New insights into chemosynthetic Fe-oxidizing communities at hydrothermal vents

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Lithotrophic Fe-oxidizing bacteria (FeOB) produce highly structured microbial mats associated with low temperature, diffuse hydrothermal venting systems. These mats are dominated by the Zetaproteobacteria, a group of largely obligate FeOB that can account for upto 90% of the community in freshly formed iron mats. Due to the ultrastructural adaptations required for bacteria that grow on iron, these communities provide substrata for additional colonization by other microbes, including other Fe-oxidizers. We used custom made colonization chambers to assess in situ growth of FeOB responsible for producing centimeter thick iron mats at at Loihi Seamount. The individual, cellular Fe-oxidation rates were on the order of 1.6 x 10-16 mol per cell per hr., and mat accretion rates were estimated 2.2 cm per yr. Analysis of microbial iron mats associated with the Urashima vent site in Southern Mariana Trough led to discovery of the Golden Horn, a structure nearly 10m high that was formed largely from the growth of FeOB associated with Fe(II)-rich vent fluids, and an estimated age of nearly 500 years. Golden Horn harbored a more diverse microbial community than newly formed iron mats. New isolates of Zetaproteobacteria from the SMT and the mid-Atlantic Ridge that can use hydrogen as well as Fe(II) as sole electron donor have also shed new light on the metabolic diversity of this group of microbes, and underscore their importance in carrying out important biogeochemical processes at hydrothermal vents.