Particle-Associated Biogeochemical Processes in Fayetteville Green Lake, a high sulfur, permanently anoxic lake

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In modern low O_2 environments, and probably the ocean during times of anoxia, anaerobic autotrophs are abundant [1]. Unlike phytoplankton in oxic environments, their maximum abundance is in deeper, nearly anoxic water where grazing is minimal; so, they have a higher likelihood of sinking to the sediment-water interface.

Their spatial distribution and biogeochemical function are organized by the tolerance of their carbon fixation enzymes to oxygen, and these enzymes fractionate carbon differently [2]. An interdisciplinary approach that pairs functional gene quantification with stable isotope analyses is required to understand how autotrophic metabolisms fractionate isotopes in particulate matter (PM) that is preferentially buried.

Here we present isotopic, functional gene, and 16S rRNA library data from size-fractionated pools of PM and PM caught by sediment traps from Fayetteville Green Lake (FGL), NY- a sulfidic, permanently anoxic, stratified lake. FGL has DIC and sulfate concentrations that are comparable to modern marine anoxic basins, the mid-Proterozoic ocean, and the ocean during Ocean Anoxic Events (OAEs), thus serving as an easily accessible "snow globe" model to study their biogeochemistry [3]. We explore how this interdisciplinary approach can be used to shed light on how the biological pump likely operated during the early evolution of life and OAEs, and therefore how the biological pump may operate in the future as oxygen minimum zones continue to spread due to global climate change.

[1] Canfield et al. (2006), *Philos. Trans. Royal Soc. B 361(1474)*, 1819-36
[2] Berg, I.A. (2011), *Appl Environ Microbiol 77(6)*,1925-1936.
[3] Havig et al. (2015), *Geochim Cosmochim Acta 165*, 389-40