New Jersey Shelf-Slope 3D Survey for Sea-Level and Sedimentary Objectives

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Sedimentary architecture, even on passive margins, is strongly three dimensional. This reflects sediment supply and transport pathways, underlying tectonism, differential compaction, and along-strike processes such as long-shore drift and ocean currents. Efforts made to study this three dimensionality using 2D seismic data have yielded tantalizing, but incomplete, results. For example, shelf and slope incisions have proven to be impossible to map using profiles spaced ~2 km apart. However, such dispersal systems must be understood in order to define the processes responsible for the lithologies recovered by scientific ocean drilling and to define the extent of shelf exposure during relative sea-level falls, which will likely assist estimation of eustatic amplitudes.

The New Jersey margin has been the focus of intensive and ongoing ODP/IODP drilling for sea-level objectives since 1993 (Legs 150, 150X, 174A, 174AX and Expedition 313); extensive 2D seismic grids have been collected in support of that drilling. However, experience has highlighted the need for 3D seismic coverage to maximize returns from drilling. Such 3D data can only be collected by the scientific community, because commercial 3D seismic data are available only on margins of interest to the oil industry and have not been collected off New Jersey. The alternative to working in areas of oil industry interest, where 3D data are available, is also valuable and should be pursued. However, commercial 3D surveys generally lack the ground truth in the critical (for sea-level studies) Neogene section that has been and is provided by continuous ODP/IODP coring.

Survey design will be critical. Areal coverage, in both dip and strike directions, is important for sedimentary objectives. This need arises because of the requirement to constrain known complex variability within a representative portion of the margin that includes examples of all key sedimentary processes. Compromise and innovation may be necessary, both to minimize cost and to avoid navigational hazards off the east coast U.S., e.g., fishing gear near the modern shelf-edge.

Building on the results of IODP Expedition 313 would be especially relevant to the societal need of understanding the cause and impact of shoreline flooding. Roughly a dozen cycles of glacio-eustatic variation were sampled at three sites; environments from open shelf to shoreface to paleosols were recovered. Three-dimensional registration of these samples would provide an unprecedented data set and yield insight into the impact of encroaching shorelines during times of rising sea level such as we are experiencing today.

Having made such a huge investment in drilling over nearly two decades at sites across the New Jersey shelf and slope, it would a great pity not to follow through with imaging equal to the complex and fundamental geologic objectives that drove us to drill in the first place.