GOT GAS? ASSESSING NON-METHANE VOLATILE ORGANIC COMPOUNDS AS A BIOSIGNATURE FOR EXTANT LIFE. P. A. Lee[1], M. D. Dyar[2], E. C. Sklute[2], A. Jarratt[3], and J. A. Mikucki[3], [1]Hollings Marine Laboratory, College of Charleston, 331 Fort Johnson Rd, Charleston, SC 29412, leep@cofc.edu. [2]Planetary Science Institute, 1700 East Fort Lowell, Tucson, AZ 85719. [3]Dept. of Microbiology, University of Tennessee, M409 Walters Life Sciences, Knoxville, TN, 37996.

Introduction: Recent findings of methane on Mars by the *Curiosity* rover have sparked considerable interest in methane as a possible biosignature of extant life on Mars. However, interpretation of the results is confounded by the presence of abiotic sources for methane. On Earth, life generates a bewildering array of non-methane volatile organic compounds (VOCs) not only as by-products of respiration, but also for a variety of purposes including cellular processes, organism-organism signaling and syntrophic interactions [1-3]. These collective subsets of metabolites represent an attractive biosignature with the potential to enable detection of extant life on Mars.

Results of ongoing VOC research on aquatic features of the McMurdo Dry Valleys, Antarctica, will be presented. One such feature is Blood Falls, a hydrological feature at the terminus of the Taylor Glacier that results from the periodic discharge of a briny liquid from an aquifer beneath the glacier (Figure 1). The aquifer is thought to be the remnant of a cryo-concentrated fjord that has been isolated from the atmosphere and sunlight for at least 1.5 million years. Discharged brine is cold (-5 to -7°C), salty (8% salinity), ferrous (~400 µM) and rich in sulfate (50 mM) [4-5]. Previous work has shown that the brine contains a viable, metabolically active chemosynthetic microbial community that couples respiration of iron oxides to use of reduced sulfur compounds as electron donors. This results in a system that is suboxic but not sulfidic [4-5], described as a cryptic sulfur cycle [6].

Preliminary results from laboratory incubations using novel microbial isolates from Blood Falls will also be presented. This work is a component of the NASA-funded ICE-MAMBA project (***I***ce-covered ***C***hemosynthetic ***E***cosystems: ***M***ineral ***A***vailability and ***M***icro***B***iological ***A***ccessibility), an collaborative effort consisting of three overlapping and integrated multidisciplinary elements. The first project is characterizing the Blood Falls brine metagenome and metatranscriptome. Second, we are studying changes in the iron mineralogy of the brine as it discharges. The third component utilizes the results of the first two efforts to develop microcosms using appropriate Blood Falls isolates and iron substrates for the determination of various molecular, mineralogical and metabolic (VOC) biosignatures. These microcosm incubations allow changes in mineralogy to be related to products characterized from functional gene analysis and formation of volatile organic compounds (VOCs). The goal of ICE-MAMBA is to link the detection of complex VOCs to the bio-utilization of iron minerals via the organisms' metabolic machinery, thereby providing a unified biosignature for extant life that is more robust than the individual biosignatures from each component.

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Figure 1. The outflow fan at Blood Falls at the terminus of the Taylor Glacier.