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Compaction and dewatering process in New Jersey Shallow Shelf inferred from IODP Exp.313 core samples

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IODP Exp.313 was conducted on the New Jersey shallow shelf in May to July 2009. The L/B Kayd chartered for a mission-specific platform recovered 612 cores at three sites. This study focuses on compaction and dewatering processes associated with the architecture of the sedimentary sequences under frequent sea-level changes (based on core-log integration). Particularly, a high sedimentation rate often induces underconsolidation of sediments with overpressured pore fluids which complicates consolidation behavior. Understanding the compaction process and its effect on architecture of the sedimentary sequences reveals probable geometry of sedimentary structure before deformation, and provides important information to estimate frequency and amplitude of eustatic changes. In this study, we aim to discuss initial in situ diagenesis and dewatering processes based on physical properties measured or estimated from down-hole logging, the Multi Sensor Core Logger System (MSCL), and discrete core samples. Correlation of the three Expedition 313 sites and the seismic profile will provide better estimation of the spatial distribution of dewatering paths.

Onboard and offshore MSCL measurements provided physical properties of whole-round cores including porosity, density, electric resistivity, P-wave velocity, magnetic susceptibility and natural gamma ray. Bulk density derived from individual core samples show good correlation with gamma-ray density from MSCL, and the other physical properties from discrete core samples also correspond to WL-logging and core logging data. Porosity-depth curve measured on MSCL exhibits slightly lower porosity than discrete samples in the glauconitic-sand interval which shows relatively higher density. In M0027A, comprehensive trend of porosity-depth curve in each lithology parallels standard curve in North Sea (e.g. Sondergeld et al., 2005). Therefore these data indicates normal compaction process in the study area. On the other hand, on-board geochemical analysis indicates distribution of abnormal fresh water at M0027A (Mountain et al., 2010). Though estimated pore pressure using density profiles do not show confining layers, porosity fluctuations mesured by MSCL and discrete samples suggest that those water lenses are possibly sealed by impermeable layers. This presentation will discuss estimated pore pressure and permeability from discrete core samples.

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