

Turbidite Facies Control on the Distribution Patterns of Matrix Pore Filling-Type Gas Hydrates in the Eastern Nankai Trough Area, Central Japan

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The MH21 gas hydrate research consortium implemented multidisciplinary studies to evaluate the distributions and total reserve quantity of gas hydrates in the eastern Nankai Trough area, central Japan during the period of 2001 through 2008. Since previous study revealed that gas hydrates in the Nankai Trough area occurred in matrix pores of sandstones, it is estimated that sedimentary facies distributions are one of key factors to control gas hydrate occurrence. To examine the relationships between sedimentary facies and gas hydrate occurrence, detailed distributions and architecture of Pleistocene submarine-fan turbidites in the eastern Nankai Trough area were reconstructed for total 17 sequence horizons using seismic/sequence stratigraphic methods, and bottom simulating reflectors (BSRs) as a proxy of gas hydrates were overlaid. Six seismic facies, indicating upper fan feeder channels, mid fan distributary channels, depositional lobes, outer fan sheet turbidites, slope to basin floor mudstones and mass transport deposits of/around a submarine fan, were identified on 2D/3D seismic sections. Mapped results for each sequence unit reveal that 11 submarine canyons from the main land of Japan functioned as fixed feeder systems, along which submarine fans were formed in the Nankai forearc basins. Submarine fan architecture changed through Pleistocene time, from braided channel type, through small radial fan type within restricted basins, trough-fill turbidite type, and muddy sheet fan type, to channel-levee type submarine fans in response to changes in basin tectonics. Finally, the facies maps of each depositional sequence were overlaid with the BSR distribution. The overlaid maps indicate that the BSRs occur on feeder channels, distributary channels, and proximal lobes of submarine fans, suggesting that gas hydrates selectively occur in coarser grained portions of a submarine fan. Because the lower part of the Pleistocene is mainly composed of braided channel type submarine fan turbidites, the lower Pleistocene horizon serves one of the major horizons bearing gas hydrates in the eastern Nankai Trough area.