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Metabolically-active obligate aerobes in the sulfidic sediments of a marine hypoxic zone: sustenance and potential role in Carbon-Sulfur cycling

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The potential presence and activity of aerobic microorganisms are never explored in marine oxygen minimum zone (OMZ) sediments even though they can significantly impact the carbon-sulfur cycle of these highly-sulfidic (anoxic) sinks of complex organic matter. Our group first discovered metabolically active communities of aerobic chemolithoautotrophs and chemoorganoheterotrophs in a three-meter sediment horizon of the eastern Arabian Sea OMZ using metagenomics and metatranscriptomics. Genetic signatures of diverse aerobic metabolisms were found to be abundant within either category of meta-omic data obtained along the ~3-m sediment-cores retrieved from 530 mbsl (meters beneath the sea-level) and 580 mbsl, off the west coast of India. Subsequently, several such obligately aerobic bacteria were isolated from across the sediment-cores which died upon anaerobic incubation despite being provided all possible alternative electron acceptors. High levels of sequence correspondence between the isolates' genomes and the habitat's metagenomes and metatranscriptomes illustrated that the strains were widespread and active *in situ*. The sulfur-chemolithoautotrophs isolated could oxidize, and grow on, reduced sulfur compounds only in the presence of O_2. Likewise, the chemoorganoheterotrophic isolates could catabolize simple or complex organic compounds at high or low, but not zero, O_2. Some of them, however, could grow anaerobically on yeast extract or acetate by reducing nitrate and/or nitrite. Fermentation did not support growth in any of the strains, but enabled some of them to maintain a fraction of the cell population amidst prolonged anoxia. Under extreme oligotrophy, limited growth followed by protracted stationary phase was observed for the chemoorganotrophic isolates at low cell density, amid high or low, but not zero, O_2 concentration. While metabolic deceleration could be particularly useful for the strains' survival in the critically carbon-depleted layers below the explored sediment-depths (core-bottom organic carbon content was 0.5-1.0 % w/w), metagenomic data suggested that *in situ* anoxia could be surmounted via potential supplies of cryptic O_2 from native, chlorite or nitric oxide dismutating, microorganisms. The present findings not only hold critical implications for the remineralization/sequestration of buried organic matter within anoxic marine sediments, but also illustrate the possibilities of sulfide back-flux (reconversion to sulfate) causing pyrite dissolution and metal mobilization *in situ*.