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Reconstruction of history of sand supply into the Kumano Forearc Basin by IODP Core-Log Integration

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Downhole logging data combined with core data are useful to determine physical properties and lithology of the formation. However, layer-by-layer analyses were not routinely conducted especially for marine siliciclastic sediments due to poor core recovery. We attempted to reconstruct poor recovery intervals in the Kumano Basin using core-log integration method.

During Integrated Ocean Drilling Program (IODP) Expeditions 314/315, Site C0002 was drilled, logged, and cored down to 1400 meters below seafloor (mbsf). Stratified structures are clearly imaged by a seismic reflection profile in the southern edge of the Kumano Basin including Site C0002 area. A 935m-thick basin fill and accretionary prism were drilled and logged with Logging-While-Drilling (LWD) at Hole C0002A and high quality data were continuously acquired. Coring operations were conducted at the intervals 0-204 and 475-1057 mbsf in Hole C0002B and C0002D. Although the two holes are close enough to correlate.

We compared lithology of the recovered cores with log data, mainly resistivity and natural gamma ray, in the two cored intervals. As the core recovery was good throughout the upper interval, clear correlations are recognized between the lithological variations and log responses. Most of the sand layers are characterized by low gamma ray and low resistivity values. In the lower interval, where cores were recovered by the RCB system, the core recovery was poor and the dominant lithology is mudstone. However, the log responses suggest that the lower interval are composed of alternating beds of sandstone and mudstone. The thickness of LWD-based mudstone coincides with the thickness of recovered sediments (=mudstone), suggesting that the recovered cores represent highly biased lithology due to extremely low recovery of sandstone.

The total recovery length of mud coincides with the total thickness of mud layers estimated from logging data even in the low recovery (37.6%) of the lower interval. It can be said that only muds were successfully recovered and most sands were washed out. Based on the core-log integration studies, the LWD-derived lithology can be applied for the entire section of the hole including non-cored and poorly recovered intervals. This study successfully reconstructed the history of sand supply into the Kumano Basin, and enables us to continuously estimate eustatic sea-level changes.

Keywords: Integrated Ocean Drilling Program (IODP), LWD (logging-while-drilling), resistivity, natural gamma ray, methane hydrate, core-log integration