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Possible energetic linkage between primary production and deep-sea benthic archaea: insight from biogeochemical lipidomics

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Marine archaea have been recognized as a cosmopolitan player for global carbon and nitrogen cycles in the water column and sub-seafloor environments. Recent molecular evidence based on lipids and DNA suggests that uncultured benthic archaea dominate biomass in marine sediment, implying past primary production is a crucial factor for their presently ongoing heterotrophy (e.g., 1-4). Focusing on benthic archaeal heterotrophic processes in deep-sea sediment, we preliminarily traced 13C-signature in archaeal lipids to determine de novo and salvage pathway by in situ 13C-experiment. On the basis of the differential 13C-uptake, we suggest that benthic archaea recycles sedimentary relic membrane lipids to minimize the energy expenditure during 405 days (5). The 16S rRNA and quantitative PCR analysis indicated a community shift in the composition of the benthic archaeal community (e.g., Marine Group I, Marine Benthic Group, Miscellaneous Crenarchaeotic Group).
In bacteria and eukarya, it is commonly recognized that free fatty acids are incorporated into cells and converted to acyl-CoA, which are eventually incorporated into membrane lipids as a salvage pathway (cf. 6). Considering the suggestion of salvage pathway in archaeal membrane synthesis (7,8), we discuss archaeal heterotrophic processes in terms of possible biogeochemical lipidomics.

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