Bacterial and archaeal contribution to autotrophy in Sino-Pacific marine sediments

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The present understanding of the chemosynthetic/autotrophic potential of microbes especially of ocean sediments is almost nascent. Oceanic stretches experiencing perpetual darkness and extreme limitation of utilizable organic matter are often at the mercy of chemosynthetic carbon fixation. Hence C-fixation is neither limited to carbon-deplete environments nor to the copious vents and seeps. This also occurs to varying degrees in carbon-replete locales depending on nature and concentration of available carbon and electron donors. Factors like organic matter influx, its quality and concentration, sub-seafloor diffuse fluid flow and thereby concentrations of various electron donors and acceptors strongly influence chemosynthetic activity. Quantification of microbial C-fixation and relative contribution of microbial domains in different sediment realms is therefore crucial. Sino-Pacific marine sediments [Western Pacific, East China Sea, South China Sea and Okinawa Trough] were examined for total microbial, using the aqueous $NaH^{14}CO_3$ (dark carbon fixation) method, bacterial and archaeal contribution to autotrophic fixation by blocking archaeal metabolism using inhibitor GC7 during the dark uptake experiment. The study also estimated the differential effects of addition of electron donors. The results suggested that the contribution by bacterial and archaeal communities could be considerable. C-fixation in marine sediments is not the function of Archaea alone, much in contrast to some recent opinions. C-fixing bacteria are also equally active in deep-sea realms. Often in spite of great effort of one domain to fix carbon, the system does not become net C-fixing due to equal and opposite C-releasing activity of the other domain. Environmental situations appear to dictate C-fixation rates at any given space or time. Thus a C-releasing bacterial or archaeal community can become C-fixing with the change of nature and concentration of electron donors or available organic load. The environmental paradigm more than genetic composition appears to finally control the biogeochemical impacts of autotrophy.