CRYPTIC PHOTOSYNTHESIS: A POSSIBLE TERRESTRIAL ANALOG FOR EARLY EARTH AND MARS. J. R. Havig[1] and T. L. Hamilton[2], [1]Department of Geology, University of Cincinnati, Cincinnati, OH 45221; jeffhavig@gmail.com, [2]Department of Biological Sciences, University of Cincinnati, Cincinnati, OH 45221; trinity.hamilton@uc.edu.

Introduction: The timing and mechanism for colonization of terrestrial surfaces by photoautotrophic microorganisms is currently an open question and could have occurred as early as the Archean [1]. Photoautotrophs, and specifically oxygenic photoautotrophs, were likely a key component for the development of a terrestrial biosphere that drove oxidative weathering of sulfide minerals before the Great Oxidation Event (GOE) of 2.5 Ga [2,3]. Thus, the composition and productivity of putative Archean terrestrial photoautotroph analogs would help to constrain models for terrestrial weathering prior to the GOE. Hydrothermal areas provide ideal locations for exploring potential early Earth analog sites due to the natural exclusion of multicellular organisms, providing landscapes dominated by microbial communities. In one such environment (The Gap Area, Norris Geyser Basin, Yellowstone National Park, WY), we sampled photoautotrophic microbial communities present in both hot springs as well as underneath loose siliceous sinter. We conducted 16S and 18S rRNA gene sequencing combined with *in situ* microcosm carbon uptake experiments and geochemical analyses to compared the community composition and light-dependent primary productivity in subaqueous microbial communities to those found in areas of subaerial siliceous sinter.

Results: All samples were selected based on the visual presence of photosynthetic pigments. Geochemical results show that the environments sampled were acidic (pH 2.6 to 3.3), with temperatures between 38 and 48°C. 16S and 18S rRNA gene sequencing indicate subaqueous and subaerial environments host distinct types of microbial communities. *in situ* microcosm studies indicate carbon fixation rates for the subaerial communities are similar to those in subaqueous environments.

Implications: Given these results, the potential for terrestrial photoautotrophic microbial communities to influence weathering of continental subaerial surfaces seems significant. These types of microbial communities may have also developed on other planets, including Mars, where they could have driven weathering and other processes. Establishing biosignatures produced by terrestrial photoautotrophic microbial communities has the potential to provide a new tool for looking interpreting signs of life in the rock record of Earth as well as Mars.

References: [1] Battistuzzi F. U. et al. (2004) *BMC Evolutionary Bio.*, 4, 44-58. [2] Stüeken E. R. et al. (2012) Nature Geoscience, 5, 722-725. [3] Havig J. R. et al. (2017) *JGR Biogeosciences* (accepted, in revision).