The «GUCADRILL» Contourite IODP Proposal-644: Environmental significance of the Mediterranean outflow water and its global implications

Dorrik A.V. Stow[1], Fº Javier Hernández-Molina[2], Isabel Cacho[3], Carlota Escutia[4], Joan Gardner[5], Makoto Ito[6]; Susana Lebreiro[7], Pamela Martin[8], Thierry Mulder[9], Michele Rebesco[10]; Andrew Roberts[11], Joachim Schoenfeld[12], Francisco Sierro[13], Luis Somoza[7], Pedro Terrinha[14], Antje Voelker[14], Phil Weaver[11]

1 IPE-ECOSSE, Heriot Watt Univ. Edinburgh EH14 4AS (UK). Dorrik.Stow@pet.hw.ac.uk.
2 Facultad de Ciencias del Mar, Univ. Vigo, 36200 Vigo, (Spain) fjhernan@uvigo.es.
3 Dpto. Estrat. Paleont. i Geoc. Marines Facultat de Geologia, Univ. de Barcelona C/ Martí Franques s/n, 08028 Barcelona (Spain). icacho@ub.edu
4 Instituto Andaluz de Ciencias de la Tierra. Campus de Fuentenueva s/n, 18002, Granada (Spain). cescutia@ugr.es
5 Naval Research Laboratory, Code 7420, 4555 Overlook Avenue S.W., Washington, D.C. 20375 (USA). gardner@qur.nrl.navy.mil
6 Chiba Univ. (Japan). mito@earth.s.chiba-u.ac.jp
7 Instituto Geológico y Minero de España, c/ Ríos Rosas, 23, 28003 Madrid, (Spain). susana.lebreiro@igme.es, l.somoza@igme.es
8 Univ. Chicago. Dept. of Geophysical Sciences, 5734 S. Ellis Avenue, Rm 451. Chicago IL 60637(USA). pmartin@uchicago.edu
9 Dpto. Géologie et Océanographie, Univ. Bordeaux 1, Avenue des Facultés, 33405 Talence Cedex (France). t.mulder@epoc.u-bordeaux1.fr
10 Istituto Nazionale di Oceanografia e di Geofisica Sperimentale, Borgo Grotta Gigante 42/C, 34010 Sgonico (Italy). mrebesco@ogs.trieste.it
11 National Oceanography Centre, Southampton (NOCS), Waterfront Campus, Southampton SO14 3ZH (UK). arob@noc.soton.ac.uk, ppew@noc.soton.ac.uk
12 Leibniz-Institute of Marine Sciences, IFM-GEOMAR. Dienstgebaeude Ostufer, Wischhofstr. 1-3, D-24148 Kiel (Germany). jschoenfeld@ifm-geomar.de
13 Dpto. Geology, Faculty of Sciences. Univ. Salamanca, 37008, Salamanca (Spain). sierro@usal.es
14 Laboratorio Nacional de Energia e Geologia (LNEG), Dept. Geologia Marinha, Estrada da Portela, Zambujal, 2721-866 Alfragide. (Portugal). antje.voelker@ineti.pt

Abstract: *This contribution present the «GUCADRILL» IODP Proposal-644, a paleoceanographic proposal focusing on the broader significance of Mediterranean Outflow Water (MOW) on North Atlantic circulation and climate. It addresses important questions related to paleocirculation and climate, the influence of oceanic gateways, and sea-level control on sediment architecture along continental margins.*

Key words: *Paleoceanography, Gateways, Mediterranean Outflow Water, Global implications, Contourites*

INTRODUCTION

The «GUCADRILL» IODP Proposal-644 title «Environmental significance of the Mediterranean outflow water and its global implications» reflects huge international interest in the Gulf of Cadiz and off West Iberia and in its global significance, building on a research database accumulated over 40 years. It is supported by 15 Co-proponents which have had a significant input into proposal planning & post-cruise research, as well as by 27 supporting researchers, all indicated a strong willingness to be closely involved in post-cruise research. That means 44 researchers from nine countries and the support of oils companies as Repsol, TGS-NOPEC and Petrobras, as well as the the Spanish company for the Morocco-Spain connection trough the *Strait of Gibraltar* (SECECSA).

Although we started working on this proposal on 2003, the Pre-proposal 644 was first submitted to IODP in March 2004 and the first Full-proposal in early October 2005. Since then, we have received an extensive and positive evaluations and suggestions from Science Steering and Evaluation Panel Comments (SSEP), science coordinators and external reviewers to improve the original version to its present form.

After April, 2008 with the evaluation by the Science Planning Committee (SPC) the proposal is with the Operation

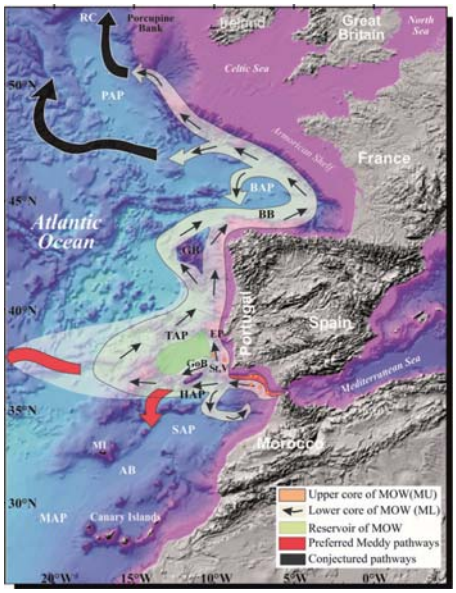

FIGURE 1. General circulation pattern of the MOW pathway in the North Atlantic (Modified from Ioga & Lozier, 1999). Relative location of the sites is showed.

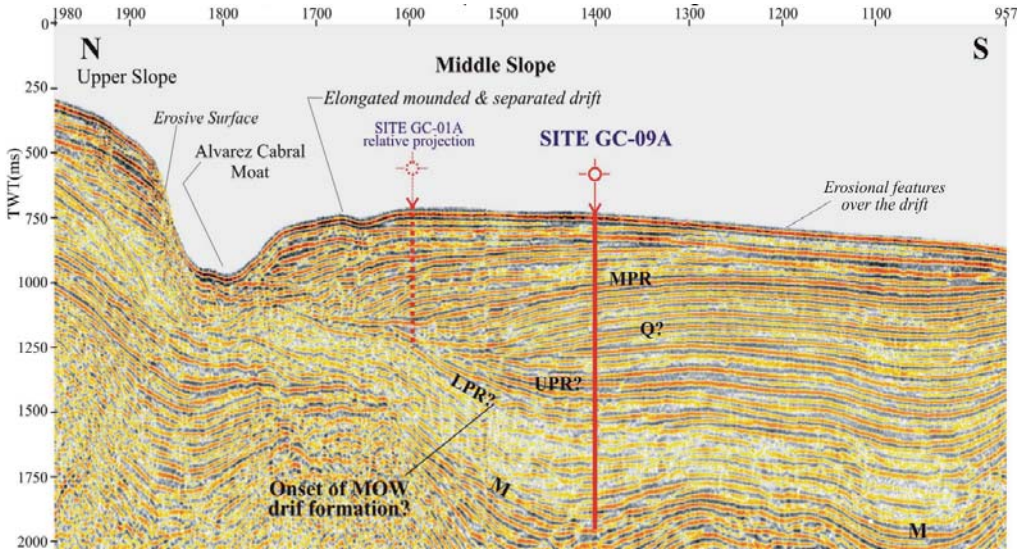

FIGURE 2. Uninterpreted multichannel seismic reflection (MCS) profile across the Faro-Albufeira drift on the middle slope of the Gulf of Cádiz provided by Repsol Oil Company for the present proposal.

Task Force (OTF), where it was ranked as a Tier 1 proposal, meaning that it is a high priority proposal and that the related expedition should be scheduled as soon as possible. Because, the ship is scheduled to return to the Atlantic by the end of FY2011, it is probably that the expedition could be ~~hopefully~~ scheduled in early FY2012, i.e. October 2011 or within the next few months after that date.

THE IODP-644 PROPOSAL

This is a paleoceanographic proposal focussing on the broader significance of Mediterranean Outflow Water (MOW) on North Atlantic circulation and climate (Fig. 1). It addresses important questions highlighted in the IODP Initial Science Plan related to paleocirculation and climate, the influence of oceanic gateways, and sea-level control on sediment architecture along continental margins. In order to answer these questions, we propose targeted drilling of a Neogene continental margin sequence in the Gulf of Cadiz and off West Iberia (Figs. 1 and 2). The high rates of accumulation associated with Contourite Depositional System (CDS) deposits in this region provide an expanded sedimentary record that permits detailed examination of paleocirculation patterns linked to past environmental change. This proposal offers a unique opportunity to understand the global link between paleoceanographic, climatic and sea-level changes from Messinian to recent time. The Gulf of Cadiz and off West Iberia CDS is an extensive compound sedimentary body, which has been developing along the mid-slope over the past 5 million years, under the direct influence of MOW (Fig. 2). It therefore holds an unmistakable signal of MOW through the Gibraltar Gateway, re-opened following tectonic adjustments at the end of the Messinian Salinity Crisis, and hence a clear record of Mediterranean Sea and MOW influence on the North Atlantic Ocean.

An extensive array of high quality data exists for the region and a detailed seismic stratigraphic framework has recently been proposed, which can only be confirmed by drilling. Seven primary sites have therefore been identified (Fig. 1) that will allow us to identify and calibrate the third and fourth order depositional units and associated widespread erosive discontinuities across the CDS (Fig. 2). This is of great significance, both regionally and globally, for: 1) monitoring the long-term variability of MOW and its global climatic significance; 2) constraining the main paleoceanographic events through late Miocene to Recent time, including high-resolution focus on late Pleistocene and Holocene rapid climate events; 3) evaluating the influence of opening of the Gibraltar gateway on North Atlantic oceanography and climate, and monitoring the effects of sea-level change on MOW flux; 4) understanding the architecture of a complex contourite depositional system, and the nature of its unit stacking pattern related to allogenic and autogenic controls; and 5) investigating the dramatic large-scale asymmetric cycles of seismic character evident on high-resolution records, thereby identifying their ~~occurrence onto~~ Quaternary-Pliocene climate/sea-level and paleoceanographic changes.

The importance of the Gulf of Cadiz and off West Iberia is clearly reflected in the large number of regional studies and multinational interest shown over the past 35 years. We have identified the following four broad scientific objectives, which require a total of seven drill sites through the Pliocene to Quaternary sedimentary record (Fig. 2): 1) Influence of the Gibraltar Gateway; 2) MOW paleoceanography and global climate significance; 3) Sea-level changes and sediment architecture of the Cadiz CDS and Iberian margin; and 4) Synsedimentary neotectonic control on architecture and evolution of the CDS. To achieve these~~s~~ major scientific objective, it is essential to integrate the results of the proposed drill sites with a dense network of existing high-resolution seismic reflection profiles. Interpretation of this seismic network is already well established, although the inferred ages require drilling confirmation.

ACKNOWLEDGEMENTS

We thanks the support from Repsol, TGS-NOPEC, Petrobras and SECECSA on this research, which is related to the CTM 2008-06399-C04/MAR Project.

REFERENCES

Iorga, M., Lozier, M.S., 1999. Signatures of the Mediterranean outflow from a North Atlantic climatology. 1. Salinity and density fields. Journal of Geophysical Research, 194, 25985-26029.

Stow, D.A.V., Hernández-Molina, F.J., *et al.*, 2006. Environmental significance of the Mediterranean Outflow Water and its global implications. IODP Full Proposal-644. GUCA-DRILL.