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Project Summary

Recent evidence obtained through orbital radar sounding indicates the presence of subglacial lakes ~800 meters below Mars' southern ice cap. Such subsurface saline water bodies may support active microbial ecosystems. Considerable evidence has also been found in the last decade to support the existence of large cold, salty oceans under the ice covers of the icy moons, Europa and Enceladus. The main goal of this project is to characterize a unique terrestrial analogue environment of these icy worlds: the recently discovered hypersaline lake complex under the Devon Ice Cap of Nunavut, Canada. The Devon Island subglacial lakes consist of 3 lakes lying beneath 560-740m of ice; modelling indicates temperatures of -12ºC and high salinities of ~ 15% salt. Due to their hypersaline nature, the Devon subglacial lake complex is a particularly tantalizing analogue for brine bodies inferred to exist on Europa, Enceladus, and Mars, and make it a compelling site to address fundamental questions about how life persists at terrestrial extremes of darkness, temperature, salinity, and pressure. Our 3-year CSA FAST application is the first step to access the Devon Island lakes directly by testing and optimizing an ice drilling system, collecting ice samples overlying the lakes for microbiological analyses and optimizing 2 biosignature detection prototypes, and to further constrain geomorphological parameters of the system.

Proposed 2022 Field Research Activities

We are requesting a summer trip (7 days) for 2022 between July 1 – July 31 with Brady O'Connor (PhD Student), Dr. Lyle Whyte (Professor), Dr. Kris Zacny (Honeybee Robotics) and Dr. Leo Stolov (Honeybee Robotics) to Devon Island. In 2022 we plan to visit the location overlying the subglacial lakes on the Devon Island ice cap. The 2022 trip is primarily for local reconnaissance of the Devon Island surface on top of the subglacial lakes to determine optimal sites for future drilling and sample collection for future field seasons in 2023 and 2024. For July 2024, we will be staying at the PCSP Resolute Facility and will take 1 or 2 half-day trips to the top of the Devon Ice Cap above the subglacial lakes. There will be no field camp on top of the ice cap and we will be on the surface for ~ 4-5 hours. In addition to site reconnaissance, we will collect near surface ice samples (1 – 2 m) for analyses of the microbial communities inhabiting the ice back at my lab at McGill University in Montreal. This will include culturing of microbes inhabiting the surface ice and genomics analyses to better understand the diversity and metabolic potential of the microbial communities. We will test whether the ice-inhabiting microbes are active or in a dormant state. The samples will also be tested using the prototype MICRO Life Detection Platform, which can characterize microbial communities and will demonstrate the platforms usefulness as a biosignature detection platform for future planetary missions.