The Terrigenous Depositional Response During the Relative High Sea Level Period, Example from Ancient Delta System in East Kalimantan, Indonesia*

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Abstract

It is generally assumed that deposition of the terrigenous sediment reached their peak in low sea level conditions where the shelf edge is at the shallowest state and most of the upper shelfal plains are exposed. Eventually, the high sea levels period was generally considered as a time of neglected sedimentation and thus were ordinarily interpreted to be associated with an abandonment phase of the terrestrial bedload deposit. On the contrary, our recent findings from outcrop and subsurface data in the Lower Kutei Basin, East Kalimantan has revealed a complex response in the fluvio-deltaic channel-fill development stages within relative high sea level periods (either authigenic or allogenic factors). Evidence has shown that some deposits certainly “survived” the abandonment period.

A three (3) km detailed transect was measured through several road cuts and open pit coal mines in the Samarinda Anticlinorium area. The well log, FMI, pressure analysis and core petrographical analyses permit an assessment of the subsurface pattern. The integrated biostratigraphy data (foraminifera, nannoplankton and palynology) are used to synthesize the regional marker. This study also benefitted from unmanned aerial vehicle (UAV) mapping, which created a high resolution (1-3 cm precision) 3D digital outcrop model (DOM). To complete the final perspective view, the recent channel deposits in the Mahakam Delta and Balikpapan bay are also used as a comparative model. These entire measurements and intensive amount of information are synthesized into the integrated geological model. We identify three (3) typical depositional models on the response to the high stand sea level that observed at the channel upper boundary, namely: (1) Drowned fluvial channel, (2) backfilled/keep-up channel, and (3) fluvial channel to shoreface rejuvenation. These types of sands have been long overlooked and currently become a new bypassed oil reservoir. This study also reveals new insights about the sedimentary processes and facies geometries in the Lower Kutei Basin, which is noteworthy toward the re-assessment of the geological model. This phenomenon was affected by a unique deltaic conditions such as (a) a large tidal prism area that covers the entire delta systems, and (b) a short (40-45 kilometers) fluvial to shelf sedimentation conduits, combined with (c) relatively high sedimentation fluxes.