DEEP CANYON AND SLOPE SUSPENDED SEDIMENT TRANSPORT IN THE WESTERN GULF OF LIONS DURING THE 2006 INTENSE CASCADING PERIOD

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Abstract
The network of mooring lines deployed between 300 m and 1900 m depth along Lacaze-Duthiers and Cap de Creus canyons and the southern open slope allowed to study the water and sediment transport in the Western Gulf of Lions during the 2006 intense cascading period. The dense water and sediment transport reached down to 1900 m depth and was both through submarine canyons and along the southern open slope towards the Catalan Margin. Sediment transported by cascading came either from the shelf or from resuspension of sediments previously deposited at mid-canyon depths. Open-sea convection processes combined with deep cascading pulses also generated sediment transport at deeper slope regions.
Keywords: Continental Margin, Particle Flux, Sediment Transport, Gulf Of Lions, Deep Sea Processes

Dense shelf water cascading in the north-western Mediterranean has been identified as a major transport mechanism able to generate high sediment fluxes in submarine canyons [1, 2, 3] and in the basin during the coldest years [4]. It is known that dense shelf water flows can transport shelf particles and erode and reshape the seafloor, increasing suspended and bed load sediment transport as they progress across the outer shelf and upper continental slope. However, observations of the spreading of dense shelf water cascading across the entire continental slope are scarce and its effects on sediment transport towards the continental rise and basin are largely unknown.

The north-western Mediterranean is a region of dense water formation due to the effect of strong and persistent northern winds (Mistral and Tramontana). The formation occurs on the shallow inner shelf of the Gulf of Lions and at open-sea, preferably in the area known as MEDOC site. Over the continental shelf, the intense wind-induced evaporation and cooling produce cold dense water that eventually overflows the shelf and cascades down the slope, especially though the westernmost submarine canyons. The process occurring in the basin is characterized by open sea vertical convection, and mixing of surface water with warmer but saltier Levantine Intermediate Water [5].

Recent studies have demonstrated that most of the off-shelf suspended sediment transport in the Gulf of Lions occurs in its westernmost sector, preferentially through the Cap de Creus submarine canyon. Based on this previous knowledge, a focussed monitoring strategy was designed within the HERMES project, to better constrain the contemporary sediment transport processes in this region. A network of mooring lines equipped with current meters and turbidity sensors at 5 m above bottom were deployed between 300 m and 1900 m depth along the axes of the two Lacaze-Duthiers and Cap de Creus neighbor canyons, as well as across the southern open slope from October 2005 to October 2006 (Fig. 1).

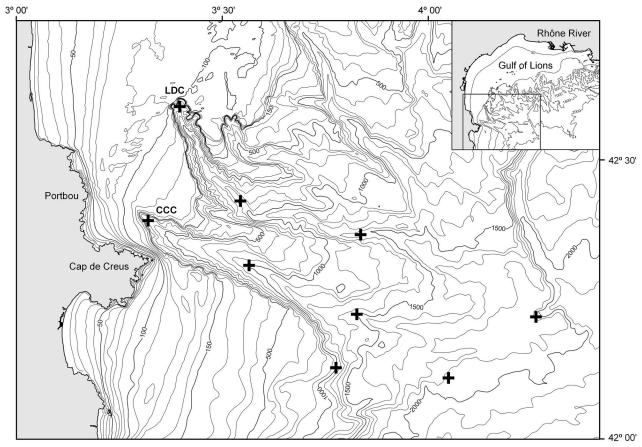

Fig. 1. Bathymetric map of the study area showing the location of the moored instruments. CCC: Cap de Creus Canyon. LDC: Lacaze-Duthiers Canyon.

Recorded data indicate that dense shelf water cascading was the main shelf-to-slope sediment transport process in the area, acting from January to April-May 2006. The dense water and sediment transport was not only through submarine canyons, but also along the southern open slope. The most important suspended sediment transport event was due to the intense cascading pulse occurring in January 2006, which produced a strong sediment flux increase along the Cap de Creus Canyon down to 1900 m depth and also along the open slope at 1000 m depth. A significant sediment flux increase also occurred in March-April 2006 due to another intense cascading pulse. In this transport event, suspended sediment concentration only increased at 1000 m depth in the Cap de Creus Canyon and on the open slope, but not at the canyon head, suggesting a redistribution of sediments previously deposited at mid-canyon depths. Deeper than 1000 m, net fluxes show that most of the suspended sediment left the canyon and flowed along the southern open slope towards the Catalan margin, whereas a small part flowed downcanyon and was exported basinward through the canyon mouth. Additionally, the increase of the deep-sea near-bottom currents induced by open-sea convection processes, combined with the arrival of deep cascading pulses, also generated moderate but continuous suspended sediment transport at deeper slope regions.

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