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Structures of mud volcanoes and distribution of methane hydrate in the Kumano Trough using pseudo 3-D seismic processing

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A mud volcano is formed by unconsolidated mud eruption on the earth's surface or the seafloor, and caused by mud diapirism that migrated sediment, fluid, and gas from deep formation. Especially in a deepsea, it is thought that dissociation of methane hydrate near the seafloor promotes diapiric movement and growth of a mud volcano.

The Kumano Trough is one of the forearc basins of the Nankai Trough subduction zone. More than 10 mud volcanoes have been found in the trough floor from previous dives and side-scan sonar surveys. Kumano Knoll 3 (KK3) is one of the mud volcanoes developed in the central part of the Kumano Trough. Previous two-dimensional seismic reflection surveys revealed a pile of 'umbrella structures' beneath the KK3. However, it is not clear that whether this structure was caused by injection of wet-sediments as sills or formations of mud volcanoes by multiple eruptions. Moreover, seismic profiles clearly show methane hydrate BSRs are widely distributed in the trough. In contrast, BSR is discontinuous beneath KK3 suggesting relationships between mud volcano activity and methane hydrate formation.

We conducted pseudo three-dimensional seismic experiment around the KK3 using R/V Tansei-maru on KT-06-19 cruise, and acquired 82 seismic profiles that have about 6 km long lines trending NE-SW in a dense grid with basically 50 m apart during the survey. Data were obtained using consecutively seismic source a GI gun (G250 inch3+I105 inch3) every 50 m. The seismic acquisition systems consist of a 1200 m long streamer cable of 48 channels and 5 compass birds to get precise positions of each CMP. We integrated two-dimensional seismic reflection survey data into three-dimensional seismic profiles by using of corrected position data. In this study, we discuss the formation history and the relationship between the mud volcano and BSRs from three-dimensional precise internal structure of KK3.

Keywords: mud volcano, Kumano Trough, seismic reflection survey, methane hydrate BSR