Continental-Margin Processes Recorded in Shelf and Canyon Sediments

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LONG-TERM GOALS

The ultimate goal of this project is to understand how the relationship between sediment deposition and accumulation leads to the formation and preservation of sedimentary strata in the seabed.

OBJECTIVES

The objectives of this research during FY05 were to:

1) publish research completed in the Adriatic Sea;

2) undertake three research cruises to the Gulf of Lions;

3) begin lab analysis to understand: Rhone flood deposits, the mid-shelf mud deposit, off-shelf transport, and submarine-canyon sedimentation;

4) coordinate the EuroSTRATAFORM program.

APPROACH

During 2000-2003, cores were collected in the Adriatic Sea associated with the Po River and a suite of Apennine Rivers. These were used to study the impact of a major flood of the Po River and to quantify seasonal aspects of sedimentation. Laboratory analyses of cores were completed during 2004-2005.

During 2004-2005, a contrasting study was undertaken in the Gulf of Lions, with examination of sediment discharge from the Rhone River, dispersal across the continental shelf, and transport into and through two submarine canyons (Cap Creus and Lacaze-Duthiers). Cores were examined by several radioisotopes to document rates of deposition, biological mixing, and net accumulation. In addition, the character of the sediment was documented by x-radiography and grain-size analysis. These studies of sedimentation were directly compared to dynamical observations of sediment transport by other investigators.

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WORK COMPLETED

During this past year, research papers directly related to our Adriatic studies were submitted for publication, in addition to a range of related synthesis papers.
In addition, three research cruises were undertaken in the Gulf of Lions, and laboratory analyses were initiated on the sediment cores that were collected. Charles A. Nittrouer continued as co-coordinator for the EuroSTRATAFORM project.

RESULTS

Most of the year was spent preparing for, participating in, and demobilizing after the three cruises. The following are the initial impressions from preliminary analyses.

1) Near the mouth of the Rhone River, physical sedimentary structures were observed and appear similar to those associated with known floods of the Eel and Po Rivers. ^{7}Be and ^{210}Pb profiles demonstrate rapid rates of sediment input to the seabed (>1 cm/y).

2) The sediment transported across the shelf (i.e., in a counter-clockwise manner around the Gulf of Lions) forms a deposit of homogenous mud between ~50-70 m water depth with moderate accumulation rates (2-3 mm/y).

3) These sedimentary characteristics extend to the shelf break in the far southwest corner of the Gulf, where the mid-shelf deposit intersects the heads of Cap Creus and Lacaze-Duthiers Canyons.

4) Both canyons are characterized by coarse-grained sediment (sand, pebbles, shell fragments) in their heads, with little evidence of sediment emplacement in the seabed. Instead, it appears that the seabed is swept clean, presumably by the cold-water bottom currents cascading down the canyons. The modern sediment is likely carried to deeper portions of the canyons, and this hypothesis is being investigated.

IMPACT/APPLICATIONS

The research completed in this project leads to an improved understanding of the processes that control the geometry of sedimentary deposits over multiple time scales. Especially important will be the validation of numerical predictions for distribution of the Rhone flood deposit, and evaluation of the seabed impact of cold-water currents cascading down the submarine canyons.

TRANSITIONS

Other EuroSTRATAFORM investigators are using results from this effort. Those studying the seabed incorporate radiochemical and textural data to document seabed characteristics more fully. Researchers analyzing boundary-layer processes also utilize these data to describe instrumentation sites. Accumulation rates, sediment budgets, and grain-size data are key components to the input parameters of numerical models.

RELATED PROJECTS

Related projects include studies of: the seabed by R. Wheatcroft and P. Wiberg; boundary-layer process by A. Ogston and P. Puig; suspended-sediment dynamics by G. Kineke, P. Hill and T. Milligan; modeling by L. Pratson and J. Syvitski; and organic carbon by S. Miserocchi, L. Langone, and D. Orange.

PUBLICATIONS

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