Current Understanding of Stratigraphy, Structures and Petroleum Geology of the Ulleung (Tsushima) Back-Arc Shelf Basin in East Sea of Korea

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The Ulleung basin was formed with the Japan Sea and Yamato basins as a result of extension behind the Japanese island-arc in Miocene. Its shelf basin contains more than 9 km thick sediment, but disappointedly only a small gas field of 200 Bcf reserve has been discovered and producing. The following summarizes current understanding of stratigraphy, structures and petroleum geology of the basin.

Stratigraphy

Basement deepens from a relatively narrow ramp with small rift sags in the west to a deep wide flat, and is overlain by eastward prograding deltaic sequences. Sequences deposited during the three major transgressive-regressive-transgressive cycles separated by unconformities of 12.5 and 6.3 Ma, each corresponding to opening and continuous subsidence, destruction of back-arc due to compression, and post-closure regional subsidence, respectively.

Structure

The basin is platformal in the northwest, and folded and faulted by thrusts (and wrenches?) in the southeast. Deformation occurred around 12.5 Ma, the timing of which is related to collision of Izu-Bonin arc against the Japan Island. The deformed and uplifted blocks were peneplained in 6.3 Ma. Recently, a thrusted block became reactivated and popped up, and N-S trending broad open folds developed in previously undeformed shelf area.

Petroleum Geology

Exploration began in early 1970's by Shell that had possessed concession blocks of both Korea and Japan. Since then, a relatively small number of wells (24 wells over the area of 12,000 km^2 in Korea) have been drilled, and numerous shows were reported in most wells, however, major discoveries are not made yet. Rocks having the confirmable source potential have not been found, but deep water facies and prodeltaic shales that occur in lower sequences and basinal part would certainly be good candidates. Sandstones of good porosity are widespread in shelfal sequences, which include delta front and plain sands. In deep water facies turbiditic sandstones of reservoir quality are frequent as well. Channel filling shale, thick prodeltaic shale, and shale intercalating in deep water facies provide seal. Traps are made by old NE-SW and younger N-S trending folds. Still many structures remain untested, and numerous geophysical anomalies are observed especially in deep sections. The basin is considered to be frontier, and deep drilling to test large structures in depth would open new plays with huge reserves close to a promising consumer market.