

### 33. POLAR AND ALPINE LAKES AS SENTINELS OF ENVIRONMENTAL CHANGE

**33-O Subglacial Lake Whillans: an active ecosystem beneath the Antarctica ice sheet.** *John Prisco*<sup>1</sup> - *Amanda Achberger*<sup>2</sup> - *Brent Christner*<sup>3</sup> - *Alexander Michaud*<sup>1</sup> - *Mark Skidmore*<sup>1</sup> - *Trista Vick-Majors*<sup>1</sup>

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Subglacial Lake Whillans is the first Antarctic subglacial lake to be sampled directly. Hot water drilling was used to access the water column and sediments of Subglacial Lake Whillans in January 2013 as part of the Whillans Ice Stream Subglacial Access Research Drilling (WISSARD) Project. The lake lies 800 m beneath the surface of the Whillans ice plain and had temperature, conductivity and pH values of -0.5 °C, 720 µS/cm and 8.1, respectively. The lake had relatively high dissolved organic carbon (~2.5 mgC/L) and low dissolved oxygen (<3 mg/L). This oxygen level (16% of air saturation) indicates that metabolic sinks exceed sources in the lake. Molar particulate organic C to N ratios in the water column averaged 65, which are much higher than those in the sediments (~16). These C:N ratios reveal a system deficient in N relative to C. An  $\delta^{18}\text{O}$  value of -38.0 ‰ for the lake indicates that glacial ice melt water is the primary water source; Cl<sup>-</sup> to Br<sup>-</sup> concentrations and ratios suggest a minor seawater component. Conductivity and  $\delta^{18}\text{O}$  values in the upper 38 cm of lake sediment infer a seawater influence in the deeper sediment layers. Delta<sup>17</sup>O-nitrate values of the lake water averaged 0.8 ‰ indicating microbial production as the dominant source for SLW nitrate. Bacterial densities in the lake averaged 100,000/mL and contained diverse morphotypes. Radiolabeled substrate incorporation and ATP levels showed active biosynthesis in both the water column and surficial sediment layer. Bacterial growth efficiency, based on <sup>14</sup>C-leucine incorporation, was 0.12. Small subunit rRNA gene sequences revealed that the lake water was dominated (81%) by phylotypes related to archaea within the Thaumarchaeota Marine Group I, a newly recognized group of chemotrophic ammonium oxidizers. Members of the Proteobacteria (Gamma, Beta, Delta), Planctomycetes, and Actinobacteria collectively represented 12% of the OTUs found in the water column. In contrast, only one archeal OTU was identified in the sediments (2 to 4 cm depth interval) and ~80% of the phylotypes identified were affiliated with the Proteobacteria. Many of the bacterial phylotypes were closely related to species that grow chemolithotrophically using reduced iron, sulfur, or nitrogen compounds or C1 hydrocarbons as electron donors and are presumably responsible for the relatively high levels of DOC within the lakewater. Collectively, our results indicate the presence of an active microbial community beneath the Whillans Ice Plain dominated by chemolithoautotrophs, which contribute to subglacial weathering processes.