

PB13) Assessment of CH₄ Oxidation in Tidal Flat Sediments

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1. 서론

A large fraction >90% of all the CH₄ produced in marine sediments is converted to CO₂ by Anaerobic Oxidation of Methane (AOM), which is mainly coupled with sulfate reduction and mediated by anaerobic methanotrophic archaea (ANME) and Sulfate-Reducing Bacteria (SRB) (Egger et al., 2015). In addition, the AOM process includes metal ion (Mn⁴⁺ and Fe³⁺)-dependent AOM and nitrate/nitrite-dependent AOM as electron acceptor(Cui et al., 2015). The microbe responsible for nitrite-dependent AOM is called *Candidatus Methyloirabilis oxyfera*, as it uses two nitrogen monoxide molecules to produce nitrogen and oxygen which is then used to attack the inert methane molecule through an intra-aerobic pathway, and may catalyze AOM through an aerobic methane oxidation pathway. However, the organism *Candidatus Methanoperedens nitroreducens* is used nitrate as the terminal electron acceptor, showing a reverse methanogenesis. Therefore, the oxidation phenomena of methane is well observed in burrowing sites of the tidal flats, where the CH₄ fluxes are influenced by the interaction of production, oxidation and transport processes.

2. 자료 및 방법

The chamber was deployed over decapods (mud shrimp, *Laomedia astacina* and crab, *Macrophthalmus japonicus*) burrows for ~ 2 h, and the CH₄ and CO₂ concentrations were continuously monitored using a closed, diffuse CH₄/CO₂ flux meter. In October 2016, in situ chamber experiments were performed at a tidal flat located in Cheonsu Bay on the central western coast of Korea, where much intertidal area remains around the coastline. The carbon isotope ratios of CH₄ and CO₂ were measured using a trace gas-isotope ratio mass spectrometer (TG-IR/MS) system (Isoprime 100, UK). In addition, methanogenic and/or methanotrophic microorganisms were identified by amplicon analysis.

3. 결과 및 고찰

Table 1 Proportions of methanogens and methanotrophs in burrow wall sediments and the surface sediment of the reference site, together with the proportions of *Candidatus methyloirabilis* group bacteria among the methanotrophs (in parentheses)

Sites	Depth (cm)	Methanogens (%)	Methanotrophs (%)
Reference	surface	0.009	0.36(15.3)
<u><i>M. japonicus</i></u> <u>burrow</u>	10	0.013	1.18(71.4)
	surface	0.009	0.64(3.6)
<u><i>L. astacina</i></u> <u>burrow</u>	15	0.102	1.26(24.1)
	20	0.088	0.51(31.7)
	25	0.116	1.26(73.6)

Nitrite-driven AOM may occur within burrows (Table 1). The proposed CH₄-oxidation process was supported by the decrease in the δ₁₃C of headspace CO₂ during the chamber experiment.

4. 참고문헌

Kang, J., Koo, B. J., Jeong, K. S., Woo, H. J., Seo, J., Seo, H. S., Kim, M. S., Kwon, K., 2018, Insights into macroinvertebrate burrowing activity and methane flux in tidal flats, *proceedings of the 15th International Coastal Symposium*, South Korea, 13-18 May 2018, 681-685.