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Recent sediment transport events in Monterey Canyon and fan channel

C. Paull (1), W. Ussler III (1), J. Johnson (1 & 2), J. Barry (1), D. Caress (1), J. Xu, W. Normark

(1) Monterey Bay Aquarium Research Institute, Moss Landing CA [paull@mbari.org/831-775-1620], (2) UNH, Durham, NH

Over the last several years, high-resolution multi-beam bathymetry, ROV-guided observations and sampling, and data from canyon monitoring activities (measurements of near-seafloor currents, turbidity, pressure, temperature, and salinity) have been collected throughout the Monterey Canyon-Fan channel system off central California. Together, these observations provide a perspective on the nature and tempo of sediment transport events in the Monterey Canyon and Fan System.

The head of Monterey Canyon is located very near-shore and captures material derived from the local river systems and material transported alongshore via littoral drift. Gravel and coarse sand, with a composition similar to the sand found on local beaches, accumulate near the canyon head and line the floor of the axial channel throughout the upper Canyon ($<$2 km water depth). Instrument deployments in the axis of upper Monterey Canyon from 2001 to 2005 have recorded evidence of $\sim$10 turbidity events, ranging from mild increases in near-bottom turbidity with no detectable change in bottom currents, to major, energetic, down-canyon flows with current speeds $>$100-200 cm s^{-1} and high turbidity, which moved large volumes of sediment and destroyed or buried instruments deployed in the canyon axis. These observations show that the recurrence interval for sediment transport events in the upper canyon ($<$2 km water depth) is sub-annual.

The axial channel associated with Monterey Canyon extends across Monterey Fan as a distinct continuous channel into more than 4 km water depths. ROV-collected vibracores, push cores, and observations of Monterey Fan and its axial channel (axial depths between 3.4 and 3.9 km) show that the seafloor on the fan is characteristically

draped with fine sediment. The presence of detectible levels of DDTr (sum of DDT and its decay products) in the uppermost ($>$5 cm) sediment throughout the canyon and fan system, indicate that significant volumes of fine grain sediments have been transported across the margin and onto the fan since 1945. In the axial channel these fine sediments are underlain by high-energy deposits (gravel, coarse sand, and rip-up clasts) that are over a meter thick, and indicate deposition by a geologically recent high-energy event. The repeated observations of a dead whale carcass laying directly in the axial channel at 2886 m, abundance of slow growing chemosynthetic biological communities directly within the channel below 2800 m depth, and some physical measurements with deployed instruments indicates that the recent high-energy events in the upper canyon did not flush through the entire Monterey Canyon system and pass out of the canyon and across the fan.

Timing of the last turbidite in the fan channel is constrained with DDTr and ^{14}C stratigraphies. While DDTr occur in the uppermost clay-rich sediments, they are absent in clays that overlie the uppermost sand deposit, indicating that the youngest turbidite in these cores was deposited $>$60 years ago. The youngest radiocarbon age on woody debris from the uppermost turbidite is 155$\pm$35 RC years B.P. Moreover the observation that coarse- sediment-carrying high-energy events are much more common in the upper canyon than on the fan suggests that the upper canyon is presently accumulating sand and other coarse sediments.