Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.29937

Hydrodynamic flow and interaction with the benthic boundary layer shape the microbial community in the white mats of Milos' shallow water hydrothermal vents

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In shallow-water hydrothermal vents (SWHVs), the dynamic interface between the discharged reduced hydrothermal fluids and the oxidized seawater, allow the establishment of diverse and complex microbial mats. Due to their shallow-depths and proximity to land masses, SWHV are heavily influenced by dynamic forcing, tidal fluctuations, and episodic events (*e.g.* storms, tides, etc). Even though several studies have investigated the microbial communities inhabiting SWHV in the last decades, less is known about how these communities respond to episodic events and how the complex interplay of physical and chemical drivers shape the structuring and establishment of microbial biofilms in these systems. Here we present data combining the taxonomic and functional diversity of the white microbial mats commonly found in sulfide rich shallow-water hydrothermal vents in Paleochori Bay on Milos Island, Greece, using a combined approach of 16S rRNA amplicon sequencing, transcripts tag-encoded sequencing, and metagenomic analysis. We explore how dynamic forcing and storm events influence microbial community re-assemblage and turn-over, and provide evidence that dynamic interactions with the benthic boundary layer play a key role in controlling the spatial distribution of taxa. We show that the white microbial mats of Milos shallow-water hydrothermal vents are dominated by Campylobacterota (former Epsilonproteobacteria), with metabolic functions associated with chemolithoautotrophic lifestyles, and exposed to a diverse array of viral communities, and that fluid dynamics and major storm events play a key role structuring microbial communities. Together our results show major pathways through which geodynamic events influence microbial taxonomic and functional diversity.