Geochemical characteristics of headspace gas and pore water in shallow sediment from the Tatar Trough

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The Tatar Trough is characterized by a number of mound with gas chimney and in particular gas flare with gas hydrate accumulation in shallow sediment, reflecting active gas generation at depth and migration to the surface environment. Because the trough is located in geologically active and important region for organic matter input and seawater circulation in the northern Japan Sea, origin and migration process could be constrained by the formation and development of the marginal sea. In this study, we characterized the geochemistry of headspace gas and pore water samples collected from northern to southern Tatar Trough and and examined biogeochemical processes associated with generation, migration, oxidation, and fixation of methane in the Tatar Trough.

All the methane concentrations and C1/C2 ratios in headspace gases increase with depth due to the active upward methane flux although the methane is oxidized at the sulfate-methane interface (SMI). These values in the northern area are higher than those in the middle and southern areas. The stable carbon isotopic ratio of methane in the northern area is relatively high (δ^{13}C=-55~-30‰). This value suggests that methane was generated by thermal decomposition of organic matter at depth. The depths of SMI significantly tended to be shallower to the north; average depth of SMI in the northern area is 2.9 mbsf, middle area is 5.9 mbsf, and southern area is 12 mbsf. This indicates that the organic matter responsible for methane generation was derived from the north probably by the oxygen-depleted water and was deposited in relatively anaerobic condition, which is strongly associated with a large-scaled environmental change.

Keywords: methane, gaschimney, AOM

