Association for the Sciences of Limnology and Oceanography (ASLO) 2018 Summer Meeting, Victoria, BC, Canada, June, 2018

Importance of winter and seasonality in aquatic systems

Priscu, J.C., Michaud, A.B., Skidmore, M.L., Vick-Majors, T.J., Dore, J.E., Christner, B.C.

More than 400 lakes have been identified below the Antarctic ice sheet and serve as end-member systems for biogeochemical processes that occur in all permanently and seasonally ice-covered lakes. Hot water drilling was used to cleanly access the water column and sediments of Subglacial Lake Whillans, the first of these lakes to be sampled directly. The lake lies 800 m beneath the ice surface and had temperature, conductivity and pH values of -0.5 $^{\circ}$C, 720 µS/cm and 8.1, respectively. The lake had relatively high dissolved organic carbon (~2.5 mg C/L) and low dissolved oxygen (~16% of air saturation). Conductivity and $\delta^{18}O$ values in the upper 38 cm of lake sediment infer a seawater influence in the deeper sediment layers. Densities of phylogenetically diverse bacteria in the lake averaged 100,000 cell/mL. Radiolabeled substrate incorporation revealed active biosynthesis in both the water column and surficial sediment layer. Methane levels reached ~300 µM in the sediments below 20 cm fueling a diffusive flux of ~7 nmol methane per meters squared per year to the sediment-water interface where most was oxidized by relatively abundant aerobic methanotrophs. Stable isotope data showed that the methane is likely produced by hydrogenotrophic methanogenesis in deeper sediments. Collectively, our results indicate the presence of an active microbial community beneath the Whillans Ice Plain supported by chemosynthesis. We also present background data on Subglacial Lake Mercer, which lies beneath ~1200 m of ice, and will be sampled in January 2019.