



Drilling of two European deltaic margins for global and climate changes, slope stability and sequence stratigraphy during the last ca. 500 kyr: The Promess 1 expedition

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“PROMESS” (PROfiles across MEditerranean Sedimentary Systems) is a group of complementary scientific proposals requiring three different coring and drilling platforms, each best suited for specific penetrations, recovery and water depths (ranging from 50 to 2500m). Its general objective is to obtain comprehensive transects (from source to sink) across two Mediterranean Deltaic Margins in the NW Mediterranean Sea (the Rhône and Catalan-Languedocian river system) and in the Adriatic (the Po and Apennine river system). These two areas, which were investigated by all kind of geophysical techniques, are of exceptional interest because of high sedimentation rates, good sequence preservation and contrasted local/regional settings. They permit to address questions of broad interest about continental margins:

- Stratigraphic response to Glacio-eustatic and climatic changes during the last 500 ka,
- Study of the impact of regime and supply variability on continental slope stability, and quantification of slope processes by in situ measurement of physical parameters in zones prone to failure, or where slides already occurred,
- Stratigraphic impact of oceanographic and climatic changes in the Mediterranean area, within complementary time intervals including (a) the Milankovitch scales over the last 500kyr, (b) the sub-Milankovitch (Dansgaard-Oeschger) scale in particular for intervals that can be precisely constrained geochronologically such as the last deglacial period,

- Depositional processes, architecture and preservation potential of sand bodies, within shelf, slope and deep-sea environments,
- Criteria for disentangling the signature of eustatic changes from that of tectonic deformation at short time scales.

PROMESS1 was devoted to coring and in situ measurements of shelf and upper slope (50-300m water depth) sedimentary environments with a geotechnical vessel from the industry. Besides its scientific interest, it was also designed to test the feasibility of using a “mission specific platform” in the perspective of European participation to the IODP.

Between June, 24th and July, 22nd, 2004, a team of European scientists embarked from Brindisi (Italy) to Barcelona (Spain) onboard the Russian vessel “Bavenit”, operated by the Dutch geotechnical company FUGRO, for a drilling expedition in the Adriatic Sea and the NW Mediterranean Sea.

In the Adriatic, two boreholes were drilled at site PRAD1 (water depth 184 m), where the objective was to study the record of the last four glacial cycles. A pilot hole (without core recovery) was first drilled for assessing the risk of shallow gases, a downhole logging was carried out in this borehole. A second site allowed continuous coring to the targeted depth (71m below sea-floor) with excellent recovery (better than 95%). Very preliminary interpretation indicates that seismic sequences previously identified correspond to 100,00 years glacial cycles. Downhole logging and physical properties of cores allow to identify magnetic events, and layers formed by volcanic eruptions. Site PRAD2 was devoted to the study of the recent most sediments (last 12,000 yrs) near the coastline, at a water depth of 56m. The targeted depth was 32 m below sea floor, sufficient to obtain a good record for the last ca 12,000 years. All together, six boreholes were drilled at PRAD2, including a pilot hole, one for continuous sediment recovery, and additional holes for in situ geotechnical tests and sampling. One of the objectives of these tests is to determine whether the wavy features shaping the sedimentary sequences are caused by near-bottom currents or result from liquefaction of unstable sediments triggered by earthquakes or storms.

Site PRGL1 in the Gulf of Lion is at 298 m water depth, and the targeted depth below sea floor was 300 m, allowing to reach an expected age of about 430 kyr BP. A pilot hole was drilled down to 310 mbsf, and logged. Two geotechnical boreholes were drilled, allowing tests and measurements to a depth of 150 mbsf. Another borehole was drilled for continuous coring to the depth of 300 mbsf. The recovery was excellent (>95%). Preliminary estimations of coccolithophore assemblages provide a general time-frame for this site. Marine isotope stage (MIS) 12 was reached at the bottom of the hole. We have also good estimates of the position of the intervals corresponding

to MIS 2-3, MIS 4, MIS 5a-d, and the transition between MIS 8 and 7. This shows that, as in the Adriatic Sea, seismic bounding surfaces are linked to 100 kyr cycles, that modify lithology and sedimentation rates on the upper slope. The presence of coarser sediment at the end of each “forced regression”, and the occurrence of some biogenic gas, trapped by the overlying clayey sediments deposited during the ensuing warm period, is likely at the origin of seismic anomalies. Site PRGL2 is at 103 m water depth, an area where glacial shorelines that formed during the last ca. 500 kyr are the best preserved. A CPTU borehole was first drilled, followed by a sampling borehole, down to 100 mbsf. As expected, many sandy intervals were encountered, but the overall recovery was however quite good, in the order of 82%. Gamma ray downhole logging was performed in the drill pipe afterward.

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