DEPOSITIONAL PATTERNS OFF ALGERIA FROM ECHO-CHARACTER MAPPING (MARADJA 2003 CRUISE) : POSSIBLE LINKS WITH THE RECENT AND HISTORICAL EARTHQUAKES

V. Gaullier [1] *, B. Savoye [2], A. Domzig [3], J. Deverchere [3], and the MARADJA Team #

[1] LEGEM, E.A. 3678, Université de Perpignan, 52, avenue Paul Alduy, 66860 Perpignan, France - *gaullier@univ-perp.fr

[2] IFREMER, Brest, France

[3] UBO/CNRS Domaines Océaniques, Brest, France

Abstract:

We present new results deduced from the Chirp high-frequency echograms collected during the recent MARADJA cruise off Algeria. They reveal the importance of gravity-dominated depositional processes (turbidity currents and mass wasting) in this active area.

Key words: debris flows, turbidites, slumps, mud penetrator

The Algerian margin is one of the less documented margins of the Mediterranean Sea. The May 21, 2003 earthquake has shown that submarine deformation is indeed active there: a significant part of the Africa-Europe convergence is probably accounted for below the sea. As for the 2003 event, large coastal earthquakes (1954, 1980) have also triggered turbidity currents, but no data were available until now to describe them. The Algerian margin was recently surveyed during the MARADJA cruise (21 August- 18 September 2003, French R/V *Le Suroit*) using swath multibeam bathymetry, backscatter imagery, and 3-5 kHz (Chirp) and seismic profiling (1, 2, 3; Fig. 1). The purposes of this study are (i) to use this new data set to describe, illustrate and identify the recent Algerian margin depositional system, and (ii) to tentatively evaluate the relationships between the sedimentary processes and the historical seismicity that affects this area.

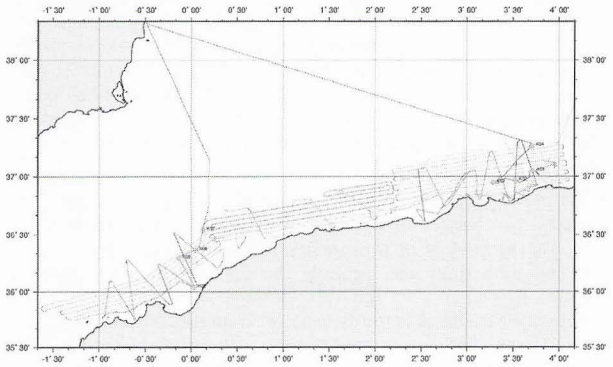

Fig. 1. Location of the CHIRP data collected during the MARADJA cruise (2003).

Recent depositional patterns, as deduced from echo-character mapping, show that gravity-induced sedimentary deposits are predominant on the steep continental slope and in the deep basin and are expressed through either slides, debris flows, or turbidites, as previously observed in various places around the Mediterranean (4, 5).

Turbiditic processes, corresponding to bedded echo characters, have been mainly identified at the foot of the steep slopes and in the deep part of the basin, where the turbidity currents seem to have been drained either by canyon and channel systems or by bathymetric lows created by deep-seated or salt tectonics, i.e., grabens or minibasins. Conversely, salt diapirs and steep fault scarps act as barriers for turbidites.

Mass-movement processes are mainly represented by transparent echo characters. They appear all along the margin, generated by slope destabilizations enhanced by thick-skinned and salt-related thin-skinned tectonics. Moreover, in the area of the May 21, 2003, earthquake, ~10-15 km off Algiers, and upslope to the area of the resulting numerous submarine cable ruptures, several mass-movement deposits are observed along the ~60 km long active fault zone, roughly parallel to the coast and that could be linked to the Boumerdes-Zemmouri earthquake (Fig. 2). One of these destabilized deposits has been cored during the MARADJA cruise and corresponds to a debris flow. Further analyses will focus on the relationships between these gravity-driven processes and the historical seismicity.

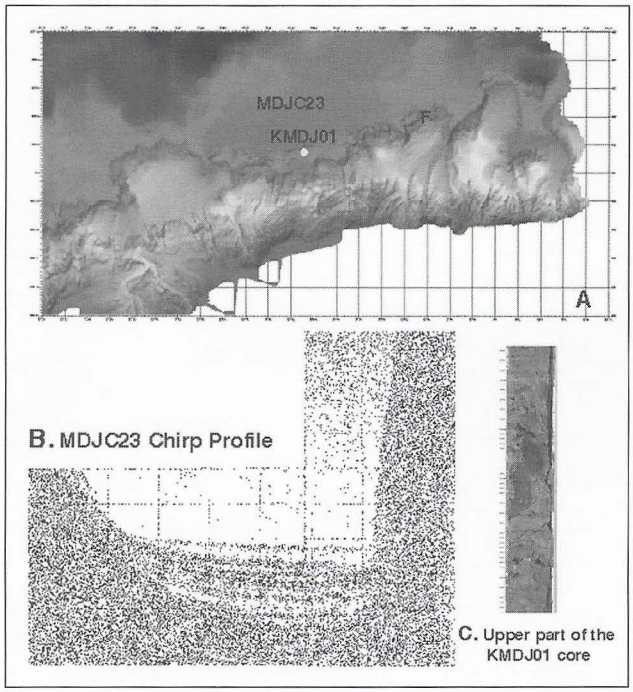

Fig. 2. A. Multibeam bathymetric zoom of the Algiers area (Z3). B. CHIRP profile located at the foot of one of the large active faults evidenced in this area. The representative echo character corresponds here to an alternance of bedded and transparent acoustic facies. The second one shows a thickening along the scarp, testifying for a syn-tectonic deposit. C. Upper part of the KMDJ01 core showing a recent debris flow.

MARADJA Team : K. Yelles, E. Calais, J-P. Bouillin, R Bracene, A. Kherroubi, B. Mercier de Lepinay, P. Le Roy, H. Pauc

References

1 - Deverchère J., Yelles K., Calais E., and the MARADJA Scientific Party 2003. Active deformation along the Algerian margin (MARADJA cruise): framework of the May 21, 2003, Mw-6.8 Boumerdes earthquake. AGU Fall Meeting, San Francisco, USA, 8-12 December.

2 - Deverchère J., *et al.,* 2004. Premier examen détaillé de la morphologie et de la structure superficielle sous-marine de la marge Ouest-Africaine: Campagne Maradja. 37th CIESM Congress, 7-11 June, Barcelona, Spain.

3 - Domzig A., Yelles K., Deverchere J., and the MARADJA Team, 2004. New, active faults revealed off Algiers area (Boumerdes and Khair-Al-Din) from seismic and swath bathymetric data (MARADJA 2003 cruise). EGU First General Assembly, Nice, France, 25 - 30 April.

4 - Gaullier V. and G. Bellaiche, 1998. Near-bottom sedimentation processes revealed by echo-character mapping studies, Northwestern Mediterranean Basin. *AAPG Bulletin*, 82 (6): 1140-1155.

5 - Loncke L., Gaullier V., Bellaiche G., and Mascle J., 2002. Recent depositional pattern of the Nile deep-sea fan from echo-character mapping: Interactions between turbidity currents, mass-wasting processes and tectonics. *AAPG Bulletin*, 86 (7):1165-1186.