Spatially distinct, temporally stable chemolithoautotrophic microbial populations mediate biogeochemical cycling at and below the seafloor in venting fluids from Axial Seamount

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At deep-sea hydrothermal vents, chemolithoautotrophic microbial communities thrive across geochemical gradients above, at, and below the seafloor. In this study, we examined the activity of autotrophs both spatially and temporally across geochemically different diffuse fluids from Axial Seamount, an active submarine volcano in the NE Pacific Ocean. Fluids were collected from 2013-2015 at three different vents and examined via RNA stable isotope probing (RNA-SIP), rate measurements, metagenomic, metatranscriptomic, genomic binning, and geochemical analyses. Results revealed that chemolithoautotrophic microbial community structure, function, and activity are spatially dynamic, vent-specific, and shaped by both fluid chemistry and physical characteristics of individual vents. Sites maintain microbial communities and specific populations over time, but with spatially distinct taxonomic, metabolic potential, and gene transcription profiles. Potential rate and RNA SIP experiments were used to determine the rates and genetic repertoire of active subseafloor autotrophs across the vents, and results show dominance of different groups of autotrophs active under each experimental condition at each vent, with variable rates of potential autotrophy and heterotrophy. Experiments were also carried out on the seafloor with a novel in situ incubator unit to provide further insights to primary productivity in the subseafloor, and comparisons between seafloor and ship experiments will be presented. This study highlights the connection between microbial metabolic processes, fluid chemistry, and microbial population dynamics at and below the seafloor and increases understanding of the role of chemolithoautotrophic vent communities in deep ocean biogeochemical cycles.