Electron microprobe wavelength dispersive spectroscopy from seafloor sulfide deposits East Pacific Rise 9-10 North

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Project
» Collaborative Research: From hot to cold in the dark - shifts in seafloor massive sulfide microbial communities as physical and geochemical conditions change after venting ceases (Hot2cold Vents)

Contributors	Affiliation	Role
Toner, Brandy Marie	University of Minnesota Twin Cities (UMTC)	Principal Investigator
Jones, Rose	University of Minnesota (UMN)	Scientist

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Coverage

Spatial Extent: **Lat**:0 **Lon**:0

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Parameters

Parameters for this dataset have not yet been identified

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Project Information

Collaborative Research: From hot to cold in the dark - shifts in seafloor massive sulfide microbial communities as physical and geochemical conditions change after venting ceases (Hot2cold Vents)

Coverage: East Pacific Rise

NSF Award Abstract:
Hydrothermal vents, which deposit seafloor massive sulfides (SMS), occur along the 89,000 km of mid-ocean ridges, submarine volcanoes, and backarc basins that occur at tectonic plate boundaries in the ocean. Active hydrothermal vent sulfide chimneys are hotspots of biodiversity and productivity in the deep ocean, as well as potential resources for metals. While significant effort has focused on understanding the diversity of biological communities and geochemistry associated with actively venting SMS, relatively little is known about the biological communities associated with SMS once venting ceases. Furthermore, little is known about the microbiological and geochemical changes that occur during the transition period from active to inactive, during which an important succession occurs in the microbial community and geochemistry of fluids within the chimney. This interdisciplinary project will create and sample this transition period by collecting multiple active SMS samples from individual vents at 9 degrees N East Pacific Rise and allowing them to transition to inactive on the seafloor, mimicking the end of venting while allowing for the exact time when venting ceased to be

known, something not possible when sampling naturally formed inactive SMS. Microbial community diversity and metabolism will be analyzed in parallel with bulk and fine-scale geological measurements for active, transitioning, and inactive sulfides. This seafloor experimental and analytical approach will provide knowledge of how microbial communities, rates of biogeochemical transformations, and geological conditions change as SMS transition from hot and actively venting to cold and inactive. Students in grades 6-8 will be entrained into the project through research cruise "ship-to-shore" interactions and communications, post-cruise workshops for educators working with students typically underrepresented in STEM fields, and a collaboration with the Science, Engineering, Art and Design Gallery (SEAD), a community and economic development project in Bryan, TX.

Hydrothermal vents are quantitatively important to the biology and chemistry of the deep ocean, but the vast majority of current knowledge focuses on actively venting deposits. However, after venting ceases, sulfides can persist on the seafloor for tens of thousands of years, making them long-lived, globally-abundant microbial substrates. In recent years, studies of inactive SMS found drastically different microbial communities than those on active deposits, indicating a succession of the microbial community, and thus a potentially different impact on deep ocean biodiversity and biogeochemistry than actively venting deposits. However, ages of the inactive structures are often not known, so it is impossible to estimate how quickly these changes occur, and how quickly co-occurring changes in sulfide mineralogy and microbiological communities occur. This project will provide the first insight into what happens at the microbial and mineralogical level as SMS initially transition from active to inactive. Active SMS will be sampled and analyzed for microbial community composition, functional capacity, gene expression and metabolic rates. Co-located subsamples will be analyzed for porosity and bulk and fine-scale mineralogy. Subsamples of those active SMS samples will be left on the seafloor to incubate and be collected weeks and a year or more later, with the same analyses conducted upon collection. This will allow for determination of microbiological and mineralogical changes that occur during that initial transition and for comparison with older inactive SMS from the same vent fields. Together, the data collected will be integrated to generate a conceptual model of succession of biology, mineralogy, porosity and pore distribution as vent deposits transition from active to inactive. This project will fill a knowledge gap about hydrothermal ecosystems and has the potential to transform the current understanding of diversity and rates of change in these important seafloor biomes.

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Funding

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