ODP AT THE WATER'S EDGE: DEFINING THE HISTORY OF SEA-LEVEL CHANGE

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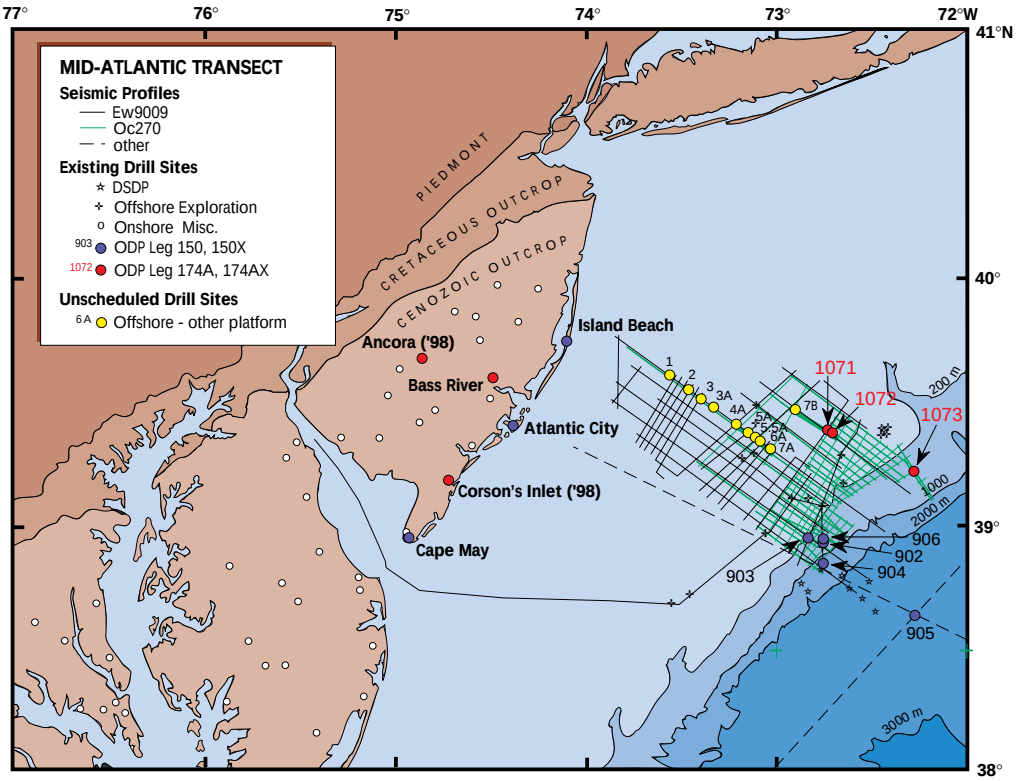
The stratigraphic record is replete with evidence that ocean shorelines have advanced and retreated throughout geologic time, with large consequences for nearshore ecosystems, material and chemical balances of the ocean, and global climate. Available data cannot determine whether these changes occurred synchronously around the globe, implying a mechanism that drives planetary sea level, or were the result of local processes such as tectonism and sediment supply. ODP is uniquely suited to address this question, and a plan is underway to: (1) date sea-level changes caused by fluctuations in global ice volume by using $\delta^{18}O$ (an ice-volume proxy) studies of deep-sea sediments, (2) determine the magnitudes of global sea-level ("eustatic") changes by drilling carbonate platforms and passive margins, and (3) evaluate relationships between local and eustatic variations by drilling thickly sedimented continental margins.

In 1993, Leg 150 exploited the latter strategy by drilling into the New Jersey continental slope as part of a multi-leg transect from the continental rise to the coastal plain (see figure and *Miller et al.,* [1996]). Major Oligocene-Neogene gaps in sediment deposition on the slope, determined from analysis of ODP cores, were found to match the age of ice buildups determined by $\delta^{18}O$ measurements, which correspond to sea-level lowerings. These breaks in sediment deposition are typically overlain by redeposited sediment, which was transported downslope during times of lowered sea level. These same gaps have been cored on shore in locations beneath the New Jersey coastal plain, but the most sensitive and instructive record of sea-level change is buried within the intervening shelf, some of which was drilled by ODP in 1997. We expect that shelf drilling results will substantiate an ice-based mechanism for global sea-level change since 33 Ma, but they may also reveal leads and lags between the time of eustatic changes and their effects on sediment deposition. These phase relationships and the spatial distribution of sediments during sea-level oscillations must be understood to accurately interpret the geologic record of sea-level changes observed elsewhere. A future challenge will be to examine times when Earth was probably ice-free (e.g., the mid-Cretaceous) to learn why stratigraphic gaps were as widespread and frequent then as they have been since 33 Ma.

Reference:
Miller, K.G., G.S. Mountain, the ODP Leg 150 Shipboard Party, and members of the New Jersey Coastal Plain Drilling Project, Global sea-level and icehouse sequences, New Jersey Margin: An ad Haq hypothesis or the holy Vail? *Science, 272,* 1097-1098, 1996.



Location map of Mid-Atlantic Transect drill sites. Each offshore site is tied through the 120-channel *Maurice Ewing* seismic grid that is shown. Legs 150 (1993) and 174A (1997) were drilled by ODP. Onshore boreholes, legs with the "X" designation, are part of this sea-level transect, and were drilled from 1993 through 1997. Sites designated as *other platform* locations have not yet been drilled, and will require a platform other than *JOIDES Resolution* to complete.