Strata formation in the Gulf of Lions during the last glacial cycles : an overview

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Promess 1 was the first scientific drilling operation in the Gulf of Lions. Together with Eurostrataform, these 2 European projects provided a huge amount of new data that allows us to analyse, from « sink to source », the main processes that control strata architecture on a deltaic margin. In the deep-sea, The **Rhone deep sea fan** functioning is strongly controlled by sea-level changes: it functions as a classical channel/levee system as long as a direct connection exists between the Rhone river and the canyon head. Following MWP1A, only episodic mass wasting, triggered by dense water cascading, feeds the system. At this time, erosion of lowstand shelf shorefaces is the major source of sand to the deep-sea.

On the long term, **canyons** represent a depositional (not erosional) environment where glacio-eustatism imprint is well recorded. During lowstands, some canyon heads are very rapidly filled-in by sediment plumes from nearby rivers, while those connected to rivers experience axial incision and lateral mass-wasting. Very recent (<100yr) sand bed within the Bourcart canyon head demonstrates that there is still sediment transfer to the slope. On **canyon interfluves**, a thick pile of hemipelagic sediment accumulates, with thick glacial and condensed interglacial intervals. Maximum flooding surfaces are underlined by pockmarcks. Their occurrence can be utilized as a dipstick of sea-levels. The imprint of high-frequency sea-level changes is well recorded by the **outer shelf sequences**, even though the general stratigraphic “motif” is dominated by 100-kyr glacial cycles. Most of the shelf deposits consist of regressive sequences that form prograding prisms thickening seaward, and pinching out at a depth of ca 80 m. Large-scale (up to 30 m thick) steep (up to 5°) clinoforms have been successfully cored. They consist of massive well-sorted sand, passing progressively to interbedded sand and mud intervals (storm deposits). The progradation rate of the shoreface sequence deposited between MIC 3 and MIC 2 is precisely determined through 14C dating.

On **the inner shelf**, transgressive and highstand (deglacial + Holocene) deposits form a thick (up to 40 m) wedge that pinches out seaward at about 80 m water depth. The retreat path of the Rhone river is well visible on detailed bathymetric maps, as well as various deltaic complexes formed at different sea-levels. In addition to acceleration and deceleration of sea-level rise, the effect of sediment flux variability is well documented for the Younger Dryas- Preboreal period.

One of the more surprising results of our studies is that, despite a relatively low-energy, (compared to shelves swept by waves and/or tides such as the Bay of Biscay, the Californian shelf or the East China Sea), shelf deposits, including relict sand offshore sands, are episodically reworked into large bedforms at any water depth. Therefore, marine erosion is a key parameter to take into account in studies of the stratigraphic record.