Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

MIS21-07 会場:511 時間:4 月 28 日 10:30-10:45

西部北太平洋における沈降粒子上の細胞外酵素活性と細菌生産速度について
Heterotrophic bacterial production and extracellular enzymatic activity in sinking particulate matter

山田 奈海葉 [1*] ; 福田 秀樹 [2] ; 小川 浩史 [2] ; 齊藤 宏明 [3] ; 鈴村 昌弘 [1]
YAMADA, Namiha[1*] ; FUKUDA, Hideki[2] ; OGAWA, Hiroshi[2] ; SAITO, Hiroaki[3] ; SUZUMURA, Masahiro[1]

[1] 産業技術総合研究所, [2] 東京大学大気海洋研究所, [3] 水産総合研究センター東北区水産研究所
[1]AIST, [2]AORI, The University of Tokyo, [3]Fisheries Research Agency

Heterotrophic activities on sinking particulate matter (SPM) have important role for flux of SPM. To demonstrate regional differences in heterotrophic activities on SPM, we measured heterotrophic bacterial production (HBP) in seawater and SPM as well as potential extracellular enzyme activity (EEA) in SPM on a transect along 155E in the western North Pacific Ocean in the subarctic (44N), the Kuroshio Extension area (35N), and the subtropical gyre (20N).

Samples were collected from the western North Pacific Ocean during cruise KH08-2 (Leg 2) on R/V Hakuho-maru from 23 August to 16 September 2008.

Hydrographic data were provided by a shipboard CTD profiler equipped with a carousel multi-sampling system. We obtained water-column depth profiles of dissolved nutrients including nitrate, phosphate, and silicate, Chl a, bacterial cell abundance (BA), and HBP.

We deployed standard cylindrical multi-traps, with eight acrylic trap tubes mounted at each depth. The traps were set vertically on the array line at three targeted depths of 50 m, 200 m, and 500 m at 44N, and 100 m, 200 m, and 500 m at 35 and 20N. The upper deployment depths were chosen to be just under or near the bottom of the euphotic zone. The euphotic zone was defined as the depth at which photosynthetically active radiation was 1% of the value just below the surface.

Before deployment, all trap tubes except tube for HBP and EEA in SPM on each array were filled with seawater that had been collected from 4 m below the surface at each station using the ship ' s pump, pre-filtered through a 0.2-μm capsule cartridge filter to minimize biological contamination, and mixed with sodium chloride to a final concentration of 4% (w/v) to create a density gradient. Trap tube at each depth was used for collecting samples for measuring HBP and EEM in SPM, and was filled with seawater filtered as described above that was collected just before deployment from the depth corresponding to the target layer of trap deployment with a 12-L Niskin bottle. The arrays were attached to a buoy and allowed to drift freely for 24 h at 44N, and 48 h at 35 and 20N.

Upon recovery, the traps were stored upright in the dark and left to settle for 1 h. After the contents had settled, the upper portion of the trap volume above the collection cup was gently drained by siphoning. During the siphoning, only about trap tube for HBP and EEA, an aliquot of the supernatant was subsampled approximately 30 cm from the top of the tube. After siphoning was complete, the upper cylinder of the trap tube was separated from the collection cup. The particle-rich water in each collection cup was pre-screened through a 500-μm-mesh sieve to remove swimmers and then mixed to disrupt large amorphous particles. The pre-screened filtrates were used for measurements of total mass flux of SPM, particulate organic carbon (POC) and nitrogen (PON) content, and HBP and EEA (leucine aminopeptidase (LAPase), s-glucosidase (BGase), lipase, and alkaline phosphatase (APase)).

Depth-integrated HBP in seawater from the surface to 500 m was comparable between the locations, whereas HBP in SPM at 44N was substantially lower than at the other sites. We found the highest POC export flux and export efficiency to bathypelagic depths, and the lowest water temperatures, at 44N. We found significant correlations between LAPase activity, BGase activity, POC flux and particulate organic nitrogen flux. LAPase activity was two orders of magnitude higher than BGase activity, with a BGase:LAPase activity ratio of 0.027. There were no significant correlations between HBP and EEA in SPM except for lipase, and lipase activity was significantly correlated with temperature. We propose that hydrographic conditions are an important factor controlling heterotrophic bacterial activity and export efficiency of organic carbon to the deep ocean, as are the sources and abundance of SPM produced in the euphotic zone via primary production.

MIS21-07 会場:511 時間:4 月 28 日 10:30-10:45

キーワード: 沈降粒子, セジメントトラップ, 細菌生産, 細胞外酵素, 西部北太平洋
Keywords: Sinking particulate matter, Sediment trap, Heterotrophic bacterial activity, Extracellular enzyme activity, western North Pacific