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BIOLOGICAL ALTERATION OF SEDIMENTARY EVENT-LAYERS ON THE EEL RIVER SHELF

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LONG-TERM GOALS

The ultimate objective of this research program is to obtain a predictive understanding of the physical and biological processes responsible for the formation, alteration and preservation of marine sedimentary deposits. While present focus is on the biological alteration of sedimentary event layers, the physical processes leading to the deposition and erosion of marine sediment remains an area of interest. The general approach of this research program is the development and testing of theory mainly through field observations and measurements.

OBJECTIVES

The focus of this project, which is a component of the STRATAFORM program, is the documentation of the post-depositional biological alteration of sedimentary event layers (i.e., beds derived from wind-driven storms and river floods) on the Eel River shelf off northern California. Specifically, the spatial (along and across-isobath) and temporal variation of the small-scale geometry of event-bed contacts is quantified using digital x-radiography. Variations in geometry will be explicitly related to spatial and temporal patterns of independently measured forcings, such as bioturbation intensity, macrofaunal community structure, sediment accumulation rate and event bed thickness. The results of this research will be a more complete understanding of the factors affecting the biological alteration of sedimentary event beds and the formulation of the next generation of models regarding strata preservation.

APPROACH

Box cores are the primary sampling device used in this research. Cores are taken in two different modes: (1) replicate time-series sampling of four stations along the 70-m isobath, and (2) broad, large-scale coverage of the Eel margin. Subsequent sources of data include transmission x-radiographs, microresistivity profiles, profiles of the naturally-occurring radionuclides, Pb-210, Th-234 and Be-7, and macrofaunal community composition, abundance and biomass. X-radiographs are digitized on a flat-bed scanner and analyzed using a variety of image processing techniques (e.g., enhancement, segmentation).

WORK COMPLETED

A total of four separate box coring cruises were conducted during the past year. During three of the cruises, WR9611, W9701 and PS9705, replicate time-series samples were collected at four stations along the 70-m isobath representing areas severely to moderately impacted by the flood deposits. In addition, cruises W9701 and PS9705 were used to map the distribution and thickness of the January 1997 flood deposit. Lastly, cruise M9707 was used to collect a large number (~150) of box cores along the sand-mud boundary at separation distances from < 5 to 1000 m to examine spatial coherence scales of bedding and other sedimentologic features.

RESULTS

A highlight of the past year was the thorough documentation of the 1997 flood deposit, which showed that it was similar in many ways to the 1995 layer. In particular, the position of the inshore boundary (~ 50 m water depth) and depth of maximal thickness (70 m) were the same for the two flood deposits. Also similar were the overall shapes of the deposits (i.e., elongated along-shelf) and the mass of sediment (roughly 6 million metric tons) in the two layers. There were, however, important differences between the two deposits. The most obvious of

which was the much larger aerial extent of the 1997 deposit, whereby significant fractions of the deposit were found directly offshore and south of the river mouth. In contrast, the 1995 flood deposit was shifted at least 10 km northeastward of the river mouth. The 1997 flood layer also extended to greater water depths (i.e., outer shelf and upper slope). Coring also indicated that the Eel River canyon may be a significant sink and/or conduit for flood sediment.

A secondary finding was that, contrary to expectations, the 1995 and 1997 flood deposits had little impact on total macrofaunal abundance. However, tube-dwelling, near-surface polychaetes (e.g., spionids, *Mediomastus*) suffered substantial mortality following each flood event. Overall, the Eel River shelf macrofauna is strongly dominated by subsurface deposit feeding polychaetes, with very few representatives from other feeding guilds (e.g., suspension feeders) and taxonomic groups (e.g., echinoderms). Bioturbation intensities are fairly high, and display a seasonal pattern which may be related to the spring upwelling period.

IMPACT/APPLICATIONS

Documenting the initial distribution and subsequent modification of sedimentary event beds will provide key insight for modelers of strata development on continental margins.

TRANSITIONS

Sedimentary strata have important and diverse acoustical implications. In a preliminary exploration of those implications, a selection of digitized x-radiographs have been subject to a statistical analysis in both the spatial and wave number domains by Dr. Dajun Tang (APL-University of Washington). This collaboration has resulted in one publication (Tang and Wheatcroft, 199X).

RELATED PROJECTS

Field sampling has been a joint effort with Drs. J. Borgeld (Humboldt State University), D. Drake (USGS), E. Leithold (NCSU) and C. Nittrouer (SUNY-Stony Brook). In addition, collaborations have been initiated with Drs. R. Geyer (WHOI) and P. Wiberg (Uva) to examine the formation and physical resuspension of the flood deposits.

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