

Geochemical characteristics of hydrocarbon gases within gas chimney structures in the Tsushima Basin and the Oki Trough, Japan Sea

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Shallow gas hydrate often develops in gas chimney structure with mound/pockmark in the Japan Sea, however, the distribution and reaction of gas inside the chimney is not well understood. We retrieved cores from the well-developed gas chimneys with mound in the southeastern margin of Tsushima Basin and western and eastern Oki Trough to examine the relationship between the geochemical composition of gas and geological structure of gas chimney in the Japan Sea of Southwest Japan.

Concentrations of sulfate dissolved in pore waters rapidly decrease with depth to the sulfate-methane interface (SMI). Contrarily, concentrations of methane increase downward from the depth of the SMI. Methane/ethane ratios are low (<100) above the SMI, however, those rapidly increase below the SMI. This is because methane was preferentially oxidized by the sulfate at the depth of SMI and methane was generated by methanogenic bacteria above the SMI. The highest methane flux is observed in the western Oki Trough area where the thermogenic methane are most dominant below the SMI among sites. This site is characterized by the subsurface structure of a large-scaled gas chimney complex and the thermal gradient as high as 57mK/m, indicating that thermogenic methane is produced in relatively shallow sediment and is efficiently delivered to the near-surface environments.

Keywords: gas chimney, hydrocarbon gas, Japan Sea