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Tectonic evolution of the Ulleung back-arc Basin, East Sea (Sea of Japan), Korea

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The Ulleung basin was formed with the Japan and Yamato basins as a result of extension behind the Japanese island-arc in Miocene. Its shelf basin contains stacked deltaic sequences of more than 9 km in thickness. The deltaic system consisting the depositional sequences includes coastal, delta plain, delta front, prodelta and submarine fan facies. The coastal facies are characterized by serrated gamma log responses and discontinuous seismic reflectors suggesting fluvial formation: delta plain by association of fining-upward cycles and shale-filled distributary channels: delta front by blocky or coarsening upward sandstones: prodelta by shale dominance and low seismic impedance: and deep water by thick sandstone-shale combinations interpreted as submarine fan complexes.

The shelf 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 the Izu-Bonin arc against the Japan Island. The deformed and uplifted blocks were peneplained in 6.3 Ma. Recently, a thrusted block became popped up, and N-S trending broad folds occurred in previously undeformed shelf area.

Depositional sequences, separated by unconformities of 12.5 and 6.3 Ma, consist of three major transgressive-regressive-transgressive cycles. Each cycle corresponds to opening and continuous subsidence, destruction of back-arc due to compression, and post-closure regional subsidence, respectively.

In the basin a small gas field of 200 Bcf reserve has been discovered and producing. Sandstones of good porosity are widespread in shelfal sequences, which include delta front and plain facies. In deep water facies turbiditic sandstones of reservoir quality are frequent as well. Rocks having the confirmable source potential have not been drilled yet, but deep water facies and prodeltaic shales that occur in lower sequences and basinal part would be good candidates. Numerous geophysical anomalies are observed in deep sections. 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 folds, and still many remained untested.