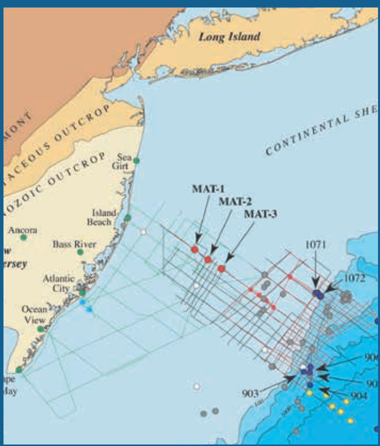
New Jersey Shallow Shelf Expedition

In April 2009, scientists from Expedition 313 New Jersey Shallow Shelf (NJSS) left Atlantic City onboard the *Liftboat Kayd* to collect cores from sediments deposited some 14 to 24 million years ago, a time of considerable sea-level fluctuation due to climatic variations. The expedition was led by Co-chief Scientists Prof. Gregory Mountain, Rutgers, the State University of New Jersey, USA and Dr Jean-Noël Proust, Centre National de la Recherche Scientifique (CNRS),University of Rennes, France. The NJSS Expedition was also supported by the International Continental Scientific Drilling Program (ICDP).



Dates: 30 April - 17 July 2009
Platform: Liftboat *Kayd*
Deepest hole: 757 m
Number of boreholes: 3
Number of cores: 612
Core recovery: 1311.4 m (80 %)
http://www.ecord.org/expedition313/

Scientific goals

1. to date late Paleogene - Neogene depositional sequences and to compare ages of unconformable surfaces that divide these sequences with times of sea-level lowerings predicted from the $\delta^{18}O$ glacio-eustatic proxy,

2. to estimate the corresponding amplitudes, rates, and mechanisms of sea-level change,

3. to evaluate sequence stratigraphic facies models that predict depositional environments, sediment compositions, and stratal geometries in response to sea-level change;

4. to provide a database to compare to sea-level studies on other margins.

The NJSS team, including scientists from eleven countries, drilled three deep holes (MAT-1, -2 and -3) between 45 and 60 kilometres offshore in water depths about 35 metres. These sites form a key part of the New Jersey/Mid-Atlantic transect, a suite of DSDP and ODP boreholes drilled over the last 30 years, in an effort to document global sea-level history over the past 42 million years. The existing data from seismic, well-log and borehole data helped to frame the geological setting from the coastal plain across the shelf to the continental slope and rise. This transect has included drilling both onshore and farther offshore in deeper water, but the critical zone for deciphering the sea-level history lies in the region most sensitive to sea-level change: the shallow-water shelf.

By using a liftboat, which was able to lower its legs to the seafloor to allow the vessel to be raised off the sea surface, the ESO engineers and technicians and the drilling contractors were able to provide a stable platform and technology that was well suited for recovering cores from the sand-rich shelf sediments in shallow waters.

(left) Liftboat Kayd on site; (right) C. Graham (ESO Data Manager) and J.N. Proust (Co-chief Scientist) inside the ESO container during the offshore phase.

Sea-level rise and shoreline retreat

Many areas of the world are currently experiencing shoreline retreat due to rising sea level. Eustatic rates of 3-4 mm/yr suggest a rise of ~3m by the year 2100 with forecasts of consequences for populations, infrastructures and ecosystems along many coasts. Preparing for this future calls for the careful study of past changes in sea level and a solid understanding of processes that govern the shoreline response to these changes. One of the best ways to assemble this knowledge is to examine the geological record of previous times of rising global sea level.

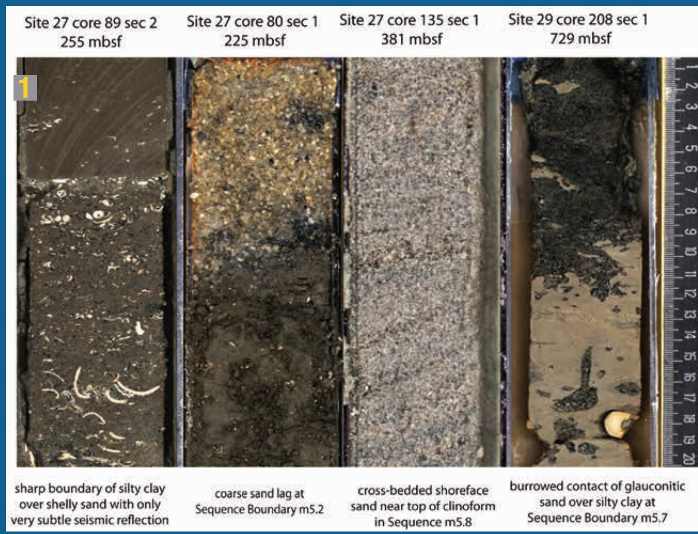
IODP INTERNATIONAL OCEAN DISCOVERY PROGRAM
icdp
ECORD EUROPEAN CONSORTIUM FOR OCEAN RESEARCH DRILLING

Scientific results

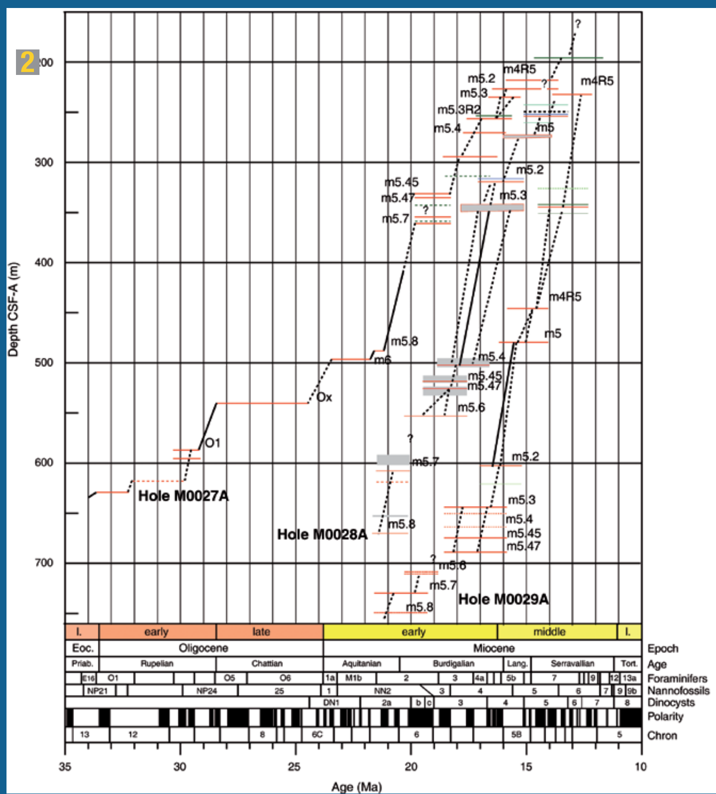
During the 12-week long offshore phase of the expedition and the Onshore Science Party held at the Bremen Core Repository in November-December 2009, the scientists analysed the cores to accurately reconstruct global sea-level changes during the period 14-24 million years ago and to assess the imprint of those changes on the development of the sedimentary sequences off New Jersey.

The Expedition Team at the Onshore Science Party in Bremen.

The strategy of drilling three sites into clinoform topsets, foresets and topsets paid off well. High-quality seismic profiles enable us to trace depositional units along this paleo-depth transect and strengthen inter-site correlations that are also based on age and lithofacies. Our confidence in seismic correlations was made possible by downhole logs, multi-track measurements of unsplit cores, and physical properties of discrete samples that provided core-log-seismic ties with depth uncertainties typically ±7 m. We expect that future studies will reduce this range and firmly link facies successions **(1)** to as many as 16 surfaces and/or sequence-bounding unconformities mapped in the regional seismic grid. Reliable zonations of muliple fossil groups plus Sr-isotopic ages measured on mollusks and foraminifera reveal a nearly continuous composite record of ~1 million year sea-level cycles between 22-12 Ma **(2)**. To further validate the 3-site transect strategy, we recovered regressive sediment bodies that are absent in onshore boreholes due to their updip locations. Lithofacies and benthic foraminifera assemblages provide a rich source of information concerning depositional setting, and imply 60-100 m water-depth changes within



single transgressive-regressive cycles in topset beds. Shifts in climate on the adjacent coastal plain have led to distinct pollen markers preserved in all three sites and provide another correlation tool. Large variations in porewater salinity are clearly controlled by facies. Their sharp vertical gradients await explanation, and relationships to microbiological communities have yet to be determined.



April 2017 - credits: ECORD/IODP and Volker Diekamp, MARUM

For further reading

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- Mountain G, Proust J-N, McInroy D, Cotterill C, and the Expedition 313 Scientists, Proc. IODP, 313: Tokyo (Integrated Ocean Drilling Program Management International, Inc.). doi:10.2204/iodp.proc.313.2010
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