

Hydrocarbon gas accumulation and mud volcanoes in the Nankai subduction margin: Insight from 3D seismic velocity analysis using automatic picking algorithm

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Numerous studies of submarine mud volcano (MV) deposits disclosed subduction-related liquid and gaseous fluids which form and discharge due to the overpressured deep subsurface caused by the overburden of overlying sediments at active continental margins. A variety of MVs have been investigated and known in the Kumano Forearc Basin, which is situated above the Nankai accretionary prism off the Kii peninsula, Japan. When we apply seismic velocity analysis to the 3D seismic data via automatic velocity picking, the results reveal the presence of gas hydrates widespread in this region. The Bottom-Simulating Reflector (BSR) at the base of the gas hydrate stability zone has imaged as a strong acoustic impedance contrast on the seismic profiles. The high accumulation of gas hydrates above BSR and free gas beneath BSR was identified due to high and low velocity anomalies respectively. Based on the results, we suggest that the gas hydrates concentrated due to the free gas influx which migrated upward through the steeply dipping strata and faults or fractures cutting through the basin. The gas (or hydrates) accumulated area is further controlled by the gas charged mud conduits deep rooted in the MVs, and large faults in the accretionary prism. Therefore these factors generated by intensive tectonic movement control the distribution and saturation pattern of gas hydrate and free gas formation, and major sources of these gases may be derived from the deep MVs. When we characterize the features of gas hydrate (i.e., double BSR caused by variation in temperature and pressure within the required duration of thermal equilibrium), we could discuss the history of tectonic and faulting activity in the accretionary prism and specifically the dynamics of the hydrocarbon origin and MVs phenomena.

Keywords: Nankai Trough, Mud volcano, Gas reservoir, Automatic velocity analysis

Seismic velocity overlapping with a stack data IL2528

