALONSO and MALDONADO, 1992).
The incomplete development and truncation of the Ebro turbidite systems have been previously attributed to the tectonic control of the Valencia Trough margin, which may inhibited the growth of depositional lobes (SHANMUGHAM and MOIOLA, 1988). It is observed, however, that in the more tectonically active Alboran Trough complete, deep-sea fans with lobes are developed. We suggest that the main factors controlling the development of depositional lobes are the combination of depositional processes and physiography, which in turn are related and modified by the structural setting in both depositional systems. In fact, the Valencia Trough is incised by a deep-sea channel, the Valencia Valley which as a major sediment convey to the distal depositional sectors, as revealed by the mineralogical composition of turbidite sands of the Valencia Fan (PALANQUES and MALDONADO, 1985). In contrast the flat floor of the Alboran Trough is not incised by any deep-sea valley (Fig. 1B). This flat depression traps sediment flows and it allows the development of depositional lobes, in spite of the very active tectonic disruption of the most recent deposits (WOODSIDE and MALDONADO, 1992). The structural evolution is an important factor controlling the overall physiographic setting and depocenter distribution of these turbidite systems, but other factors such as sediment supply and processes are also significant for the development of specific depositional environment.

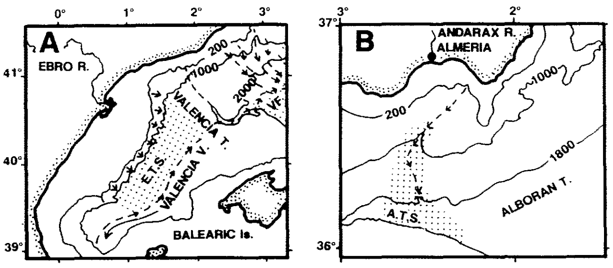

Figure 1. Physiographic setting of (A) the Ebro turbidite systems (E.T.S.) and (B) the Alboran turbidite system (A.T.S.) in the western Mediterranean Sea. Dashed arrows indicate main canyon axes. T, trough; V, valley; VF, Valencia Fan; R, rivers; Is., islands.

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