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Growth of Purple Sulfur Bacteria on Solid-Phase Iron Sulfide as the Sole Source of Electron Donors

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Purple sulfur bacteria (PSB), a group of anoxygenic photosynthetic sulfide-oxidizers, are key contributors to the cycling of sulfur, carbon, and oxygen in various types of marine and terrestrial ecosystems. Despite the critical roles PBS have played in both modern and ancient settings, our understanding of PSB's full metabolic capabilities is only beginning. The focus of this work is to test if PSB can utilize solid-phase iron sulfide [i.e., FeS (amorphous mackinawite) and FeS_2 (pyrite)] as energy source, and further, to illuminate the mechanisms involved such solid-supported PBS growth (if positive results occur). Motivation for this work arose through examining the complex evolutionary history of ancient oceans, which experienced several extended periods of transition from being sulfidic to ferruginous. Such transitional periods might have resulted in temporary depletion of soluble reduced sulfur and massive iron-sulfide precipitation, forcing PSB to search for alternative energy sources. To the best of our knowledge, whether PSB can utilize solid-phase substrate has never been reported previously. Up to date, we have successfully grown Allochromatium vinosum in iron-sulfide-amended minimum culture medium and obtained full growth profiles including time profiles of sulfide, sulfate and dissolved iron concentrations for the positive control (amended with Na2S) and iron-sulfide samples using colorimetric assay, ion chromatography, and ICP-MS, respectively. Compared to the positive-control, the cell culture growth using iron sulfide as the electron donor was much slower, and the changes in sulfide, sulfate, and iron concentrations were extremely small (non-detectable in some cases). More work is currently under way to determine the mechanisms of *A. vinosum* -iron sulfide interactions. Specifically, we have conducted parallel experiments using dialysis tubing of different MWCO to separate the iron sulfide from the bulk solution. We have also extracted DNA and RNA from the positive control and iron-sulfide samples in a time resolved manner, and will carry out RNA-sequencing and comparative data analysis. We expect to report significant preliminary mechanistic data at the conference.