**Dissimilatory Iron Reduction by microorganisms under hot deep subsurface conditions.** S. Ruper\(^1\), Anurag Sharma\(^2\) and James H. Scott\(^3\).

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**Introduction:** Since the postulation of a deep, hot biosphere [1] where life could survive independent of photosynthesis, efforts continue towards defining the base of the biosphere. The findings of microbial life in deep subsurface [2] and hydrothermal vents in the ocean bottom [3] have provided observations and biochemical insights into ecosystems under these conditions. However, these direct field approaches essentially only scratch the surface of our planet and remain limiting as far as the whole planet is concerned. Due to the extent of inaccessibility of deep subsurface, such approaches have barely tested the environmental limits for biology. Any estimation of the extent of viable biological activity at environmental extremes requires a systematic experimental approach that can push the limits of observation to conditions not accessible by direct sampling. Ascertainment of the limits of biological activity to extreme pressures has been challenging. Therefore, in order to increase understanding of extremophilic microbial physiology, there is a need for systematic physiological study of microbial systems taken to extreme environments [4].

Geochemical constraints on life in deep subsurface environments limit the extent of biochemical activity, such that the fundamental electron transport mechanism mediating biochemical activity is the defining limit to maintaining life. Recent investigations [5] point to significant communities of heterotrophic microorganism that belong to genera that utilize a range of inorganic compounds as terminal electron acceptors. If heterotrophic growth is occurring at these depths then the key question is: what are the electron acceptors being used to recycle the carbon? The abundance of ferric iron either as part of iron containing mineral or as iron-rich oxides has the potential to provide an abundant oxidant for more diverse and deeper microbial (SLiME) communities [6]. Therefore a better understanding of the role of dissimilatory iron reduction in the deep subsurface may provide a clearer picture of how carbon is recycled and how bioenergetics are coupled throughout the community.

In this study, we present preliminary results on iron reduction at conditions simulating deep subsurface by utilizing techniques developed for in-situ high pressure study [4, 7]. *Shewanella MR-* was cultured with 100 mM Fe-citrate and loaded in diamond anvil cells to high pressures (2-12 kbar). In situ Raman spectroscopy and optical fluorescence measurements were made to constrain the biochemical Fe-reduction. The cell viability was determined with in-situ optical measurements as well as cell growth by extraction from high pressure conditions. These experimental results demonstrate the feasibility of microbially mediated Fe-reduction at conditions compatible with deep subsurface Earth. The determined constraints on high pressure metabolism do not only increase our understanding of biological activity in Earth’s subsurface, but can inform current understanding of the ubiquity of life in all planetary systems.