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DRILLING below the SALT in the WESTERN MEDITERRANEAN SEA: the GOLD PROJECT.

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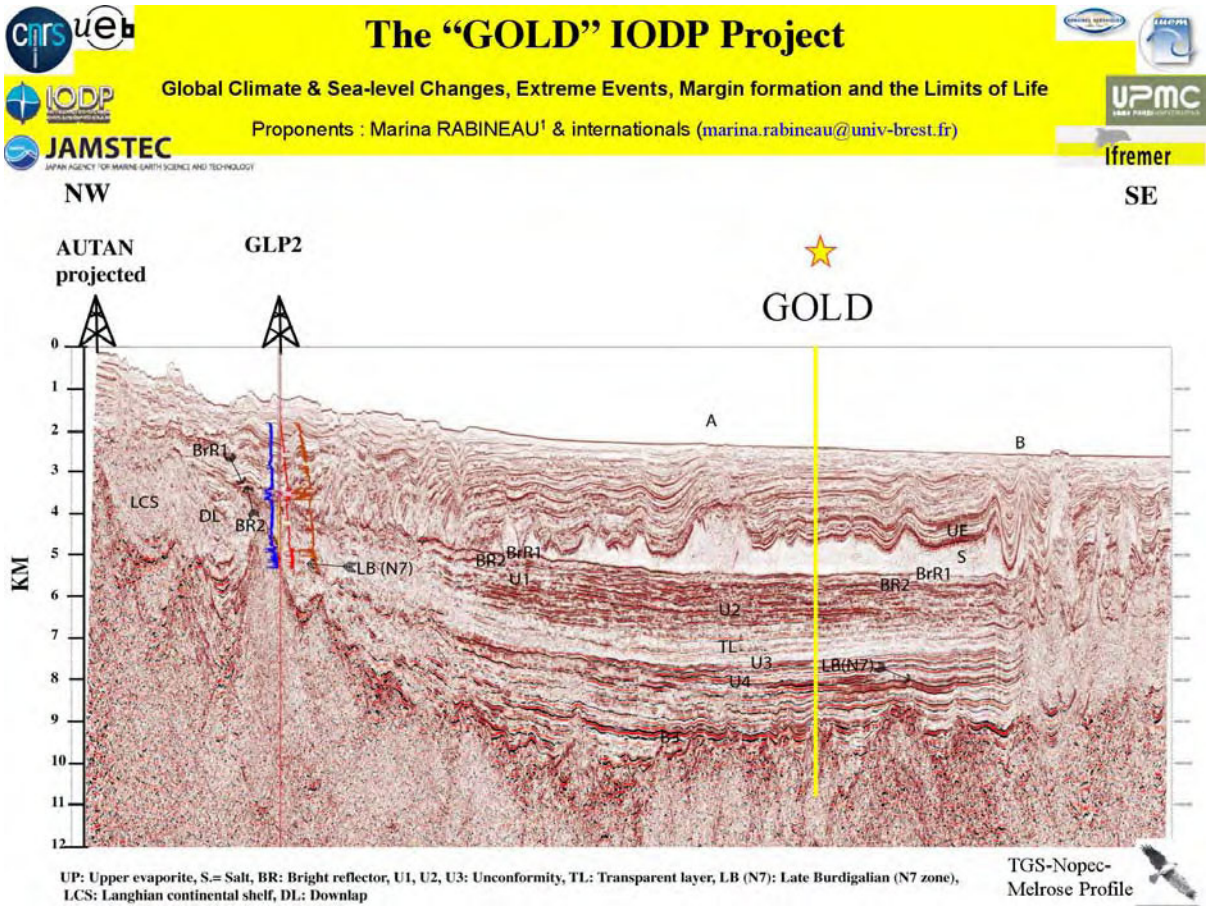
The Gulf of Lion within the Occidental Mediterranean Sea has appeared in the last years as a unique natural laboratory to study both evolution and interaction of deep processes (geodynamics, tectonics, subsidence, isostasy) and more surficial processes (rivers behavior, sedimentary fluxes, sea-level changes, climate impact...). Here, we present, in the name of a large group of international researchers, the main objectives for a deep drilling GOLD project at the toe of the continental slope (2400 m water depth) in the Gulf of Lion. This position is the only place in the Gulf of Lion where the sedimentary column is fully complete without major erosion and hiatuses. It is located sufficiently far from the shelf and slope to be saved from the messinian extraordinarly erosional event, and also free from salt faulting and salt diapirs that deform deposits. At this position we record the full and very high resolution history of the last 23-30 Ma of earth history within 7.7 km of sedimentary archives. From a petroleum point of view, the deepest part of the margin has been under-explored as all previous wells were drilled on the shelf and slope GLP1 & 2 being the deepest one (Fig. 1). New interpretations in the area (in particular concerning the messinian event) considerably change earlier views of potential hydrocarbon reservoirs.

New outcomes from a deep drilling are numerous, such as:

1) For the substratum, seismic reflexion data (ECORS and SARDINIA data) image quite clearly, at the toe of the slope, the limit between continental crust and transitional substratum where highly reflective lower crust clearly visible below the shelf, disappears. Refraction data confirm those observations: the upper continental crust thins to less than 5 km, and changes laterally to a relatively thin crust with high velocities which precise nature is still a problem (Gailler et al., 2009). Magnetic maps also indicate a large smooth domain as sometimes observed at the toe of margins in the world. The aim of the drilling is to bring crucial information on the nature of this puzzling crust, which is, in association with precise kinematic and paloebathymetric reconstructions, an essential clue for the understanding of sedimentary basin genesis (Aslanian et al., 2009).



2) The Gulf of Lion receives most of the sediments eroded from the Alps and transported through the Rhône River, We infer that the amount of sediment will vary significantly according to the existence or the absence of ice sheet and glaciers. The drilling will therefore enable to date and characterize the impact of the initiation and the change in glacioeustatic cyclicities on alpine glacier and ultimately on sedimentation in the deep basin during Plioquaternary. For the Miocene and older sediments (Oligocene ?), the drilling combined to seismic reflexion data, will give the nature, the paleoenvironments and dating of deposits enabling an Astronomically Tuned Neogene Time Scale to be established for a badly known period (Aquitanian, Burdigalian and Langhian). Sampling these deposits will also give key elements to reconstruct in detail the early history of margin formation and subsidence testing recent work that suggested that the margin stayed in a high position during early phase of rifting (Bache, 2008).

3) The messinian extreme event represents a unique sedimentological, hydrological, oceanographic, biological and probably climatological crisis in earth history. It is a unique case to study and quantify the impact of an outstanding sea-level drop (more than 1000 m, one order of magnitude greater than Late Quaternary glaciations) on sedimentary river behavior, deltaic and evaporitic deposition, but it is also a biotic crisis. Furthermore, the amount of messinian deposits (detritics, evaporites and salt deposits) reaches more than 3000 m which corresponds to an enormous depositional rate. Such important erosion and sedimentation must provide crucial information on margin dynamic (isostatic readjustment, behaviour of the upper mantle). So far, DSDP and IODP drillings have reached the upper part of the evaporites only, the beginning of the crisis is still a matter of intense debate and conjectures. Our observations suggest a thick serie of «lower evaporites», under the halite but above major detritic deposits (Bache et al., 2009). Other interpretations suggest less amount of messinian

detritics and pre-messinian canyons (Lofi & Berné, 2008) or evaporites deposition before major detritic phase and without sea-level drop (Krijsmann, 1999). The deep drilling with the R/V Chikyu is the only way to go through the complete series of evaporites in the provence basin, sample the initiation and evolution of the crises, the first deposits related to the lowering of sea-level on one hand and to the salinity crisis on the other.

4) Finally, this drilling represents the first opportunity to study the composition and functions (metabolic processes and products, regulation of populations, etc.) of the microbial communities (Bacteria, Archaea, viruses, fungi and protists) from deep marine sediments of the Mediterranean Sea, the so-called 'deep biosphere'. This site is particularly interesting to address the question of life's tolerance to environmental extremes and habitability since extreme conditions such as high P, high T°, salt layers (are there organisms in salt inclusions?) and particular organic matter content are prevailing. The ultra-deep drilling GOLD should reach 7700 mbsf when the present-day deepest detection for molecular signatures of microbes is at 1626 mbsf (Roussel et al. 2008). Consequently, it would represent an opportunity to determine the limits of life in terms of depth and physico-chemical constraints (for example, when considering only the parameter temperature, thermicity values together with our current knowledge of life let us think that life could be present up to 4-5 km bsf). This drilling is also interesting to study the questions of dispersal and evolution (isolation during Messinian salinity crisis), and the interaction biosphere-geosphere.

We invite all interested participants to join this drilling project and let you know that we will propose an IODP Magellan Workshop in Banyuls 3-5th March 2010 to gather scientists around this proposal and drilling projects in the Mediterranean Sea

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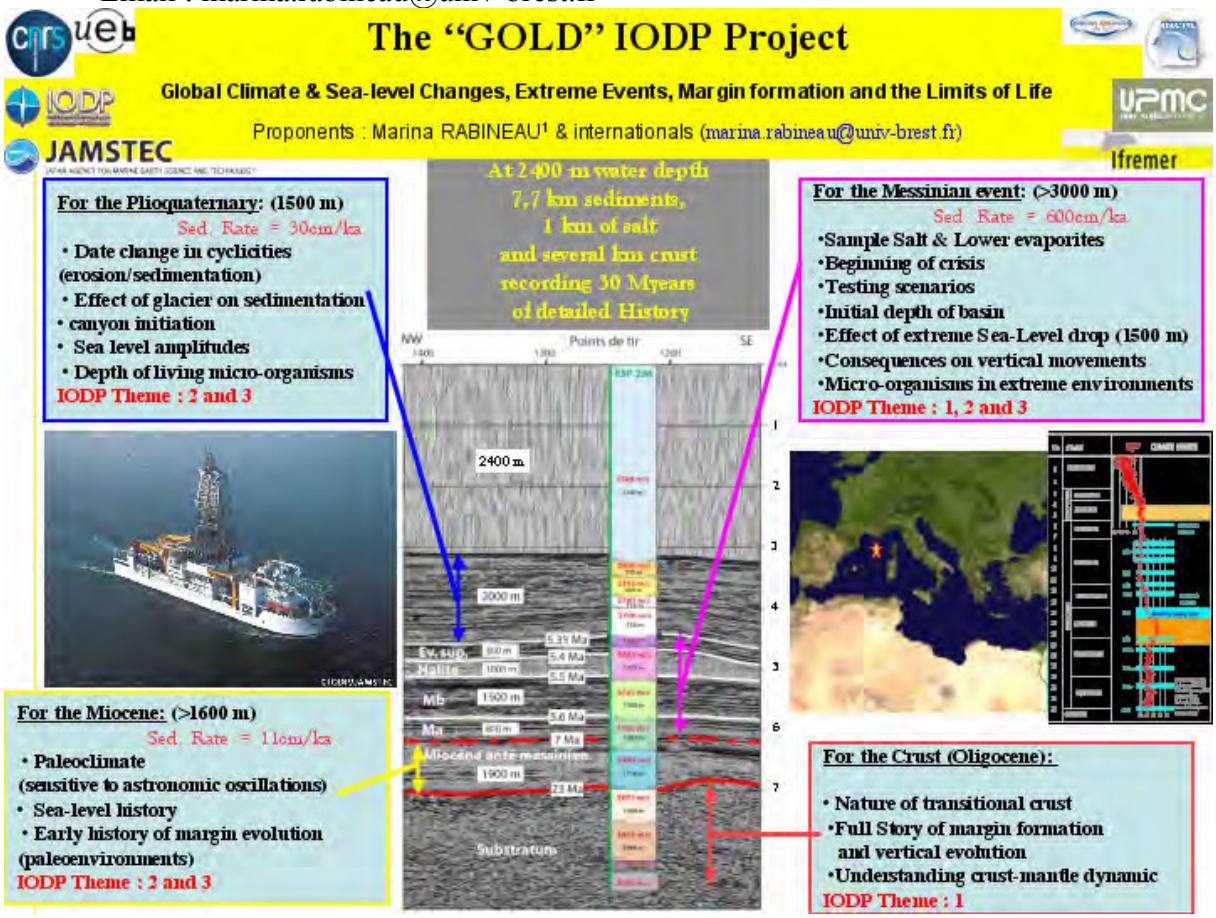

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