RECONTEXTUALIZING A MICROBIAL ISOLATE IN GEOCHEMICAL SPACE

HANS CARLSON [1], HUALAN LIU [1], MORGAN N. PRICE [1], ADAM P. ARKIN [1], ADAM M. DEUTSCHBAUER [1]

[1] Lawrence Berkeley National Lab, Berkeley, CA 94704. E-mail: carlsonh@berkeley.edu, hkcarlson@lbl.gov

Microbial fitness is dependent on complex interactions between microbial biochemistry and environmental geochemistry. While biotic and dispersal processes are important controls on microbial community structure and function, gene-geochemistry interactions remain a dominant driver of microbial growth and persistence in the environment. Here we characterize the gene-microbe-geochemistry interactions for an environmental bacterium, *Pseudomonas fluorescens* N2E2, isolated from groundwater in Oak Ridge, Tennessee using high-throughput cultivation and high-throughput genetics. By comparing the inhibitory concentration of 80 inorganic compounds to their concentrations in the field, we predict that Mn, Ni, Al, Co and NO_3^- are may limit the range of N2E2 in the natural environment. We also use a bar-coded transposon library of N2E2 to determine which genes influence N2E2 fitness in the presence of these compounds. Geochemical gradients in the environment are multi-dimensional, and by comparing gene fitness profiles between various metals we predict and quantify synergistic inhibition of *P. fluorescens* growth by Al, Ni, Co, and Mn. We also quantify the role of metabolic state on N2E2 fitness by determining metal inhibitory potencies for cultures grown with different carbon sources (lactate and glucose), under nitrate reducing conditions and under iron-limited conditions. Taken together, our results provide predictions of gene-microbe-geochemistry interactions that can be tested in field studies.