

Distribution of aerobic microbial activities in ultra-oligotrophic sediments of the South Pacific Gyre

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During the Integrated Ocean Drilling Program (IODP) Expedition 329, we observed the presence of aerobic microbial communities and dissolved oxygen throughout the sedimentary sequence from the seafloor to the sediment-basement interface at all sites we explored in the South Pacific Gyre (SPG) [1]. This finding indicates that there is no depth limit to the sedimentary biosphere in the oligotrophic ocean region. However, substrate-specific metabolic activities of these aerobic microbial communities still remain poorly constrained. Using a NanoSIMS isotope imaging, we studied carbon and nitrogen assimilation activities of aerobic microbial cells after the incubation with various ¹³C- and/or ¹⁵N-labeled substrates for 1.5 years. We observed assimilation activities on various heterotrophic conditions (e.g., ¹³C-labeled glucose, acetate, and pyruvate, and ¹³C- and ¹⁵N-labeled amino acids) at all depths and locations. The uptake of ¹³C-labeled bicarbonate was found to be rare, but occurred in some incubation conditions. Our results demonstrate that microbial communities widely distributed in the ultra-oligotrophic SPG sedimentary biosphere consists mainly of the aerobic organotrophic microbial ecosystem with small autotrophic populations. The microbes retain their metabolic potentials under the most energetically challenging conditions at least over several tens of millions of years.

[1] D'Hondt, S. *et al.*, *Nature Geoscience*, 8(4), 299-304, 2015.