High abundance and dark CO2 fixation of chemolithoautotrophic prokaryotes in anoxic waters of the Baltic Sea

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ABSTRACT: We determined the abundance and distribution of chemolithoautotrophic prokaryotes in the redoxcline in two basins (Gotland Deep, Landsort Deep) of the central Baltic Sea by combining dark CO_2 fixation measurements with flow cytometric cell sorting. Maximum CO_2 fixation rates were recorded in sulfidic waters about 20 m below the chemocline. Flow cytometric analyses of deoxyribonucleic acid (DNA)-stained bacterioplankton revealed the existence of at least five different prokaryotic clusters in water samples collected below the chemocline. Dark CO_2 fixation in these clusters was determined by flow cytometric sorting after anoxic incubations with $NaH^{14}CO_3$ tracer. Two clusters, representing about 30% of total prokaryotes, were responsible for 65% to 100% of the total dark fixation. Calculated cell-specific CO_2 fixation rates in the two basins ranged from 3.5 to 24.7 fg C cell^{-1} d^{-1} and suggested that these clusters are dominated by chemolithoautotrophic prokaryotes. Mean cell-specific fixation rates reached more than 10 fg C cell^{-1} d^{-1} in most cases, indicating relatively high growth rates (doubling times 1-2 d) of chemolithoautotrophic prokaryotes. Our results provide the first evidence of such high cell-specific CO_2 uptake and abundance of chemolithoautotrophic prokaryotes in a pelagic marine environment. However, the identity of the organisms as well as the mechanisms fueling CO_2 dark fixation in the anoxic zone remain unknown.

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