

Formation of shallow gas hydrates and geochemistry of gas and pore water from UT13 cruise in the Japan Sea

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Active gas venting and distribution of massive gas hydrates are largely observed on the summits of the Umitaka Spur and Joetsu Knoll in the eastern margin of the Japan Sea, where the fault system associated with strong anticline structure constrains the accumulation of gas and following gas hydrate formation. The UT13 cruise has conducted to collect shallow sediments from the Oki Trough, north eastern of Noto Peninsula, and offshore Akita-Yamagata areas, where gas chimney structure and strong backscatter indicate migration of gas-charged fluid and potential formation of gas hydrates near the seafloor. Geochemistry of pore water, dissolved gas, and hydrate-dissociated gas reflect the geochemical environments associated with the delivery of gas and fluid and formation/dissociation of gas hydrates in the shallow sediments.

Flake-like and nodular gas hydrates were observed at 1-6 mbsf in the Oki Trough and offshore Akita-Yamagata, respectively. Concentrations of methane dissolved in pore water are high, comparable to those in the Umitaka Spur and Joetsu Knoll area, and the SMI depths are accordingly shallow at ~2.7 mbsf in the entire research area, indicating high potential of gas hydrate accumulation in the shallow sediments. Concentrations of chloride are sporadically low in all areas due to gas hydrate dissociation during core recovery, accumulations of small gas hydrates with saturations up to 20% were observed, reflecting ubiquitous formation of gas hydrates in the research area. Concentrations of calcium and magnesium show fine increase and decrease in response to sulfate changes at deeper than SMI, reflecting the change of the methane flux mainly, the formation/dissociation of gas hydrates may have changed seafloor topography and geochemical properties of pore water and gas in the shallow sediments.

Contrary to the Umitaka Spur and Joetsu Knoll area where thermogenic gas dominates in the shallow gas hydrates, chemical and isotopic compositions of gas indicate that the majority of gas is of biogenic origin with minor contribution from thermogenic ethane and hydrogen sulfide, the latter may result in expanding gas hydrate stability and forming gas hydrates near the seafloor.

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