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Formation Processes of Mud Volcanoes in Kumano Basin in the Eastern Nankai Accretionary Prism off SW Japan

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Mud volcanoes in Kumano Basin in the eastern Nankai Accretionary Prism off southwest Japan have been investigated. Detailed topographic surveys, submersible observations and various subbottom material analyses have identified seven mud volcanoes so far in the Kumano Basin. The mud volcanoes are generally about 100 m high and less than 2 km in diameter and are all situated above the anticlines latent below the flat basin floor.

Living Calyptogena and other chemosynthetic creatures were observed on surface of some mud volcanoes by the submersible dives. Hydrocarbon gas extracted from pore water in surface sediments indicates mixture of thermogenic origin by analyses of gas composition and their isotope ratios. This suggests existence of a continuous fluid supply from a rather deep portion below the mud volcanoes.

Recovered rubbles within clastic ejecta from the mud volcanoes are composed of semi-consolidated mudstone, mud breccia and biotite-rich arkose sandstone. Identified nannofossil indicates that most of the rubbles are sedimentary rocks originally deposited in the late Early Miocene through the Middle Miocene. Pyrolysis analysis by Rock-Eval method evaluated the clastic ejecta is all immature for natural hydrocarbon gas generation. This suggests that the above-mentioned pore water is likely originally from much deeper portion rather than the origin of the clastic materials.

As a result of microscopic observation, there are two typical textures found in the clastic ejecta. One is that muddy blocks and matrix are tremendously fractured in all sorts of directions by intrusive carbonate vein. The other texture shows that most of grains in the arkose sandstone are fractured and filled with authigenic carbonate. The fractures in the grains seem interrelating and their linked fracture zone strike in specific direction. Therefore, it can be considered that the former texture indicates hydro-fracturing which occurred within a mud diapir while fluidization progressing. And the latter is likely shear fracturing which occurred in the margin of mud diapir when the diapir rises up intruding within mother rock.

References

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[2] Ijiri et al. (2002) Abstracts of Geochemical Society of Japan, 49, p116.