New stratigraphic nomenclature through integrated sequence stratigraphy for the Ulleung Basin, East Sea, offshore Korea

Bitna Park

Morphodynamics and Quantative Stratigraphy Lab.
Dept. of Earth System Sciences, Yonsei University

There have been numerous seismic and well data acquired and interpreted by many researchers since the exploration of hydrocarbons commenced in the Ulleung Basin in 1972. Despite of attempts to establish the stratigraphy for the basin, controversy of the stratigraphic nomenclature has continuously arisen in academia and the industry. In an effort to prevent any confusion, this study aimed to establish the stratigraphy and suggest stratigraphic nomenclatures for the basin strata through the integrated study of sequence stratigraphy using all available bio, well and seismic data.

Resulted from integrated stratigraphic analysis, fourteen sequences and their boundaries, from Lower Miocene to Holocene, were defined with new nomenclatures as LM10 to PT10. These horizons were mapped by interpreting horizontal facies changes in regional seismic sections and vertical variation of the pattern on the gamma-ray log and bio sample data.

Geological age was determined using the comprehensive biostratigraphic analysis based the reference on microfossil data and corrected with absolute age dating results near onshore of the southern eastern Korea (e.g. Pohang basin) and the eastern Japan region. Micropaleontological and palynological analyses were done in eleven wells. Each datum was based on bioevents of calcareous nannofossils, foraminifera, diatoms, dinocysts, spore and pollen, and correlated with major sequence boundary recognized in the regional seismic sections and well logs.

Seismic reflection referring patterns of the gamma ray and mud log allows to interpret bed set, parasequence, parasequence set (=systems tract) and sequence. Megasequences were also reported and they are mostly sequences regarding tectonic events. Depositional environments in the basin include fluvial, coastal, shelf to basin-floor systems. The predominant sedimentary processes were deltaic progradation and aggradation that build shelves and cause sediment gravity flow transporting sediment to the basin floor. Over the course of the basin evolution, submarine canyons occasionally developed at the shelf edge and were typically filled with muddy and silty deposits. The erosive surface showing on the top of clinoform, the most-recognizable horizon that extends to both the upstream and downstream directions, indicates a composite sequence boundary. A regressive surface of marine erosion on the shelf, flooding surface of the fluvial and deep marine environments shows configurations similar with the sequence boundary of shallow water environments

For the future work, it would be recommended a simplified modelling and/or a flume experiment to understand the mechanism and role of canyon-cut filled with muddy and silty deposits on shelf edge during the active tectonic stage in the Ulleung basin.