PF-05

Diversity and activity of methanogenic microbial community in a high-temperature biodegraded oil field

Hanako Mochimaru[1], Daisuke Mayumi[1], Hideyoshi Yoshioka[1], Susumu Sakata[1], Hideyuki Tamaki[2], Yoichi Kamagata[2]
[1]GSJ. AIST, [2]AIST

高温地下油層環境における原油分解とメタン生成

○持丸 華子[1]、眞弓 大介[1]、吉岡 秀佳[1]、坂田　将[1]、玉木 秀幸[2]、鎌形 洋一[2]
[1]産総研・地圏、[2]産総研・生プロ

Key word：methanogen, 16S rRNA gene, oil reservoir, crude oil biodegradation

The microbiological and geochemical studies have indicated that methanogenesis occurs in deep subsurface oil reservoirs. In this study, we investigated the methanogenic community and activity in a high-temperature petroleum reservoir by a combination use of geochemical analyses, radioisotope tracer experiments, enrichment cultures and molecular genetic analysis. The formation water, crude oil, and gas samples were obtained from an oil producing well (depth, 938 m; temperature, °C) in Yamagata, Japan. In the geochemical analysis, the dominance of isoprenoid over straight-chain alkanes was observed in the oil sample, indicating that the crude oil has been partially biodegraded. The culturable methanogens were detected in the order of 10^3 cells per ml in the formation water, which is approximately 1% of the total cells detected under microscopy observation. Based on 16S rRNA gene clone library analysis, putative crude oil degrading bacteria (e.g *Syntrophus* spp.) and a hydrogenotrphic methanogen (*Methanothermobacter* sp.) were predominant in the original formation water. Radiotracer experiments using [^{14}C]-labelled bicarbonate or acetate further revealed that hydrogenotrphic methanogenesis dominated over acetoclastic one. This study suggests that the crude oil is likely converted into methane via its biodegradation followed by hydrogenotrophic methanogenesis in the oil reservoir.

PF-06

Sedimentary nitrogen cycles in the Ogasawara Trench and abyssal plain

Miho Hirai[1], Manabu Nishizawa[1], Hidetaka Nomaki[1], Katsunori Yanagawa[2], Tomo Kitahashi[3], Osamu Koide[1], Eiji Tasumi[1], Tohru Kikuchi[4], Hisako Hirayama[1], Junichi Miyazaki[1], Keisuke Koba[5], Takuro Nunoura[1], Ken Takai[1]
[1]JAMSTEC, [2]Grad. Sch. Sci., Univ. Tokyo, [3]AORI, Univ. Tokyo, [4]nt. Grd. Sch. Art & Sci., Yokohama City Univ., [5]Grad. Sch. Agri., Tokyo Univ. of Agri.& Tech.

小笠原海溝底及び深海平原堆積物中の窒素循環

○平井 美穂[1]、西澤　学[1]、野牧 秀隆[1]、柳川 勝紀[2]、北橋　倫[3]、小出　修[1]、田角 栄二[1]、菊池　徹[4]、平山 仙子[1]、宮崎 淳一[1]、木庭 啓介[5]、布浦 拓郎[1]、高井　研[1]
[1]海洋研究開発機構、[2]東大・理、[3]東大・大気海洋研、[4]横浜市大・国際、[5]東農工大・農

Key word：nitrogen cycle, stable isotope, sediment, deep sea

Great progress has been made in understanding the nitrogen cycle in oceanic waters by the recent identification of ammonia-oxidizing archaea and anaerobic ammonia oxidizer (anammox), and by the following comprehensive approaches to clarify the abundance and activity of each component in the nitrogen cycle. However, nitrogen cycle in sedimentary habitats is still uncertain. To further characterize nitrogen cycle in the deep-sea sediments, we conducted comprehensive microbial and geochemical analyses including quantifications of putative nitrifers, denitrifers and anammox, and nitrogen and oxygen stable isotopic compositions of nitrate in the interstitial water in the hadopelagic and bathypelagic sediment cores taken from the bottom of the Ogasawara Trench and the edge of abyssal plain by the trench (water depths of 9776 and 5474m), respectively. Intriguingly, abundance of potential proteobacterial denitrifers correlated with that of nitrifers through the depth, and anammox also likely co-occurred with nitrifers. Overall, results presented in this study suggest the co-occurrence of aerobic and anaerobic processes in the nitrogen cycle in these deepsea sediments.

PF-07

Cyclic electron flow in hot spring microbial mats is driven by anoxygenic phototrophic bacterium

Hiroyo Otaki, Satomi Iwata, Shin Haruta, Katsumi Matsuura
Grad. Sch. of biol.,Tokyo Metropolitan Univ.

光合成細菌によって駆動される温泉バイオマット中の電子循環

○大滝 宏代、岩田 聡実、春田　伸、松浦 克美
首都大・院生命

Key word：electron cycling, photosynthesis, material flow, microbial mats, hot spring

We have been investigating anaerobic material flows of three elements: S (sulfide, sulfur, sulfate), C (carbon dioxide, organic carbon) and H (di-hydrogen, protons), in the hot spring microbial mats at Nakabusa in Japan. However, only material flow is not enough information to estimate energy budget of the community. In this report, to understand energy flow of the mats, we propose a concept of cyclic electron flow within the community and the flow is driven by photosynthesis. A comprehensive view of our three elemental cycles provided suggestions for the concept.
S: 1) sulfate is reduced to sulfide with hydrogen by sulfate reducer. 2) sulfur is reduced to sulfide with hydrogen by sulfur reducer. 3) sulfide is oxidized to sulfur phototrophically. C: 1) carbon dioxide is reduced to carbohydrates phototrophically. 2) carbohydrates are utilized heterotrophically, e.g., fermentation. H: hydrogen is produced by fermentative bacterium breaking down carbohydrates.
Carbohydrates, hydrogen and sulfide are released to discharge much electron by the producers and then charged by others as electron donors. Photosynthesis takes an essential role for a cyclic electron flow in the community; electrons are pumped up about 1.5 V to high potential. Development and maintenance of the mats would occur by external sulfide and sulfate from hot spring water.

PF-08

What does the variety of methanes in the deep-sea sediments after the 2011 Off Tohoku Earthquake indicate?

Eiji Tasumi[1], Takuro Nunoura[1], Shinsuke Kawaguchi[1], Yuuta Konno[1], Katsunori Fujikura[1], Yasuo Furushima[1], Hiromi Watanabe[1], Norio Miyamoto[1], Tekshi Tsuji[2], Kazuno Arai[3], Takuroh Noguchi[4], Kazunori Hasegawa[5], Tomohiro Toki[6], Hidetaka Nomaki[1], Wataru Tanigawa[1], Takafumi Kasaya[1], Michinari Sunamura[7], Ken Takai[1]
[1]JAMSTEC, [2]Kyoto Univ., [3]Chiba Univ., [1]Kochi Univ., [5]National Museum of Nature and Science, [6]Ryukyu Univ., [7]Tokyo Univ.

東北地方太平洋沖地震後に観察された深海底堆積物中メタンの多様性が示すものとは

○田角 栄二[1]、布浦 拓郎[1]、川口 慎介[1]、今野 祐多[1]、藤倉 克則[1]、古島 靖夫[1]、渡部 裕美[1]、宮本 教生[1]、辻　健[2]、新井 和乃[3]、野口 拓郎[4]、長谷川 和範[5]、土岐 知弘[6]、野牧 秀隆[1]、谷川　亘[1]、笠谷 貴史[1]、砂村 倫成[7]、高井　研[1]
[1]海洋研究開発機構、[2]京都大学、[3]千葉大学、[4]高知大学、[5]国立科学博物館、[6]琉球大学、[7]東京大学

Key word：methane, earthquake, deep-sea, sediment

As with the case of shore, we think the 2011 Off Tohoku Earthquake made serious effect on marine ecosystem. We tried to research the impact by the mega-earthquake on marine ecosystem including chemical, physical, geology and geophysics in Off Sanriku area. We found a large fault and huge volume of sediments including the dead body of maline lives, traces of disturbance on the seafloor, aboard HOV SHINKAI 6500. In measuring the carbon isotope ratio of methane, we detected clear difference between the samples. It suggests that several types of the methane origin are exist, such as geophysical and microbial methanogenesis. Huge mass acculated on the sea-floor might activate methanogenic microbes, especially that use methylamines as a energy source. Sediment cores near the fault contains huge amount of heavy methane, high ^{13}C rate methane. However, we could not find any cold-seep clam colonies in this site. Furthermore, the copy number of mcrA gene, the indicator of methanotrophic microbes, is lower than the cold-seep clam site analyzed in this research.These results indicate that geophysically mediated methane is supplied more recently, that is after the earthquake.