Monitoring CH_4 amounts deep inside deep-water mud volcanoes

*A. Kioka[1], T. Tsuji[2], H. Otsuka[3], J. Ashi[3]

1. Universität Innsbruck, Austria, 2. Kyushu University, Japan, 3. The University of Tokyo, Japan

Mud volcanoes are among the largest geological sources releasing CH_4 gas. Numerous studies have revealed their origins and compositions released from submarine mud volcanoes. Yet, quantification of the amount of gas inside submarine mud volcanoes has been challenging due to the difficulty of in situ measurements, which has hampered better evaluation for their contribution to the global methane budget. Here we provide a coupled geochemical and geophysical model that bridges bulk methane concentrations and seismic wave velocities in the mud conduit of submarine mud volcano. This model is applicable to most submarine mud volcanoes, and is able to estimate methane concentration at greater depths where methane hydrate cannot be present, using downhole logging data or seismic data. Our calculation for submarine mud volcanoes in the Eastern Mediterranean and the Nankai plate subduction zones shows that the weight fractions of gaseous and dissolved methane in total weight of sediment are 1,000--3,500 ppm within their mud conduits, which are much higher than previously expected from pore-water evidence from conventional shallow subsurface sampling. Although more definitive calculations cannot be made until the model parameters are better constrained, our approach provides an opportunity for re-estimating the global methane budget in submarine mud volcanoes, shedding new light upon the impact of submarine mud volcanism on carbon cycle.

Keywords: Submarine mud volcanoes, Methane concentration, Gaseous and dissolved methane, Chemical thermodynamics, Rock physics

