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Developing new technologies to investigate the Devon Island subglacial lake system

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ᐱᓕᕆᐊᖅᑭᒪᔪᖅ:	McGill University, Lyle Whyte

McGill University, Lyle Whyte

21,111, Lakeshore Rd., Ste Anne de Bellevre, QC H9X3V9, Phone: 514-398-7889, Email: lyle.whyte@mcgill.ca

Sainte Anne-de-Bellevue Quebec H9X 3V9

Canada

ᐅᖄᓚᐅᑏᑦ: 514-398-7889, ᓱᑲᔪᒃᑯᑦ:

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ᖃᓄᐃᑦᑑᑎᓂᒃ ᐱᓕᕆᐊᖅᑲᖅᓂᐊᕆᐊᖕᒐᓐᓂᒃ

ᖃᓪᓗᓈᑎᑐᑦ: 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 -12°C 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.We are requesting 1 trip (1 - 7 days) per summer from 2022 to 2024 between the months of May and July for Brady O'Connor (PhD Student), Dr. Lyle Whyte (Professor), Dr. Kris Zacny (Honeybee Robotics) and Leo Stolov (Honeybee Robotics) to the Devon Island ice cap. The field site for all 3 years will be directly above the subglacial lakes, northwest of the centre of the ice cap and approximately 120 km from the nearest community (Grise Fjord). During the field trips in 2023/24, 1 or 2 additional team members from the University of Alberta may also accompany us. For July 2022, we will be staying at the PCSP Resolute Bay facility and will take 1 or 2 half-day trips by helicopter 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. 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 field seasons in 2023 and 2024. In addition to site reconnaissance, using a Kovacs manual ice corer, 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.The 2023 and 2024 field seasons will include longer stays atop the ice cap. In 2023/24 we will camp at the site for 4 to 5 days to a maximum of 7 days during the month of May. To accommodate the supplies required for these longer trips, a twin otter aircraft will be used to transport our team to and from the site. The need for a longer stay and camp at the site is to operate the SLUSH melt probe. In 2023/24 we will attempt to melt down between 50 and 100 meters which will require a few days to achieve given the slow speed of the melt probe and the challenging conditions atop the ice cap. In parallel, we will also collect deeper ice cores using the Kovacs corer, this time to a maximum depth of 20 meters and will be transported back to McGill University for microbiological analyses the same as described above. During the 2023/24 field seasons, team members from the U. of Alberta will perform non-invasive remote sensing work to further constrain the geomorphology of the subglacial lakes and the surrounding environment.The camp in 2023/24 will require 4-6 people for ~5-7 days. The camp will include up to 5 tents (2 - 3 for sleeping, 1 for technical work and cooking, and 1 for a bathroom and storing materials), 3 power generators and 3 propane tanks. All grey water and human waste will be sealed in containers and disposed of back at PCSP Resolute Bay. Food and all other waste material will be contained in sealed bags and disposed of at PCSP Resolute Bay. The field site will be left as it was found with minimal lasting impact to the ice cap surface.

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ᐃᓄᒃᑎᑐᑦ: ᒫᓐᓇᐅᔪᖅ ᑕᑯᑎᑦᑎᑎᓯᒪᔪᑦ ᐱᔭᐅᔪᑦ ᓄᓇᕐᔪᐊᑉ ᓯᓚᑖᓂ ᓯᓚᑦᑎᓐᓂᑦ ᖃᖅᑲᑦᑕᖅᑎᑕᐅᓯᒪᔪᒥᑦ ᓇᓄᓇᐃᖅᓯᓯᒪᕗᖅ ᐱᑕᖃᕐᓂᖅᒥᓐᓂ ᓯᕐᒥᓂᖕᖓᖅᑐᑦ ᑕᓲᑦ ~800 ᒦᑕ ᐊᑖᓂ ᒥᒥᐅ ᖃᐅᔨᓴᕐᕕᖕᒥᑦ ᓂᒥᐊᓂ ᕿᕿᔪᖅ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᖅ ᖄᖓ. ᑕᒪᒃᑯᐊ ᖄᖕᒥᑦ ᑕᑯᕋᖅᑐᑦ ᐃᒪᐃᑦ ᐃᑲᔫᑎᒐᔭᖅᑐᖅ ᒫᓐᓇᐅᔪᖅ ᖁᐱᕆᖕᒥᓐᓂᒃ ᐆᒪᔪᕋᓛᓚᒦᑦ ᐊᕙᑎᖕᒥᓪᓗ. ᐃᓯᒪᒥᑦᑎᐊᖅᑰᒥᑦ ᑕᑯᔭᐅᓯᒪᔪᑦ ᓇᓂᔭᐅᔪᓂᑦ ᑭᖑᓪᓕᖅᕙᖓᓂᑦ ᖁᓕᑦ ᐊᕿᒍᓂ ᐃᑲᑲᔫᑎᔪᒃᓴᓂᒃ ᐱᑕᖃᕐᓂᖓᓂᒃ ᓂᒡᓕᓱᒃᑐᒥ, ᑕᑯᐅᖅ ᐃᒪᕕᖕᒥ ᐊᑖᒍ ᓯᑯᓯᒪᔪᑦ ᑕᕿᑉᑦ, ᐅᑭᐸ ᐊᒻᒪᓗ ᐃᓐᓯᓚᑦᓴ. ᐅᑯᐊ ᑐᕌᓇᔭᕐᒥᑦ ᑕᒪᑐᒍᖓ ᐱᓕᓇᐊᖑᔪᒍᒃ ᖃᐅᔨᓗᑕ ᑭᓱᖃᒪᖕᒫᑕ ᐊᔾᔨᐅᒥᔭᐅᓂᖕᒥᓐᓂᒃ ᓄᓇᒥᐅᑕᕐᓂᒃ ᖃᓄᑎᒥᖕᒪᖕᒫᑕ ᐊᕙᑎᖕᒥᓐᓂ ᑖᒃᑯᐊ ᓯᑯᖃᖅᑐᓂ ᓯᓚᕐᔪᐊᒥᑦ: ᒫᓐᓇᐅᔪᖅ ᓇᓂᓯᕕᖅᑐᑦ ᑕᑯᖑᓂᖅᓴᒥᒃ ᐃᒪᕕᖕᒥᑦ ᑕᓯᕐᒥᒃ ᐊᑖᓂ ᑕᓪᓗᕆᑦ ᕿᕿᔪᖅ ᖄᖓᓂᑦ ᓄᓇᕗᒻᒥ, ᑲᓇᑕ. ᐅᓇ ᑕᓪᓗᕆᑦ ᕿᑭᖅᑕᖓᓂ ᓯᕐᒥᓂᖕᒫᖅᑐᑦ ᑕᓲᑦ ᐱᖓᓱᖑᖅᓯᒪᔪᑦ (3) ᑕᓯᑦ ᐊᑖᓂ 560-740ᒦᑕ ᓯᑯ; ᖃᓄᐃᓕᖓᓇᔭᕐᓂᖓ ᖃᐅᔨᓴᕆᑎᑦᑎᒍᑦ ᓇᓄᓇᐃᖅᓯᒪᔪᖅ ᓂᒡᓕᓯᖕᓂᖓ -12 ᐤᓯᐅᑎᐊᔅ ᐊᒻᒪᓗ ᐊᖏᔪᒥᒃ ᑕᖑᕐᖅᑐᖅ ~15 ᑕᖑᖅ. ᐱᔾᔪᑎᒥᓪᓗᒍ ᑕᖑᖑᓗᐊᕐᓂᖓᓄᑦ, ᑕᓪᓗᕆᑦ ᓯᕐᒥ ᑕᓯᕆᖅᓯᒪᔪᑦ ᐊᔾᔨᒌᓐᖏᑦᑑᔪᑦ ᐱᓗᐊᖅᑐᒥᒃ ᖃᐅᔾᔨᓇᖅᓯᕙᓪᓕᐊᑎᐊᕐᑰᔾᔭᖅ ᑕᖑᖑᕐᑎᑦᑎᕙᓪᓕᐊᓂᖓ ᑕᐃᒪᓐᓇᐅᕐᑰᔾᔭᒪᑦᑕᑕᐅᖅ ᑖᒃᑯᓇᓂ ᔪᓗᐸ, ᐃᓐᓯᓚᑦᓴ, ᐊᒻᒪᓗ ᒫᔅ, ᐊᒻᒪᓗ ᐃᓂᑦᑎᐊᕙᐅᔪᓐᓇᕐᒪᑦ ᑐᑭᓯᓂᐊᖅᓘᒍ ᐊᐱᕐᑯᑎᑐᖅᑦ ᐱᔾᔪᑎᒥᓪᓗᒍ ᐆᒪᖅᑐᖅᑲᕆᓐᓇᕐᒪᖖᒌᑦ ᓄᓇᒥᐅᑕᓂᒃ ᑖᖅᑐᒪᓇᐋᓗᒐᓗᐊᖅᐸᑦ, ᓂᒡᓕᓯᒃᑐᒪᓇᐋᓘᒐᓗᐊᖅᐸᑦ, ᑕᖑᕐᒥᓐᓇᐅᒐᓗᐊᖅᐸᑦ, ᐊᒻᒪᓗ ᐳᓪᓕᖅᑲᖅᒥᒃ. ᐅᓇ 3-ᐅᑭᐅᓄᑦ ᑲᓇᑕᒥ ᐊᓂᕐᓂᖅᑲᕐᓐᖏᑦᑐᒧᑦ ᓄᓇᕐᔪᐊᖅ ᓯᓚᑖᓄᑦ ᑎᒥᖁᑖ ᖃᖓᑕᔫᑦ ᐊᒻᒪᓗ ᓄᓇᒥ ᓴᓇᔪᑦ ᐃᓕᑦᑎᕚᓪᓕᕐᓗᑎᒃ ᖃᐅᔨᓴᐃᓂᓪᓚᖑᒃᑯᑦ ᐊᒻᒪᓗ ᖃᖓᓴᐅᔭᓕᖓᓂᒃᑯᑦ ᐊᑐᖅᑕᐅᔪᖅ ᓯᕗᓪᓕᖅᐹᒥᒃ ᐊᑐᖅᓯᕕᒥᓂᐊᕐᓗᒍ ᑕᓪᓗᕆᑦ ᑕᓯᕐᓂᑦ ᐃᓂᖅᑲᕐᓗᑎᑦ ᖃᐅᔨᓴᕐᕕᒥᓗᒥᑦ ᐊᒻᒪᓗ ᐊᑐᖅᓯᑦᑎᐊᕆᑎᒥᓗᒥᑦ ᓯᑯᒥ ᓂᐅᖅᑐᐃᓂᖅ, ᓄᐃᑦᑎᓂᖅ ᓯᑯᓂᒃ ᖃᐅᔨᓴᕆᑎᑖᕐᓗᑎᒃ ᖄᖕᒥᓐᓂᑦ ᑕᓲᑦ ᐆᒪᔭᑦᑐᓂᒃ ᖃᐅᔨᓴᕐᓗᑎᒃ ᐊᒻᒪᓗ ᐊᑐᖅᓯᑦᑎᐊᕆᑎᒥᓗᒥᑦ 2 ᐆᒪᔪᑦ ᐊᔾᔨᒌᓐᖏᑦᑐᑦ ᓇᓂᔭᐅᔪᑦ, ᐊᒻᒪᓗ ᑐᑭᓯᓇᓱᒋᐊᑲᓂᕐᓗᑎᒃ ᓄᓇᒥᒃ ᖃᐅᔨᓴᕐᓗᑎᒃ ᐊᕙᓗᓕᒫᖓᓂ ᑕᐃᒪᐃᑦᑐᖅᑲᖅᑐᑦ. ᑐᒃᓯᕋᖅᑐᒧᑦ 1 ᑕᐅᕗᖔᖅᓯᒪᓗᑕ (1-7 ᐅᓪᓗᐃᑦ) ᐊᑕᐅᓯᐊᖃᑦᑕᕐᓗᑕ ᐊᕿᒍᒥ 2022 ᑎᑭᓪᓗᒍ 2024 ᐊᕙᑖᓂᑦ ᑕᕿᑉᑦ ᒪᐃ ᐊᒻᒪᓗ ᔪᓚᐃ ᑖᒃᑯᓄᖓ ᐳᓚᐃᑎ ᐅ'ᑳᓄ (ᐃᓚᓐᓂᐊᕐᕕᒃᔪᐊᒥ ᐃᓚᓐᓂᐊᖅᑐᖅ), ᓅᒃᑖᖅ ᒪᐃᔪ ᒍᐃᑦ (ᐃᓚᓴᐃᔨ), ᓅᒃᑖᖅ ᑯᓚᔅ ᔭᑦᓂ (Hᐊᓂᐋ ᖃᓇᓴᐅᔭᓕᕆᔨᑦ) ᐊᒻᒪᓗ ᓕᐅ ᓯᑐᕗ (Hᐊᓂᐋ ᖃᓇᓴᐅᔭᓕᕆᔨᑦ) ᑕᐃᑯᖓ ᑕᓪᓗᕆᑦ ᓯᑯ ᕿᕿᔪᖅ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᒧᑦ. ᓄᓇᒥ ᐃᓂᒥᔭᕗᑦ ᑕᒪᐃᓐᓄᖅ 3 ᐊᕿᒍᓂ ᖁᓛᓂᑦᑎᐊᖅ ᓯᕐᒥᖕᓂᑦ ᑕᓯᕆᖅᓯᒪᔪᑦ, ᐅᐊᖕᓇᖕᓚᓂ ᐱᓇᖕᓇᖕᓚ ᕿᑎᖕᓚᓂᖕᒫᕐᓗᒍ ᓯᑯ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᖅ ᐊᒻᒪᓗ 120 ᑭᓕᒦᑕᔅ ᖃᓂᑲᖅ ᓄᓇᓃᑦ (ᐊᐅᔪᐃᑦᑐᖅ).ᑕᐃᒃᓂ ᓄᓇᒦᓪᓗᑕ 2023/24, 1 ᐅᒡᕙᓅᓐᓃᑦ 2 ᐱᓇᓯᐊᖃᑕᐅᔪᑦ ᐃᓚᒥᔭᐅᑲᓐᓂᕐᓂᐊᖅᑐᑦ ᐃᓚᓐᓂᐊᕐᕕᒃᔪᐊᖓᓂᑦ ᐊᐃᐳᑕ ᐅᕙᑦᑎᓐᓂ ᐃᓚᐅᓂᐊᖅᑐᑦ. ᑕᐃᔅᓯᒨᖓ ᔪᓚᐃ 2022, ᑕᐃᒃᓂ ᑐᔪᕐᒥᓂᐊᖅᑐᒍᑦ ᕿᕿᔪᒥᒃ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᒥᒃ ᐱᓕᕆᑎᑦᑎᔾᔪᑕᐅᔪᖅ ᐃᓗᖁᑎᖓ ᖃᐅᓯᐃᑦᑐᕐᒥ ᐊᒻᒪᓗ 1 ᐅᒡᕙᓅᓐᓃᑦ 2 ᐅᓪᓗᖅ ᐃᓚᖏᓐᓇᖓᓂ ᐊᐅᓪᓚᖅᓯᒪᓗᑕ ᖁᓕᒥᒨᓕᒃᑯᑦ ᖁᓖᒎᓗᑕ ᑕᓪᓗᕆᑦ ᓯᖁ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᖅ ᖁᓖᒍᑦ ᓯᕐᒥᕕᓃᑦ ᑕᓯᕆᖅᓯᒪᔪᑦ. ᐋᕿᒃᓯᓂᐊᓐᖏᑦᑐᑦ ᑐᐱᕐᓂᒃ ᓯᓂᒃᑖᓐᖏᑦᑐᒍᑦ ᖄᖓᓂ ᕿᕿᔪᖅ ᓯᑯ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᖅ, ᐊᒻᒪᓗ ᖄᖓᓃᓪᓗᑕ ~4-5 ᐃᑲᕐᖁᓄᑦ. ᑕᐃᒃᓂ 2022 ᐊᐅᓪᓚᖅᓯᒪᓂᖏᓐᖔᑦ ᑕᐅᕗᖓ ᓄᓇᓕᖕᓂ ᖃᐅᔨᓴᖅᑎᖃᕐᓗᑕ ᑕᓪᓗᕆᑎ ᖄᖓᓂ ᓯᕐᒥᕕᓃᑦ ᑕᓲᑦ ᖃᐅᔨᓇᓯᒡᓗᑕ ᐃᓚᑦᑎᐊᕙᐅᖕᒫᖓᑦ ᓯᕗᓂᒃᓴᑦᑎᓐᓂ ᓂᐅᖅᑐᕐᕕᒥᓂᐊᕐᓗᒍ ᐊᒻᒪᓗ ᖃᐅᔨᓴᕆᑎᒃᓴᓂᒃ ᓄᐊᑦᑎᕕᒥᓗᒍ ᓯᑯᓂᒃ ᐊᐅᔭᖕᒥᓐᓂ 2023 ᐊᒻᒪᓗ 2024. ᐊᒻᒪᓗ ᐃᓂᖓᓂ ᖃᐅᔨᓴᕐᓗᑕ, ᐊᑐᖅᓯᓗᑕ ᒍᕚᒃᔅ ᓯᑯᒥᑦ ᓂᐅᖅᑑᑎᒥᒃ, ᓄᐊᑦᑎᓂᐊᖅᑐᒍᑦ ᖄᖓᓂᑦ ᓯᑯᓂᒃ ᖃᐅᔨᓴᕆᑎᒃᑕᖅᖕᓴᕐᓗᑕ (1-2 ᒦᑕ) ᖃᐅᔨᓇᓯᑦᑎᐊᕐᓂᐊᖁᑦᑕ ᐆᒪᔪᖕᒥᓐᓂᒃ ᓯᑯᓃᓰᓂᒃ ᑐᓄᐊᓂ ᐊᖕᒥᓐᓇᖅᑐᓄᑦ ᖃᐅᔨᓴᕆᑎᑦ ᒥᒥᐅ ᐃᓚᓐᓂᐊᕐᕕᒃᔪᐊᖓᓂ ᒪᓐᑐᓇᐊᒥ. ᐅᓇ ᐃᓚᖅᑲᖅᑐᖅ ᓄᑕᐅᔪᓐᓃᖅᑎᓪᓗᒥᑦ ᖃᐅᔨᓴᕐᓗᒥᑦ ᖁᐱᕆᖕᒥᑦ ᐆᒪᔪᑦ ᖄᖓᓂ ᓯᑯ ᐊᒻᒪᓗ ᖃᓄᖅ ᐆᒪᑎᒥᖕᒪᖕᒫᑕ ᖃᐅᔨᓇᓯᑦᑎᐊᕐᓗᒥᑦ ᑐᑭᓯᑦᑎᐊᕐᓂᐊᖁᑦ ᐊᔾᔨᒌᓐᖏᑦᑐᓂᒃ ᐊᒻᒪᓗ ᐆᒪᔪᖁᖖᓗ. ᖃᐅᔨᓴᕐᓂᐊᖅᑐᑦ ᖃᓄᖅ ᓯᑯ-ᐆᒪᕕᐅᖕᒪᖖᒋᑦ ᐅᒡᕙᓅᓐᓃᑦ ᓱᓕ ᐆᒪᖅᓯᒪᓐᖏᑦᑐᓂᒃ. ᐅᑯᐊ ᖃᐅᔨᓴᕆᑖᕗᑦ ᖃᐅᔨᓇᓱᖕᓂᐊᕐᒥᔪᑦ ᓯᕿᓂᕐᒧᑦ ᒥᑭᔪᓂᒃ ᐆᒪᔪᓕᐅᖅᐸᖕᒪᖖᒋᑦ ᖁᐱᕐᕈᓂᒃ, ᐅᑯᐊᓗ ᑭᓲᓂᖕᒥᓐᓂᒃ ᓇᓗᓇᐃᕐᓗᑎᒃ ᖁᐱᕈᑦ ᑲᑎᖕᒐᔪᑦ ᐊᒻᒪᓗ ᑕᑯᑎᑦᑎᓗᑕ ᐊᑐᖅᑕᑦᑎᓐᓂᒃ ᐊᑑᑎᖃᕐᒪᖖᒋᑦ ᐆᒪᔪᓄᑦ ᑭᓲᓂᖕᒥᓐᓂᒃ ᖃᐅᔨᑎᑦᑎᕙᒃᑐᑦ ᐊᑐᖅᑕᕗᑦ ᑖᒃᑯᐊ ᓯᕗᓂᒃᓴᑦᑎᓐᓂ ᓄᓇᕐᔪᐊᑦᑎᓐᓄᑦ ᖃᓄᐃᓕᐅᕆᑕᐅᔪᓐᓇᕐᒪᖖᒋᑦ. ᑕᐃᒃᓂ 2023 ᐊᒻᒪᓗ 2024 ᐊᐅᔭᖓᓂ ᓄᓇᒦᑎᓪᓗᑕ ᐃᓚᖃᕐᓕᐊᖅᑐᖅ ᐊᑯᓂᐅᓂᖅᓴᒥᒃ ᑕᐅᕙᓃᓪᓗᑕ ᖄᖓᓂ ᓯᑯ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᖅ. ᑕᐃᒃᓂ 2023/24 ᑕᒻᒦᖅᓯᒪᓂᐊᖅᑐᒍᑦ 4 ᑎᑭᓪᓗᒍ 5 ᐅᓪᓗᓄᑦ ᐊᑯᓂᐅᓂᖅᓴᐅᓂᐊᕈᑦᑕ 7 ᐅᓪᓗᓄᑦ ᑕᑭᖓᓂ ᒪᐃ. ᐱᓯᒪᓂᐊᖅᑐᒍᑦ ᐱᖁᑎᑦᑎᓐᓂᒃ ᐊᑐᓇᐊᖃᖅᑐᓂᒃ ᐊᑯᓂᐅᓂᖅᓴᐅᓂᐊᕈᑦᑕ ᐊᐅᓪᓚᖅᓯᒪᓗᑕ, ᖃᖓᑕᔫᖅ ᒥᑭᔪᖅ ᐊᑐᕐᓂᐊᖅᑕᕗᑦ ᓇᒍᖓᐅᔾᔪᑕᐅᑲᑦᑕᕐᓗᓂ ᐱᓇᓯᐊᖃᑎᒥᔭᑎᓐᓂᑦ ᑕᐃᑐᖓᐅᑎᔭᐅᕙᓪᓗᑎᒃ ᐊᒻᒪᓗ ᐊᖏᕐᖁᐅᑎᔭᐅᕙᓪᓗᑎᒃ. ᐊᑯᓂᐅᓂᖅᓴᒥᒃ ᑕᐅᕙᓃᑦᑕᓇᐊᖃᕈᑦ ᐊᒻᒪᓗ ᑕᒻᒦᖅᓯᒪᔭᓇᐊᖃᕈᑦ ᐃᓂᖓᓂ ᐊᑐᕐᓂᐊᖅᑐᒍᑦ ᓯᑯᐊᓂ ᐊᐅᒃᓯᕙᓪᓗᑕ ᐃᒥᖃᖅᑕᓗᑕ. ᑕᐃᒃᓂ 2023/24 ᐊᐅᒃᓯᓇᓯᖅᓂᐊᖅᑐᒍᑦ ᐊᕙᑖᓂ 50 ᑎᑭᓪᓗᒍ 100 ᒦᑕᔅ ᐊᑐᓇᐊᖃᖅᑕᕗᑦ ᐊᒥᓲᓐᖏᖅᑐᓄᑦ ᐅᓪᓗᓄᑦ ᖃᓄᖅ ᐊᐅᒃᓯᔪᓐᓇᖅᑎᒥᖕᒪᖖᒌᑦ ᓱᑲᓂᖓ ᐊᒻᒪᓗ ᐱᔭᕐᓂᓐᖏᑦᑑᖓᑕ ᖃᓄᓈᓂᖓ ᖄᖓᓂ ᓯᑯ ᕿᕿᔪᖅ ᐊᐅᒍᓐᓇᓐᖏᑦᑐᖅ. ᒪᓕᑦᑎᐊᕐᓗᒍᑦᑕᐅᖅ, ᓄᐊᑦᑎᓂᐊᖅᑐᒍᑦ ᐃᓗᐊᓃᓐᓂᖅᓴᓂᒃ ᓯᑯᓂᒃ ᐊᑐᖅᓯᓗᑕ ᒍᕚᒃᔅ ᓄᐅᖅᑑᑎᒥᒃ, ᒫᓐᓇᐅᔪᖅ ᐊᖏᓛᖅ ᐃᑎᓂᖓ 20 ᒦᑕᔅ ᐊᒻᒪᓗ ᐊᒡᔭᖅᑕᐅᓗᑎᒃ ᒥᒥᐅ ᐃᓚᓐᓂᐊᕐᕕᒃᔪᐊᖓᓄᑦ ᐊᖏᓐᓇᖅᑐᑎᒍᑦ ᖃᐅᔨᓴᕐᓗᒥᑦ ᑕᐃᒫᒃ ᓇᓗᓇᐃᖃᐅᔭᓐᓂ ᖁᓖᓂ. ᑕᐃᒃᓂ 2023/24 ᓄᓇᒦᑎᓪᓗᑕ ᐊᐅᔭᒃᑯᑦ, ᐱᓇᓯᐊᖃᑎᕆᑦ ᑕᐃᒃᖓᑦ ᐃᓚᓐᓂᐊᕐᕕᒃᔪᐊᖓᓂᑦ ᐊᐃᐳᑕ ᐸᒡᕕᖕᒥᓪᓗᑎᒃ ᖃᐅᔨᓴᕐᓕᐊᖅᑐᑦ ᐅᖓᓯᒃᑐᒥ ᖃᓄᖅ ᐊᒃᓯᕿᓐᖅᑐᒦᓕᖅᑎᒥᖕᒪᖖᒋᑦ ᓄᓇᖓ ᐊᒻᒪᓗ ᒪᓂᖁᖓ ᓯᕐᒥᕕᓃᑦ ᑕᓯᕆᖅᑐᓂ ᐊᒻᒪᓗ ᐊᕙᑎᓕᒫᖕᒥᑦ. ᐅᓇ ᑕᖕᒫᖅᓯᒪᕕᒥᔭᖅ 2023/24 ᑖᒃᑯᐊᖑᓂᐊᖅᑐᑦ 4-6 ᐃᓄᐃ ~5-7 ᐅᓪᓗᓄᑦ. ᑕᖕᒫᖅᓯᒪᕕᒥᔭᖅ ᐃᓚᖃᕐᓂᐊᖅᑐᖅ 5 ᑐᐱᕐᓂᒃ (2-3 ᓯᓂᒡᕕᑦ, 1 ᖃᓄᐃᓕᐅᕆᐊᖃᖅᑐᓄᑦ ᓴᓇᕕᒃ ᐊᒻᒪᓗ ᐃᒐᕕᒃ, ᐊᒻᒪᓗ 1 ᐊᓇᕐᕕᒃ ᐊᒻᒪᓗ ᓯᕐᓗᐊᖑᓗᒍ), 3 ᔭᓄᓚᐃᑕᔅ ᐊᒻᒪᓗ 3 ᐳᓪᓚᓃᑦ. ᑕᒪᕐᒥᒃ ᐊᑐᖅᑕᐅᔭᕇᖅᑐᑦ ᐃᒪᐃᑦ ᐊᒻᒪᓗ ᐊᓇᖅᑕᐅᑎᑦ ᔮᖅᑕᐅᑦᑎᐊᕐᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ ᐃᒥᑕᐅᓗᑎᒃ ᕿᕿᔪᓂ ᖃᐅᔨᓴᕐᕕᒃ ᖃᐅᓯᐃᑦᑐᕐᒥ. ᓂᕿᑦ ᐊᒻᒪᓗ ᑕᒪᕐᒥᒃ ᐊᓯᖕᒥᑦ ᐊᒃᑕᑯᑦ ᔮᖅᑕᐅᑦᑎᐊᕐᓂᐊᖅᑐᑦ ᐊᒻᒪᓗ ᐃᒥᑕᐅᓗᑎᒃ ᕿᕿᔪᓂ ᖃᐅᔨᓴᕐᕕᒃ ᖃᐅᓯᐃᑦᑐᕐᒥ. ᓄᓇᒥ ᓇᔪᖅᑕᕗᑦ ᕿᒪᖕᓂᐊᖅᑕᕗᑦ

ᑕᐃᒫᒃ ᐅᐸᓗᐅᖅᑕᑦᑎᑐᑦ ᐋᕿᒃᓯᒪᑦᑎᐊᕐᓗᓂ ᒥᑭᔪᒥᒃ ᓯᑯᒥᒃ ᖄᖓᓂ ᐊᒃᑐᐃᓂᐊᖅᑐᒍᑦ.

Inuinnaqtun: N/A

Personnel

Personnel on site: 4

Days on site: 2

Total Person days: 8

Operations Phase: from 2022-06-15 to 2024-07-31

ᐱᓕᕆᐊᕆᔭᐅᓂᐊᖅᑐᑦ

ᓇᒥ	ᖃᓄᐃᑦᑑᒥᑦ ᐱᓕᕆᐊᖃᕐᓂᐊᖅᐸ	ᑭᒃᑯᑦ ᓄᓇᖁᑖᓂ	ᑐᓴᐅᒪᔭᒃᓴᑦ ᓄᓇᐅᑉ ᖃᓄᖅ ᐊᑐᕋᐅᓚᐅᖅᓯᒪᔭᕆᐊᖓᓂᒃ	ᐃᑦᓴᕐᓂᑕᖃᕐᕕᐅᕙᓪᓚᐅᖅᐸ ᐃᓄᖕᓄᑦ ᓇᔪᖅᑕᐅᖃᑦᑕᕐᓂᑰᕙᓗ ᑕᐃᑦᓱᒪᓂᑐᖃᐅᓕᖅᑐᖅ	ᖃᓂᓐᓂᖅᐹᖅ ᓄᓇᓕᒋᔭᐅᔪᖅ ᐊᒻᒪᓗ ᓴᐳᒻᒥᒃᓲᕕᐅᕙᓗ ᓱᓇᓄᑦ
Devon Island Subglacial Lakes Region	Sampling sites	Crown	N/A	None. Not aware of any archeological/paleontological value of the ice cap.	Approximately 120 km to Grise Fiord which is the nearest community we're aware of. Approximately 120 km to Nirjutiqavvik National Wildlife Area (Coburg Island National Wildlife Area) which is the nearest protected area we're aware of.

ᓄᓇᓕᐅᑉ ᐃᓚᐅᖃᑕᐅᓂᖓ ᓄᓇᓖᓪᓗ ᐊᕕᒃᑐᖅᓯᒪᐅᕐᓂᖓᓄᑦ ᐃᑲᔪᑕᐅᔪᓐᓇᖅᑐᑦ

ᓄᓇᓕᒋᔭᖅ	ᐊᑏᑦ	ᑲᑐᔾᔨᐊᖃᑎᒌᒋᔭᖅ	ᖃᖓᓗ ᑐᓴᖅᑎᑕᐅᓚᐅᕆᐊᖅᒥᓐᓂᒃ
ᖃᐅᓱᐃᑦᑐᖅ ᕿᓯᓘᑦ	N/A	Hunter and Trappers Association of Resolute Bay	2022-11-01

ᓇᐃᓴᓐᓰᑦ ᐱᒍᓐᓇᐅᑏ ᐊᓐᕆᖅᑕᐅᓯᒪᔪᑦ

ᓇᒥᕆᐊᓐᕆᓐᓂᒃ ᐱᓕᕆᐊᕆᔾᕕᐅᓂᐊᖅᑐᑦ ᑎᑎᖄᓗᕆᑦ:

North Baffin

ᓇᐃᓴᓐᓰᑦ ᐱᒍᓐᓇᐅᑏ ᐊᓐᕆᖅᑕᐅᓯᒪᔪᑦ

ᒐᕙᒪᕆᔭᐅᔫᑉ ᐊᕕᒃᑐᖅᓯᒪᐅᖅᓂᓐᒐᓐᓂ ᒪᓕᒐᖅᔫᓐᒐᔪᓂᒃ ᐱᖁᔭᖅᔫᓐᒐᔪᓂᒡᓗ ᑲᒪᔩᑦ ᐱᔪᓐᓇᐅᑎᑖᕈᑎᓂᒃ ᓇᐃᓴᓐᓯᓄᓪᓗ ᑲᔪᓯᒃᑲᐃᔩᑦ	ᖃᓄᐃᑦᑐᓪᓚᕇᐅᕙ ᓇᐃᓴᓐᓯᑖᕈᑕᐅᔪᖅ ᐱᔪᓐᓇᐅᑎᑖᕈᑕᐅᔪᖅ ᐊᓐᕆᖅᑕᐅᔪᖅᑯᓐᓃᑦ	ᒫᓐᓇ ᖃᓄᐃᓕᓐᒐᕙ	ᐅᓪᓗᒥ ᑐᓂᔭᖅ/ ᑐᒃᓯᖅᑑᑕᐅᓚᐅᖅᓯᒪᔪᖅ	ᑭᒡᓕᖅᑲᖅᕕᓐᒐ
ᓄᓇᕗᑦ ᒐᕙᒪᖓ, ᖃᐅᔨᓴᖅᑐᓕᕆᔨᒃᑯᑦ	We have completed the NPC application and once this NIRB application is submitted we will be waiting on confirmation of the NRI license.	Active		

Project transportation types

Transportation Type	ᓱᓇᒧᑦ ᐊᑐᒐᐅᓂᐊᖅᐸ	Length of Use
Air	Helicopter or twin otter transportation from Resolute Bay (PCSP) to the top of the Devon Island ice cap	

Project accomodation types

Temporary Camp

ᐊᑐᒪᐅᓂᐊᖅᑐᖅ

ᐱᖁᑦ ᐊᖏᔪᖅ ᐊᑐᖅᑕᐅᓂᐅᓴᔪᖅ ᐃᓚᖃᓯᐅᑎᓗᒋᑦ ᐃᑰᑕᐃᑦ, ᒥᓪᓗᐊᕿᑏᑦ, ᖃᖓᑕᓲᖅ, ᓄᓇᓯᐅᑦ ᐊᓯᖏᓪᓗ

ᐊᖏᔪᖅ ᐱᖁᑦ ᐊᑐᒪᐅᓂᐊᖅᑐᖅ ᖃᓄᐃᑦᑑᓂᖓ	ᖃᑦᓯᐅᕙᑦ	ᐊᖏᓂᖏᑦ - ᐳᖅᑐᓂᖏᑦ	ᓱᓇᒨᑦ ᐊᑐᒪᐅᓂᐊᖅᐸ
Kovacs corer	1	0.2m x 0.2m x 1m	A corer which will be used to collect ice core samples 1 -2 meters into the subsurface of the ice cap.
SLUSH Drill system	1	0.57m x 0.57m x 5m	A drill developed by Honeybee Robotics used to drill into ice using a melt probe. In year one, the drill will be used to drill up to 2 meters into the subsurface of the ice cap and up to 100 meters by year 3 of the project.

ᑎᑎᕋᐅᓯᕆᓗᒍ ᐅᖅᓱᒃᓴᐃᑦ ᐊᑦᑕᓇᖅᑐᖅᑕᓖᓪᓗ ᐊᑐᖅᑕᐅᓂᐊᕐᓂᖏᑦ

ᓱᓇᒨᑦ ᐅᖅᓱᒃᓴᒡᒋᐊᖅ ᐊᑐᒪᐅᓂᐊᖅᐸ	ᖃᓄᐃᑦᑐᓪᓚᕆᐅᕙ	ᖃᑦᓯᐅᕙᑦ ᐅᖅᓱᒃᓴᖃᐅᑏᑦ	ᐆᒃᓴᐅᑉ ᐃᒪᖄᖅᑎᒋᔾᓇᕐᓂᖓ	ᑲᑎᓪᓗᒍ	ᐆᒃᓴᐃᑦ ᐊᒥᓲᓂᖏᑦ	ᓱᓇᒨᑦ ᐊᑐᒪᐅᓂᐊᖅᐸ
Propane	fuel	3	5	15	Gallons	Propane will be used in years 2 and 3 of the project (2023 & 2024) for heating and cooking while camping at the field site.
Other	fuel	1	2	2	Gallons	Gasoline/oil mix to be used to power a Honda 2 kw generator which will in turn be used to power the SLUSH drill.

ᐃᒪᖅ ᐊᑐᖅᑕᐅᔮᖅᑐᖅ

ᐅᓪᓗ ᑕᒫᖅ ᐊᑐᖅᑕᐅᓂᐊᖅᑐᖅ	ᖃᓄᖅ ᐃᒥᖅᑕᖃᑦᑕᕐᓂᐊᖅᐸᑦ	ᓇᑭᑦ ᐃᒥᖅᑕᖃᑦᑕᕐᓂᐊᖅᐸᑦ
0	Snow melt/bring from PCSP Resolute	PCSP Resolute

ᐊᑲᑕᔪᑦ

ᐊᑲᑕᔪᓪᓗᓂᐊᕐᓂᖅ

ᐱᓪᓗᐊᓗᐅᔾᔨᒪᔨᒍᑦ ᐱᓪᓗᐊᓗᐅᔾᔨᓂᐊᖅᑐᖅ	ᖃᖅᓄᐃᑦᑐᖅ ᐊᑲᑕᔪᖅ	ᖃᖅᓄᑎᒋ ᐊᑲᑕᔪᑦ ᓴᖅᑭᐊᓂᐊᖅᑐᓗᐅᔾᔪᑦ	ᖃᖅᓄᖅ ᐊᑲᑕᖅᑕᐅᓂᐊᖅᐸ	ᓴᓕᒻᒪᖅᓴᐅᑎᑲᓴᖅᓂᐅᓂᐊᖅᑐᑦ
Camp	ᐃᒪᐃᑦ ᐊᑐᖅᑕᐅᔾᔨᓇᖅᓯᒪᔪᑦ	50 liters	Transport back to and disposal at PCSP Resolute.	N/A
Camp	ᖃᓄᖅᑕᓪᓗᓂᖅ	50 liters	Transport in sealed containers back to PCSP Resolute for proper disposal.	N/A

ᐊᓯᑎᒥᐅᑕᓂᑐᑦ ᐊᑲᑐᖅᑕᐅᓯᒪᔪᑦ

We predict minimal environmental impact to the field site. In 2022 we only plan to spend up to 10 hours on the ice cap over the course of two days. No equipment and/or waste will be left in the field. All waste will be collected in waste containers and transported back to PCSP at Resolute Bay for disposal in the proper manner. For 2023 and 2024, we plan to camp at the field site for 4 - 5 days. During this time, human waste will be collected in sealed buckets and transported back to PCSP Resolute for proper disposal. All other waste material will be stored in trash bags and brought back to PCSP Resolute for proper disposal. We foresee causing very little impact on the field site. We perceive NO impact to Eskers and other unique or fragile landscapes, unlike what is stated in the form below, which will not save as such.

Additional Information

SECTION A1: Project Info

SECTION A2: Allweather Road

SECTION A3: Winter Road

SECTION B1: Project Info

SECTION B2: Exploration Activity

SECTION B3: Geosciences

SECTION B4: Drilling

SECTION B5: Stripping

SECTION B6: Underground Activity

SECTION B7: Waste Rock

SECTION B8: Stockpiles

SECTION B9: Mine Development

SECTION B10: Geology

SECTION B11: Mine

SECTION B12: Mill

SECTION C1: Pits

SECTION D1: Facility

SECTION D2: Facility Construction

SECTION D3: Facility Operation

SECTION D4: Vessel Use

SECTION E1: Offshore Survey

SECTION E2: Nearshore Survey

SECTION E3: Vessel Use

SECTION F1: Site Cleanup

SECTION G1: Well Authorization

SECTION G2: Onland Exploration

SECTION G3: Offshore Exploration

SECTION G4: Rig

SECTION H1: Vessel Use

SECTION H2: Disposal At Sea

SECTION I1: Municipal Development

ᒫᓐᓇ ᐊᕙᑎᐅᑉ ᖃᓄᐃᑦᑐᓪᓚᕆᐅᓂᖓ: ᓄᓇᐅᑉ ᖃᓄᐃᑦᑑᓂᖓ

The Devon Island ice cap is a large ice cap situated on the eastern side of the island. The ice cap has a maximum depth of ~900 meters. The top layer of the ice cap where the study will take place is mainly composed of firn and snow. Crevasses in the ice cap are also known.

ᒫᓐᓇ ᐊᕙᑎᐅᑉ ᖃᓄᐃᑦᑐᓪᓚᕆᐅᓂᖓ: ᐆᒪᔪᖅᑕᖃᕐᓂᖓ

There is no vegetation on the ice cap and to the best of our knowledge, there are no animal populations which reside on the ice cap.

ᒫᓐᓇ ᐊᕙᑎᐅᑉ ᖃᓄᐃᑦᑐᓪᓚᕆᐅᓂᖓ: ᐃᓄᓕᕆᓂᕐᒨᖓᔪᑦ-ᐱᕆᓪᓕᐊᔪᓕᕆᓂᕐᒨᖓᔪᑦ

The site is far from any community. Devon Island is uninhabited. We perceive it highly unlikely to encounter archaeological or culturally significant sites on the ice cap. There is no land or resource use on the ice cap.

Miscellaneous Project Information

Please see attached PCSP application form for details on training and measures used to mitigate emergencies while in the field. Please see attached document for our comprehensive spill prevention/plan. Our confirmation of application to the NPC is also attached.

ᓇᓗᓇᐃᖅᑕᐅᓂᖏᑦ ᐊᒃᑐᖅᑕᐅᓯᒪᔪᑦ ᖃᓄᐃᑦᑑᓂᖏᑦ ᐸᓚᐅᒥᙵᓯᖅᑕᐅᓂᐊᕐᓂᖏᓪᓗ

We perceive very little impact to the site. The only lasting impact to the site will be shallow bore holes in the top of the ice cap and one up to 100 meters deep by year 3 of the project. These boreholes are small in diameter (approximately 15 cm wide) and we expect them to fill in naturally after one Arctic winter/spring thaw. These boreholes will also be localized to an area of only 20 to 30 meters, minimizing their impact on the surrounding environment. All impacts on the site from human activity will be minimized by containing all waste materials and fluids in sealed containers which will be transport back to and disposed of properly at PCSP Resolute. No materials will be left at the site once work is completed.

Cumulative Effects

Aside from seasonal melt on top of the ice cap, the Devon Island ice cap is relatively unchanging year over year. We plan not to leave any evidence of our presence or work beyond a few localized shallow boreholes. These boreholes are predicted to fill naturally within one year, therefore we do not foresee any cumulative effects from our work on the environment.

Impacts

ᓄᓗᓄᐃᖅᑕᐅᓂᖅᑎᑦ ᐊᕐᑎᑎᒥᐅᑕᓂᑐᑦ ᐊᑲᖅᑕᐅᓯᒪᔪᑦ

	PHYSICAL	Designated environmental areas	Ground stability	Permafrost	Hydrology / Limnology	Water quality	Climate conditions	Eskers and other unique or fragile landscapes	Surface and bedrock geology	Sediment and soil quality	Tidal processes and bathymetry	Air quality	Noise levels	BIOLOGICAL	Vegetation	Wildlife, including habitat and migration patterns	Birds, including habitat and migration patterns	Aquatic species, incl. habitat and migration/spawning	Wildlife protected areas	SOCIO-ECONOMIC	Archaeological and cultural historic sites	Employment	Community wellness	Community infrastructure	Human health
ᓴᓇᓂᖅ																									
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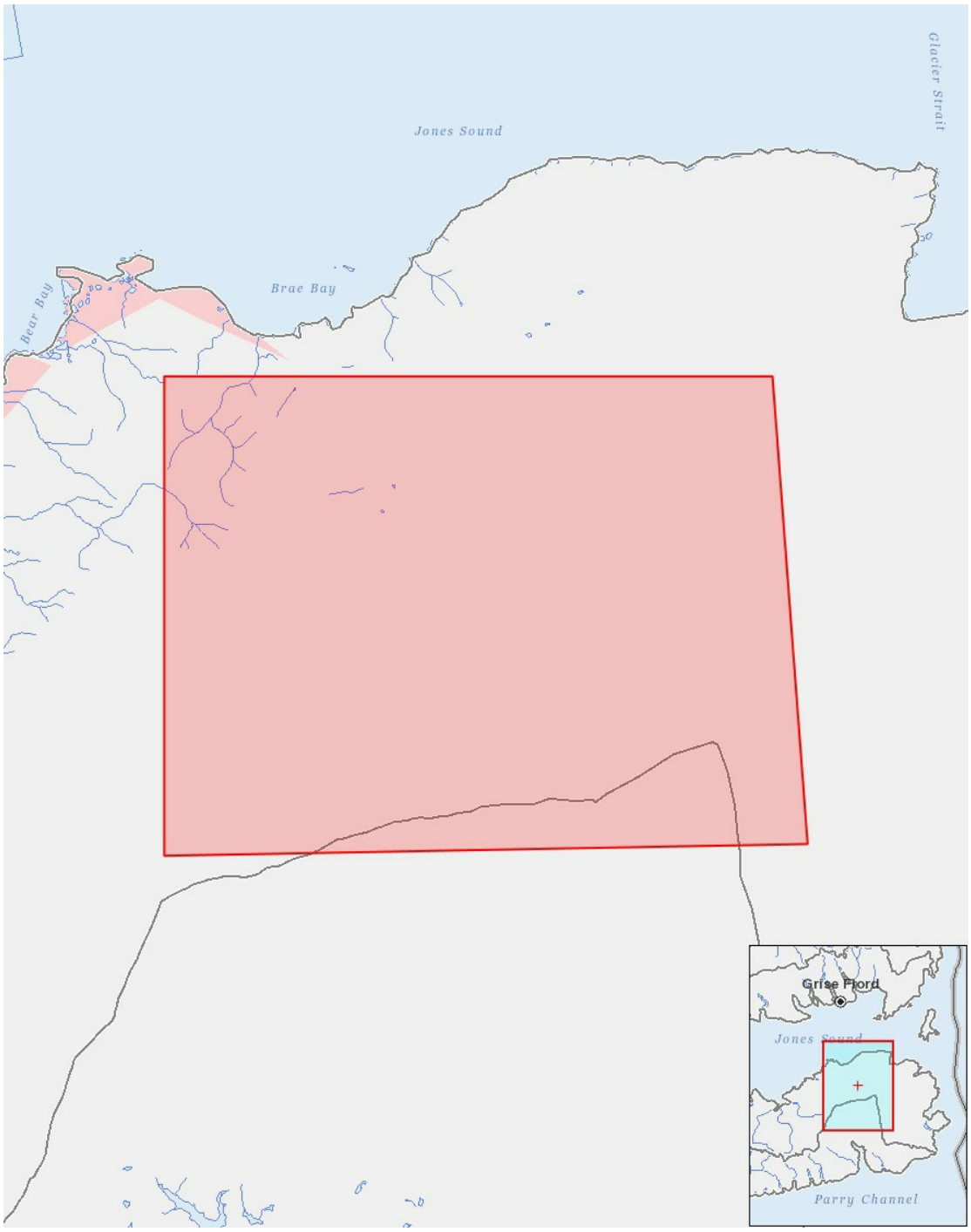
ᐅᔨᖁᑲᑕᖁᓂᖅ																									
Sampling sites		-	-	-	-	-	-	-	-	-	-	-	-		-	U	U	-	-		-	P	-	-	-
ᐃᑐᑦᑎᓇᓂᖅ																									
-		-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-		-	-	-	-	-

(P = ᐊᖅᐅᓭᑭᑎᓕᐅᓇᖅᑐᑦ, N = ᐊᖅᐅᖅᑭᔨᕐᑕᐅᓕᐅᓇᖅᑐᑦ ᕿᓚᐅᒥᔨᕐᓯᒪᖁᑐᑦᑕᐅᓕᐅᓇᖅᑭᑎᑦᓗ, M = ᐊᖅᐅᖅᑭᔨᕐᑕᐅᓕᐅᓇᖅᑐᑦ ᕿᓚᐅᒥᔨᕐᓯᒪᖁᑐᑦᑕᐅᓕᐅᓇᖅᑐᑦᓗ, U = ᖁᐅᐅᔪᒪᓂᖅᑭᑎᑦᑐᖅ)

ᓇᒋᒪᖏᕆᖅ ᐱᓕᓇᐊᓇᓴᐅᐯᐊᖅ



List of Project Geometries

1	polygon	Devon Island Subglacial Lakes Region