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# Contribution of ammonia oxidizers to the dark ocean's carbon budget

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Chemolithoautotrophic production is a source of organic carbon to waters below the sunlit surface layer. It is suggested that chemolithoautotrophy contributes substantially to the microbial heterotrophic carbon demand thereby balancing organic matter consumption and supply in the dark ocean. Ammonia-oxidizing archaea (AOA) are the most abundant chemolithoautotrophs in the ocean and are assumed to dominate dissolved inorganic carbon (DIC) fixation below the euphotic zone. However, measured DIC fixation rates in the deep ocean are, on average, one order of magnitude higher than what could be supported by ammonium supplied by the export flux of particulate organic nitrogen. To resolve these discrepancies, we developed a method to selectively inhibit the activities of ammonia oxidizers and quantified their contribution to DIC fixation during two oceanographic expeditions in the eastern tropical and subtropical Pacific Ocean. Our results suggest that, despite their high abundances, AOA contribute only a small fraction to dark DIC fixation, accounting for 2 to 22% of the depth-integrated rates in the eastern tropical Pacific. While the highest AOA contribution to DIC fixation was observed at the depth of the nitrification maximum (up to 50%), the majority of DIC fixation within the lower euphotic zone and below 200 m depth was not fueled by ammonia oxidation. When accounting for high-end estimates of nitrite- and sulfur-fueled chemolithoautotrophy and heterotrophic DIC fixation, we could explain 58 to 113% of the depth-integrated dark DIC fixation rates in the eastern tropical Pacific. Our work provides a new perspective on global ocean chemolithoautotrophy and offers new insights into the long-standing question of the main energy sources fueling DIC fixation in the dark ocean. Taken together, these results help to reconcile the observed discrepancies between nitrogen supply and DIC fixation at depth, and advance our understanding of microbial carbon processing in the dark ocean.