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Carbon flow and microbial activity in the hydrothermally altered sediment of Guaymas Basin

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The Guaymas Basin, in the Gulf of California, is a deep–sea hydrothermal system characterized by rapid accumulation of organic-rich sediments and active oceanic crust production [1]. Magmatic intrusions from the spreading center alters the overlying sediments, generating a wide range of hydrocarbons such as methane, short/long chain alkanes, polycyclic aromatic hydrocarbons and other low-molecular-weight metabolites (e.g., CO_2, H_2, ammonium, organic acids and alcohols [2, 3], which constitute energetic substrates for a diverse array of microorganisms that live and thrive under extreme conditions. We integrated geochemical analysis and experimental incubations with radiotracers to constrain the carbon flow and microbial activity in hydrothermally influenced sediments from the Guaymas Basin. Abundant methane, acetate, methanol and hydrocarbons were detected in the porewaters. Rate measurements suggested methane could be produced from bicarbonate, acetate, methanol and hydrocarbons. High oxidation rates versus low methanogenesis rates indicated that these substrates were predominantly consumed by non-methanogenic processes. Methane was anaerobically oxidized and AOM was generally coupled to sulfate reduction. Microbial activity was influenced by environmental factors, which also shaped the distribution of microbial communities. These results reveal a dynamic carbon flow mediated by various microorganisms and provide new insight into the carbon metabolism and cycling in seafloor hydrothermal systems.

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