Relationship between submarine-fan turbidite sandstone distributions and gas-hydrate occurrence in the eastern Nankai Trough area

Osamu Takano[1]; Tatsuo Saeki[2]; Tetsuya Fujii[2]

[1] JAPEX Research Center; [2] JOGMEC

As many previous researches revealed, it is general consensus that the most of gas hydrate in the eastern Nankai Trough area occur in the matrix pores of sandstones. The information on the distributions and properties of sandstones in this area is one of important keys to estimate the distributions and actual volume of gas hydrate in the eastern Nankai Trough area, accordingly.

To clarify detailed depositional systems and distributions of sandstones, sedimentological and sequence stratigraphic analyses were conducted for 2D/3D seismic, well-logs and cores data for the Upper Pliocene Kakegawa Group and the Pleistocene Ogasa Group in the eastern Nankai Trough area. The core facies indicates that sandstones of the Kakegawa and Ogasa Groups are composed of turbidites, suggesting that the major depositional system is a submarine fan system developed in a deep marine environment in the forearc basin. Seismic sequence analysis revealed that the Kakegawa and Ogasa Groups were divided into seventeen depositional sequences, and six seismic facies, indicating depositional elements of a submarine fan, were identified for each sequence unit. In the 3D seismic areas, depositional elements were displayed using 3D visualization technique. Finally, all information was mapped and compiled to reconstruct a depositional model of submarine fans for each sequence.

The obtained maps reveal that nine submarine canyons from the main land of Japan functioned as fixed feeder systems, along which submarine fans were formed in the forearc basins. Submarine fan architecture changed through Plio-Pleistocene time in response to changes in tectonic regime and sediment supply conditions. During Pliocene time, braided channel-style submarine fans were dominant due to coarse clastic supply, and topographic control was rare, since tectonic condition was stable. During Early to Middle Pleistocene time, small radial fan-type submarine fans were dominant, being confined within parallel troughs of synclinal depressions, which were formed by compressional deformation related to plate subduction activity. These parallel troughs were connected with conduit channels, through which clastics were supplied downward. In contrast, tectonically inactive western basin was dominated by muddy sheet-like submarine fans without any depositional lobes. During Late Pleistocene time, channel-levee system-type fans became dominant, as slope gradient increased due to a seamount subduction event.

As the next step, the resultant facies maps were overlaid with the BSR (bottom simulating reflector) distributions, high velocity zones and high amplitude zones, which are regarded as gas-hydrate distribution proxies. The overlaid maps indicate that these proxies occur on feeder channels, distributary channels and proximal lobes of submarine fans, suggesting that gas hydrate selectively occurs in coarser grained portions of a submarine fan.