Geophysical Research Abstracts
Vol. 14, EGU2012-2847-2, 2012
EGU General Assembly 2012

Characterization of New Jersey Shelf Sedimentation using geochemical and physical properties: IODP Expedition 313

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The New Jersey margin is an ideal location to study the impact of late Cenozoic sea level change on the evolution of shelf depositional systems due to a combination of rapid depositional rates, tectonic stability and a well-preserved fossil record. IODP Expedition 313 recovered siliciclastic sediments from three holes through a series of Miocene clinoforms with eight lithologic units correlated across the sequences. Given the available information on age, the mid-Miocene climate transition (14.2-13.8 Ma (Shevenell et al., 2004)) occurred during deposition of sediments within Unit II. This climate transition is one of the most significant in the Cenozoic and marks a change from the early-Miocene climate optimum between 16 and 14.5 Ma to the growth of the Antarctic ice sheet. Unit II is interpreted as a series of transgressive shoreface packages, overlain by fine-grained sediments deposited in an offshore environment. From seismic data it is recognizable as a change in organization from relatively discontinuous near-parallel reflectors in the unconsolidated sands of Unit I to more continuous reflectors coinciding with the appearance of silts. By studying petrophysical and geochemical datasets in combination and at high resolution (centimeter scale) we investigate the nature of significant variations within the successions. Distinctive features in the petrophysical dataset (e.g. high magnetic susceptibility of the upper clay unit) aid in correlating sediment packages across the holes. By acquiring geochemical data (continuous core XRF calibrated using conventional XRF analyses) at an equivalent resolution, fine-scale variations across key surfaces are better characterized. The geochemical results presented here focus on a 70 m interval of Unit II sediments recovered from the most landward (M0027A) of the three holes. The lithological variation is reflected in the geochemistry and fining upward packages can be clearly recognized from Si/Al ratios. Geochemical enrichments across key surfaces provide insight into the processes operating on the sequences at the time of deposition. For example, at the uppermost seismic reflector in Unit II (around 208 mbsf), the succession shows an enrichment of certain transition metals and LREEs relative to other fine grained intervals in the unit as well as peaks in the concentration of As and P2O5. The enrichment may be due to prolonged exposure to seawater in a sediment-starved environment, creating a condensed sequence of offshore clays. This is consistent with a major unconformity/sequence boundary at or just below this depth. By extending the scope of the project to include geochemical data from the holes drilled further offshore during Expedition 313 (M0028A and M0029A) characterization of the shelf sedimentation during the mid-Miocene global cooling event will be improved.