Influence of sea-level and climate on deposits in the Gulf of Cadiz

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Abstract: *We study a set of sediment cores with a detail chronostratigraphic framework to precise evolution of sedimentary processes during the recent Quaternary. We found during LGM sedimentation rates higher than during the Marine Isotope Stage (MIS)1 and hiatuses during MIS 1. A major hiatus occur near the beginning of Holocene in the distal part of Portimao Bank.*

Key words: *bottom currents, MOW, climate, sea-level, contouritic sequence, recent Quaternary.*

INTRODUCTION

We present a set of data on the Cadiz contourite depositional system (CDS). The present-day circulation pattern is characterized by the exchange of water masses through Gibraltar strait (Mulder *et al.*, 2002; Hernández-Molina *et al.*, 2006). The Mediterranean Undercurrent or MOW acts near the sea-floor and the water mass of Atlantic Inflow (AI) water acts at the surface. Pattern of deposition and erosion is interpreted as reflecting changes in the strength of the MOW through time in relation to sea-level and climatic changes (Faugères *et al.*, 1986; Llave *et al.* 2006).

In this study we precise from sedimentation rates impact these factors on modification of the circulation pattern of the MOW. The sedimentary processes, accumulation rate and contouritic sequences (Gonthier *et al.*, 1984; Stow *et al.*, 1986) are investigated in the light of short time scale climate variability of thousand years, more particularly during Heinrich event (H2), H1, Younger Dryas (Y0), Bölling-Alleröd (BA) to Holocene period (H).

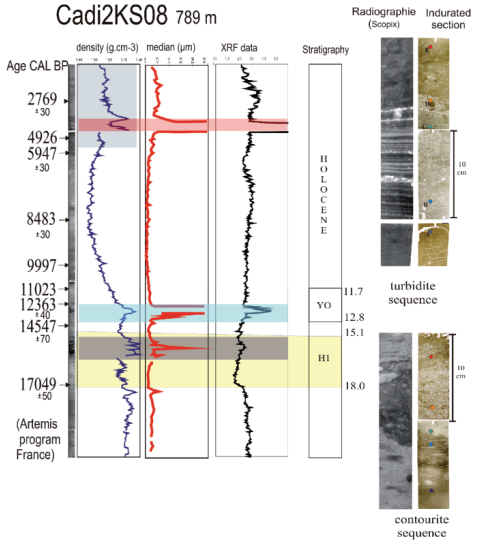

FIGURE 1. Interaction between gravity processes and contouritic sedimentation. (See location on Fig. 2).

DATA AND RESULTS

This study is based on classical sedimentological analyses, a high resolution stratigraphic framework based on biostratigraphic analyses and radiocarbon AMS 14C dates, Artemis French Project (Fig. 1 and 2). Cores were obtained during IMAGES V-GINNA (1999), Cadisar 1 (2001), Cadisar 2 (2004), Spanish and English cruises.

In the cores analyzed, the H2 and the LGM sedimentation rates are higher in the eastern part (20 to > 65 cm /10^3 yrs) than in the western part (3 to 25 cm /10^3 yrs). Below the influence of the Mediterranean upper Water, (MU) on the Faro drift, and under the Southern branch of the Lower Mediterranean Water, (SB) on the Guadalquivir drift, the sedimentation rate are variable (Fig. 2a). On the Albufeira drift, in the progradation area, we have no cores data but, the south flank of the drift is eroded (hiatuses). In the south-eastern part of the Gulf the sedimentation rates increased from the outer terrace (20 to /10^3 yrs) to the distal part west of Gil Eanes channel and increase in the distal part of the Cádiz channel. Muddy contouritic sequences may be dominant in the LGM.

During (H1), (BA), and (Y0), the sedimentation rates decrease highly but globally present the same pattern. Major variation is coarser contouritic sequences highly bioturbated during (H1), and (YO). During (BA) muddy contouritic sequences are frequent on the pathways of the MOW circulation (Fig. 1). In detail, this summary not appears to be so simple, particularly in the environment where we observed furrows, marginal valleys, and channels.

During the Holocene, the maximum sedimentation rates are observed in the upper terraces of the Portimao canyon, where the MOW is capturated (35 to >200 cm/10^3 yrs), then, they decrease under the pathway of the southern branch of the Lower Mediterranean Water, 30 to cm/10^3 yrs, and in the marginal valleys (26 to cm/10^3 yrs). Medium sedimentation rate are present on the Faro-Albufeira drift, Guadalquivir drift, and Alfufeira high. On the Albufeira drift sedimentation contouritic interacts with turbiditic processes (Fig. 1). In the distal part of

Gil Eanes channel medium sedimentation rate (28 to 10 cm/10^3 yrs) and C14 calibration show recent activity. On the contouritic terrace (near secondary channels) we observe hiatus in the upper Holocene and below coarser contouritic sequences. A major hiatus at the beginning of Holocene, near 10 kyr Cal B.P. is noted in distal part of the Portimao Bank where slump deposits have been cored.

DISCUSSION

It appears that during the Last Glacial Maximum, the sea-level is low and the sedimentation rate higher than in all the others studied periods of time. We also observed these values at the top of a mud diapir, in the distal part west of the Cadiz channel and in the distal part of Gil Eanes channel. There the sedimentation rates and sea-level drop act in the same way. This fact may be explained by the low sea level at LGM which favorized larger transport of particles into the Gulf of Cadiz by the Gil Eanes and the Cadiz channel. More than, probably the pathway of the MOW was positioned lower on the slope than today (Rogerson *et al.*, 2005).

During the Heinrich event (H1) the sedimentation rates decrease from an important proportion (report from 1.4 to 1.7), and circulation of MOW was active over a considerably large surface (in Rogerson *et al.*, 2005). During the Bölling-Alleröd the finest grain-size are observed. This suggests that a low activity of the MOW favorized the deposit of important quantity of particles. In Holocene contouritic sedimentation, hiatuses, turbiditic sequences are present. And, more particularly in the distal part of Portimao Bank, the lack of the beginning of Holocene show also that the gravity processes activity are a major part of the sedimentation (natural instability or tectonic impact like earthquakes).

In the eastern channel there is essentially coarser bioclastic sand and coarser sand (Hanquiez, 2002; Habgood, *et al.*, 2003). Probably they are lag deposits may be linked to the erosion or filling of the paleochannel present in the straits of Gibraltar.

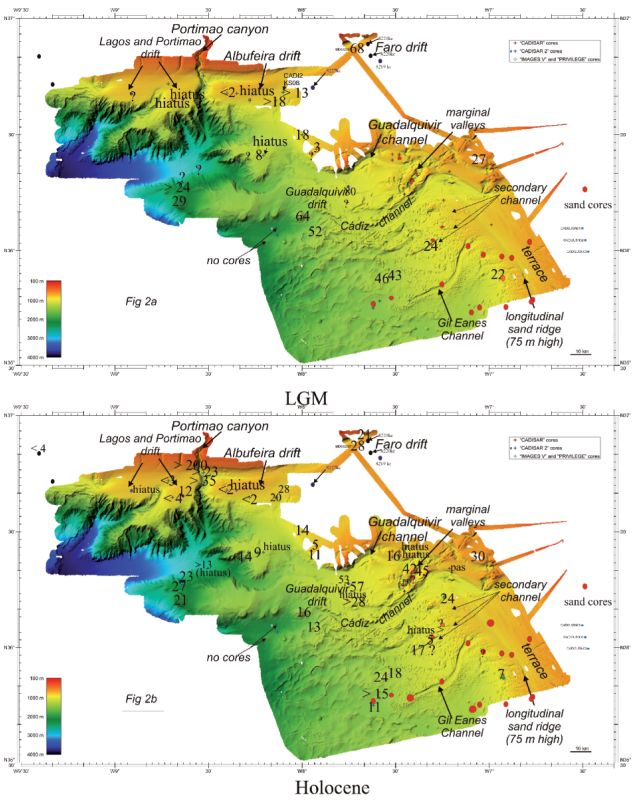

FIGURE 2. Sedimentation rates during LGM (Fig 2a) and Holocene (Fig 2b).

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