Geophysical Research Abstracts
Vol. 16, EGU2014-12153-1, 2014
EGU General Assembly 2014

Multi-scale characterization of a Contourite Depositional System from Gamma Ray data analysis. Insights from IODP Expedition 339 in the Gulf of Cadiz

Johanna Lofi (1), Emmanuelle Ducassou (2), Aurélie Galvani (1), Francisco Javier Rodríguez-Tovar (3), Trevor Williams (4), Francisco Javier Hernández-Molina (5), Dorrik Stow (6), Eulogio Pardo-Igúzquiza (7), and the IODP Expedition 339 Scientists Team

(1) University of Montpellier, Géosciences Montpellier, Montpellier, France (johanna.lofi@gm.univ-montp2.fr), (2) EPOC, University of Bordeaux I, France, (3) Universidad de Granada, 18002 Granada, Spain, (4) Lamont-Doherty Earth Observatory of Columbia University, USA, (5) Royal Holloway Univ. London, Egham, Surrey TW20 0EX, UK, (6) Heriot-Watt University, Edinburgh, Scotland, UK, (7) Geological Survey of Spain, IGME, 28003 Madrid, Spain

Contourite Depositional Systems (CDS) generated by bottom current activity have been described in most oceanic basins, especially on the continental slope, rises and abyssal plains. Beside an economic light due to the continuous expansion of hydrocarbon exploration towards deeper water, CDS form sedimentary archives that can be crucial for paleoceanographic reconstructions.

Recently, IODP Expedition 339 was conducted in the Gulf of Cadiz in order to investigate the CDS under the influence of the Mediterranean Outflow Water (MOW). Five sites were successfully drilled, cored and logged, making this area an ideal ground for testing the contourite paradigm over a 5 Ma long record. Following opening of the Gibraltar Gateway, preliminary results show that contourite deposition started from 4.2-4.5 Ma, increasing in the Quaternary. Significant widespread unconformities, present in all sites but with hiatuses of variable duration, are interpreted as a signal of intensified MOW, coupled with flow confinement.

Expedition 339 data allows characterization of CDS from both seismic, core and well log data. Downhole logging measurements acquired during the expedition provided continuous in situ Natural and Spectral Gamma Ray (GR) records of the drilled formation, allowing for the analysis of the interaction between bottom circulation and sedimentary deposits at several scales:
- At small scale, the good core recovery allows core/log integration. Grain size analysis performed on cores from Site U1386 have been combined with Gamma ray data, primarily tracking clay content, measured on cores and in open hole. The correlation confirm that high GR values correlate well with muddy intervals while low GR values reflect coarse-grained intervals;
- At an intermediate scale, spectral analysis performed on GR logs at 3 sites (U1386C, U1389E and U1387C) confirm the record of orbital-scale variations in the sediment properties of contourites over the last 1.6 Ma;
- At a larger scale, site to site correlation of the GR logs has been performed for the last 1My and tied with δ18O curves based on the existing preliminary age model, allowing discussing climate and eustatic control on the evolution of MOW bottom-current activity and circulation patterns.

The bi-gradational contourite depositional sequence is classically interpreted as reflecting changes in bottom current activity, with coarse grain intervals reflecting phases of current intensification. Past studies performed on shallow cores taken from the Gulf of Cadiz evidenced an enrichment in coarse grained material during the Last Glacial Maximum, interpreted as an increase in MOW velocity during cold periods, sometimes associated with increased density flow. The preliminary results presented here suggest that this relationship may not be extrapolated to the entire Pleistocene and to the entire study area, because at several sites, some intervals enriched in sands seem to correlate with high stand periods (and inversely some muddy intervals with low stand periods). Keeping in mind that the age model still needs to be refined and that the drilled deposits may not all correspond to contourite deposits (eg. debrites, turbidites…), these observations rise important questions in terms of sediment supply and factors controlling the MOW intensity and its variability in space and time.