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Final report of activities for the 2023 Keewatin Glacial Dynamics project

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The landscapes we see today in northern Canada are a product of what happened during and since ancient glaciations. As the environment evolved with the rhythm of growth and decay of the ice sheets, it is paramount to understand the history of these glaciation and deglaciation cycles to provide a context for geological and environmental studies. Much is known about these glaciations in southern Canada, but north, extensive regions remain poorly studied because of their remoteness and hence knowledge there is limited. West-central Keewatin is one these regions where field data on glacial geology is lacking. In this context, a field season was planned in 2023 to gather field data on glacial geology in mainland Nunavut, focusing on the area surrounding Lake Dubawnt. The objectives of this fieldwork included documenting and sampling till materials, recording ice-flow indicators, and collecting boulders and bedrock samples to study glacial terrains. Additionally, we sampled littoral and deltaic sands to better understand the regional history of glacial lakes.

The scientific team comprised GSC research scientists and a student from the University of Quebec at Montreal, supported by a local wildlife expert (hired via Baker Lake HTO), a helicopter pilot, and Tukto Lodge staff. The main helicopter-based operations were conducted from the lodge situated on Mosquito Lake, Northwest Territories (62.492°N, 103.283°W), and two fuel caches were established to support the most distant operations. Field observations were recorded using the GSC Field Application (https://github.com/NRCan/GSC-Field-Application) on Samsung Toughpads equipped with built-in GPS capabilities. This software was integrated with the Surficial Data Model database, enabling the systematic recording of geological data. The team's work included documenting 108 ice-flow indicators at outcropping bedrock sites. These indicators, such as small-scale landforms and erosional features, provided critical information about the direction and chronology of ice flows in the region.

Thirty-seven till samples were collected from hand-dug soils following established protocols that include taking at each site small (~3-5 kg) and large bags (~10-15 kg) of fresh material from different soil horizons for different kind of physical and geochemical analyses. In addition, 40 granitic boulders and bedrock suitable for dating the age of the surface of the rock were sampled using a small portable rocksaw. A total of 6 samples were collected from sands of landforms linked to glacial lakes, such as beaches and deltas. These samples will be subjected to dating processes, contributing to a more comprehensive understanding of the region's glacial history. Additionally, 7 bedrock or cobble samples were collected for whole-rock geochemical analyses to identify their type and to provide representative examples for pebble count identification. Interestingly, the team encountered a unique green rock that stood out amidst the different rock types. This rock was identified as green quartzite, and further analyses will be conducted to determine potential sources and the means by which glaciers transported it to its current location.

Preliminary interpretations of the relative chronology and spatial relationship of ice-flow indicators suggest that 6 distinct major flow phases could be recorded.

The next steps involve analyzing these samples in the laboratory and integrating the results with field data to gain a deeper understanding of the region's glacial history. This will contribute to better exploration opportunities and understanding rapid ongoing changes in this northern Canadian region. Detailed information regarding the 2023 field activity will be made publicly available through the GEOSCAN platform of Natural Resources Canada, as an open file in late 2023 or early 2024.

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ᑭᖑᓪᓕᖅᐹᖅ ᐅᓂᒃᑳᖅ ᖃᓄᐃᓕᐅᕈᑎᓄᑦ 2023–ᒥ ᑭᕙᓪᓕᕐᒥ ᐊᐅᔪᐃᑦᑐᒥᒃ ᐱᓕᕆᐊᖃᕐᓂᕐᒥᒃ

ᐃᑎᐊᓐ ᐳᕌᑦ ᐊᒻᒪ ᔮᓇᑦ ᑳᒻᐳᓪ

ᓄᓇᓂᒃ ᖃᐅᔨᓴᕐᓂᖅ ᑲᓇᑕᒥ, ᓄᓇᓕᕆᔨᑦ ᐊᒻᒪ ᐅᔭᕋᖕᓂᐊᒐᒃᓴᓕᕆᔨᒃᑯᑦ, ᓄᓇᒥᙱᖅᓯᒪᔪᓕᕆᔨᒃᑯᑦ ᑲᓇᑕᒥ, 601 Booth St., Ottawa, ᐋᓐᑎᐅᕆᐅ, ᑲᓇᑕ, K1A 0E8

ᓄᓇᐅᑉ ᑕᐅᑦᑐᐊ ᐅᓪᓗᒥ ᑕᑯᕙᕗᑦ ᑲᓇᑕᐅᑉ ᐅᐊᓐᓇᖓᓂᑦ ᓴᓇᔭᐅᓯᒪᔪᖅ ᖃᓄᐃᓕᐅᕈᑕᐅᕙᓚᐅᖅᑐᓂᑦ ᑕᐃᒪᙵᓂᑦ ᓱᕐᒥᑐᖃᕐᓂᑦ. ᐊᕙᑎᕗᑦ ᐱᕈᖅᐸᓪᓕᐊᑎᓪᓗᒍ ᐊᒻᒪ ᓯᑯᐃᑦ ᓱᕋᒃᐸᓪᓕᐊᑎᓪᓗᒋᑦ, ᑐᑭᓯᐅᒪᔭᕆᐊᖃᓪᓚᕆᒃᐳᑦ ᓱᕐᕖᑦ ᐱᐅᓯᕆᕙᓚᐅᖅᑕᕆᐊᓂᒃ ᐊᒻᒪ ᓱᕐᕖᑦ ᐃᖏᕐᕋᓂᕆᕙᒃᑕᕆᐊᓂᒃ ᓄᓇᓕᕆᓂᖅ ᐊᒻᒪ ᐊᕙᑎᒥᒃ ᖃᐅᔨᓴᕐᓂᖅᑕᖃᖅᑯᓪᓗᒍ. ᖃᐅᔨᒪᔭᐅᕐᔪᐊᖅᑐᑦ ᑖᒃᑯᐊ ᓱᕐᕖᑦ ᖃᓪᓗᓃᑦ ᓄᓇᖓᓐᓂ, ᑭᓯᐊᓂ ᐅᑭᐅᖅᑕᖅᑐᒥ, ᓄᓇᓖᑦ ᖃᐅᔨᓴᖅᑕᐅᑦᑎᐊᙵᕆᓐᓇᖅᐳᑦ ᐅᖓᓯᒌᓂᕆᓐᓄᑦ ᐊᒻᒪ ᑕᐃᒪᐃᓐᓂᖓᓄᑦ ᖃᐅᔨᒪᓂᕆᑦ ᐱᑕᖃᑦᑎᐊᙱᕐᓗᐊᕐᓂᕆᓐᓄᑦ. ᐱᖓᓐᓇᖅᐸᓯᖓᓂ ᑭᕙᓪᓕᕐᒥ ᐃᓚᕆᔭᐅᔪᖅ ᑖᒃᑯᓇᓂ ᐊᕕᒃᑐᖅᓯᒪᓂᐅᔪᓂ ᖃᐅᔨᓴᕝᕕᐅᔪᓂ ᓱᕐᒥᐅᑉ ᓄᓇᖓᓂ ᐱᑕᖃᑦᑎᐊᙱᕐᓗᐊᕐᓂᖓᓄᑦ. ᑕᒪᓐᓇ ᐱᔾᔪᑎᒋᓪᓗᒍ, ᓄᓇᒥ ᐱᓕᕆᐊᑦᑎᐊᓕᓪᓗᑎᒃ ᐸᕐᓇᐃᓚᐅᖅᐳᑦ 2023-ᒥ ᑲᑎᖅᓱᐃᔭᓕᓪᓗᑎᒃ ᓯᓚᒥ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᓱᕐᒥᐅᑉ ᒥᒃᓵᓄᑦ ᓄᓇᖅᐸᓯᒃᑐᒥ ᓄᓇᕗᒻᒥ, ᑲᒪᒋᔭᐅᓪᓗᐊᑕᕐᓗᓂ ᑕᓯᐅᑉ ᖃᓂᒋᔭᓂ. ᑐᕌᖓᔭᐅᔪᑦ ᑕᒪᑐᒪᓂ ᐱᓕᕆᓂᕆᔭᐅᔪᒥ ᐃᓚᖃᓚᐅᖅᐳᑦ ᑎᑎᕋᖅᓯᕙᓪᓕᐊᓂᕐᒥᒃ ᖃᐅᔨᓴᒐᒃᓴᓂᓪᓗ ᐱᖁᑎᓂᒃ, ᑎᑎᕋᖅᐸᓪᓕᐊᓂᕐᒥᒃ ᓯᑯᐅᑉ ᐃᖏᕐᕋᓂᖓᓄᑦ ᖃᐅᔾᔪᑕᐅᔪᓐᓇᖅᑐᓂᒃ, ᑲᑎᖅᓱᐃᓂᕐᒥᓪᓗ ᐅᔭᕋᓱᒡᔪᖕᓂᒃ ᖃᐃᖅᓱᐃᓚᕐᓂᓪᓗ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ ᖃᐅᔨᓴᕐᓂᐊᕐᓗᓂ ᓱᕐᒥᐅᑉ ᒪᓂᕋᖓᓂᒃ. ᐊᒻᒪ ᓱᓕ, ᖃᐅᔨᓴᓚᐅᖅᐳᒍᑦ ᖃᓕᕋᕐᓂᒃ ᐊᒻᒪ ᓯᐅᕋᕐᓂᒃ ᑐᑭᓯᒃᑲᓐᓂᕈᒪᓪᓗᑕ ᐊᕕᒃᑐᖅᓯᒪᔪᓂ ᐱᐅᓯᓕᔭᐅᕙᓚᐅᖅᑐᓂᒃ ᓱᕐᒥᐊᓘᑉ ᑕᓯᕐᖏᓐᓂᒃ.

ᖃᐅᔨᓴᖅᑎᑦ ᐅᑯᐊᕈᓚᐅᖅᐳᑦ GSC–ᑯᑦ ᖃᐅᔨᓴᖅᑎᖏᑦ ᐊᒻᒪ ᐃᓕᓐᓂᐊᖅᑎ ᑯᐸᐃᖕᒥ ᓯᓚᑦᑐᖅᓴᕐᕕᒡᔪᐊᖕᒐᓂ ᒪᓐᑐᕆᐊᒥ, ᐃᑲᔪᖅᓯᖅᑕᐅᓪᓗᑎᒃ ᓄᓇᓕᖕᓂ ᐆᒪᔪᓕᕆᔨᒻᒪᕆᖕᒍᑦ (ᖃᒪᓂ'ᑐᐊᕐᒥ ᐊᖑᓇᓱᒃᑐᓕᕆᔨᒃᑯᑎᒍᑦ), ᖁᓕᒥᒍᓕᒃᑯᑦ ᐊᖁᑎ, ᐊᒻᒪ ᑐᒃᑐ ᑐᔪᕐᒥᕝᕕᒥ ᐃᖅᑲᓇᐃᔭᖅᑎᑦ. ᖁᓕᒥᒍᓕᒃᑯᑦ ᐊᐅᓚᓂᓪᓗᐊᑕᐅᔪᑦ ᐱᓕᕆᐊᖑᓚᐅᖅᐳᑦ ᑐᔪᕐᒥᕝᕕᖕᒥᑦ Mosquito Lake-ᒥ, ᓄᓇᕗᐊᒥ (62.492°N, 103.283°W), ᒪᕿᕐᓂᓪᓗ ᐅᖅᓯᐊᓗᖕᓂᒃ ᕿᖕᓂᔭᐅᓂᑯᓂᒃ ᐋᖅᑭᒃᓯᔪᖃᓚᐅᖅᓗᓂ ᐃᑲᔪᖅᑐᐃᔭᓕᓪᓗᑎᒃ ᐱᐅᙱᓐᓂᖅᐹᓂᒃ ᐊᐅᓚᓂᕆᔭᐅᔪᓂᒃ. ᓯᓚᒥ ᓇᐅᑦᑎᖅᓱᖅᓃᑦ ᑎᑎᕋᖅᑕᐅᓚᐅᖅᐳᑦ ᐊᑐᖅᑐᖃᖅᓗᓂ GSC–ᒧᑦ ᓯᓚᒥ ᐱᓇᔪᑎᕆᔭᐅᔪᒥᒃ (https://github.com/NRCan/GSC-Field-Application) ᐅᕙᓂ, Samsung Toughpads–ᒧᑦ ᐱᓯᒪᔪᓂᒃ ᓴᓇᔭᐅᓯᒪᔪᓂᒃ ᑕᒻᒪᕆᒃᑯᑎᓂᒃ ᐊᔪᙱᓐᓂᖃᖅᑐᓂᒃ. ᑖᓐᓇ ᖃᕆᓴᐅᔭᓕᕆᔾᔪᑎ ᐃᓚᓕᐅᔾᔭᐅᓚᐅᖅᐳᖅ ᖃᕆᓴᐅᔭᒃᑯᑦ ᑎᑎᕋᖅᓯᒪᔪᑦ ᖃᐅᔨᓴᖅᑕᐅᓂᑯᑦ ᖃᕆᓴᐅᔭᒃᑯᑦ ᑐᖅᑯᖅᑐᐃᕝᕕᖕᒥ, ᖃᕆᓴᐅᔭᒃᑯᑦ ᑎᑎᕋᖅᐸᓪᓕᐊᔪᓐᓇᖅᓯᓪᓗᑎᒃ ᓄᓇᐅᑉ ᖃᓄᐃᓕᖓᓂᖓᓂᒃ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ. ᐱᓕᕆᖃᑎᒌᑦ ᐱᓕᕆᐊᖏᑦ ᐃᓚᖃᓚᐅᖅᐳᑦ ᑎᑎᕋᖅᐸᓪᓕᐊᓂᕐᒥᒃ 108–ᓂᒃ ᓯᑯᒥ–ᑯᒃᐸᓪᓕᐊᔪᓄᑦ ᓇᓗᓇᐃᖅᓯᔾᔪᑎᓂᒃ ᖃᐃᖅᓱᕆᓂᒃ ᖃᐃᖅᓱᕆᓂᒃ. ᑖᒃᑯᐊ ᓇᓗᓇᐃᖅᓯᔾᔪᑏᑦ, ᓵᕐᓗ ᒥᑭᔪᑦ ᓄᓇᐃᑦ ᐊᒻᒪ ᓄᖑᑉᐸᓪᓕᐊᓂᖏᑦ, ᐱᒻᒪᕆᐅᔪᓂᑦ ᑐᑭᓯᕆᐊᕈᑎᖃᖅᑎᑦᑎᓚᐅᖅᑐᑦ ᑐᑭᒧᐊᖅᑎᑕᐅᓂᖏᓐᓄᑦ ᐊᒻᒪ ᑭᖑᓕᕇᒃᑕᖅᑐᑦ ᓯᑯᐃᑦ ᐃᖏᕐᕋᓂᖏᓐᓂᑦ ᐊᕕᑦᑐᖅᓯᒪᔪᓂᑦ.

37-ᓂᒃ ᖃᐅᔨᓴᕐᕝᕓᓂᒃ ᑲᑎᖅᓱᐃᔪᖃᓚᐅᖅᐳᖅ ᐊᒃᑲᒧᑦ ᐃᔾᔪᕐᓂᑦ ᒪᓕᒃᑐᖃᓚᐅᖅᑎᓪᓗᒍ ᐋᖅᑭᒃᑕᐅᓯᒪᕙᕆᐊᖅᑐᓂᒃ ᐊᑐᖅᑕᐅᕙᒃᑐᓂᒃ ᐃᓚᖃᖅᑐᓂᒃ ᐊᑐᓂᑦ ᐃᓂᓂ ᒥᑭᑦᑐᓂ (~3-5 kg) ᐊᖏᔪᓪᓗ ᐆᑦ (~10-15 kg) ᓄᑖᓂᒃ ᐱᖁᑎᓂᒃ ᐊᔾᔨᒌᙱᑦᑐᓂᑦ ᐃᔾᔪᓂᑦ ᐊᔾᔨᒌᙱᑦᑐᓂᑦ ᑎᒥᖏᓐᓂᙳᖅᑐᓂᒃ ᖃᐅᔨᓴᕐᕝᕓᑦ. ᐊᒻᒪ ᓱᓕ, 40–ᓂᒃ ᐅᔭᖅᑲᓂᒃ ᐅᔭᕋᓪᓗᔪᐊᓂᒃ ᐊᒻᒪ ᖃᐃᖅᓱᕆᓂᒃ ᐅᔭᖅᑲᓂᒃ ᖃᐅᔨᓴᕐᕝᕓᓂᒃ ᖃᐅᔨᓴᕐᕝᕓᓂᒃ ᐊᑐᖅᐸᑎᒃ. ᑲᑎᔾᔨᑦ 6–ᓂᒃ ᖃᐅᔨᓴᕐᕝᕓᓂᒃ ᑲᑎᖅᓱᐃᔪᖃᓚᐅᖅᐳᖅ

ᓯᐅᕋᕐᓂᑦ ᓄᓇᒥᙵᖅᑐᓂᒃ ᐊᒃᑐᐊᓂᓕᖕᓂᑦ ᓯᕐᒥᓄᑦ ᑕᓯᕐᓄᑦ, ᓲᕐᓗ ᕿᖕᓂᙳᓇᖅᑐᓄᑦ ᐊᒻᒪᓗ ᑎᐱᖕᖏᓄᑦ. ᑖᒃᑯᐊ ᖃᐅᔨᓴᖃᒃᓴᑦ ᐱᔾᔪᑎᖃᕐᓂᐊᖅᑐᑦ ᐱᓕᕆᐊᖑᕙᓪᓕᐊᔪᓂᒃ, ᐃᑲᔫᑕᐅᓗᑎᒃ ᐊᑕᖅᕆᓂᖅᓴᒃᑯᑦ ᑐᑭᓯᐊᓕᕐᓗᒋᑦ ᐊᕕᒃᑐᖅᓯᒪᔪᑦ ᓯᕐᕖᑦ ᐱᐅᓯᕆᕙᓚᐅᖅᑕᖏᓐᓂᒃ. ᐊᒻᒪ ᓱᓕ, 7−ᓂᒃ ᖃᐃᖅᓱᕆᓂᒃ ᐅᑦᕙᓘᓐᓅᑦ ᖃᓪᓗᓈᖅᑕᓂᒃ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ ᑲᑎᖅᓱᐃᓚᐅᖅᐳᑦ ᐃᓗᐃᑦᑐᕐᒧᑦ ᓄᓇᐅᑉ ᐃᓚᐅᕈᑎᒃᓴᖏᓐᓂᒃ ᖃᐅᔨᓴᖅᑕᐅᓪᓗᑎᒃ ᖃᓄᐃᑦᑑᓂᖏᓐᓂᒃ ᐊᒻᒪ ᑭᒡᒐᖅᑐᐃᔾᔨᓂᒃ ᐆᒃᑑᑎᖃᕐᓗᑎᒃ pebble ᓈᓴᐃᓂᕐᒧᑦ ᓇᓗᓇᐃᒃᑯᑕᓂᒃ. ᐱᒃᑯᒥᓇᖅᑐᖅ, ᐱᓕᕆᖃᑎᖏᑦ ᑕᑯᓚᐅᖅᑐᑦ ᐊᔾᔨᐅᙱᑦᑐᒥᒃ ᑐᖑᔭᕈᔪᒃᑐᒥᒃ ᐅᔭᕋᖕᒥᒃ ᓴᖅᑮᔭᖅᑐᒥᒃ ᐊᔾᔨᖏᖏᑦᑐᓂᒃ ᐅᔭᖅᑲᓂᒃ. ᑖᓐᓇ ᐅᔭᕋᖅ ᓇᓗᓇᐃᖅᑕᐅᓚᐅᖅᐳᖅ ᑐᖑᔭᕈᔪᒃᑐᖅ ᐅᔭᕋᒃ, ᖃᐅᔨᓴᖅᑕᐅᒃᑲᓐᓂᕐᓗᑎᓪᓗ ᖃᐅᔨᓇᓱᒡᓗᑎᒃ ᓇᑭᙵᕈᓐᓇᕋᔭᕐᒪᖔᑦ ᖃᓄᕐᓗ ᓯᕐᕖᑦ ᐊᐅᓪᓚᖅᑎᑕᐅᓚᐅᕐᒪᖔᑦ ᒫᓐᓇ ᐃᓂᒋᔭᖓᓄᑦ.

ᓯᕗᓪᓕᖅᐸᖅᓯᐅᑎᑦ ᑐᑭᓕᐅᖅᑕᐅᔪᑦ ᐊᒃᑐᐊᓂᓖᑦ ᑭᖑᓕᕇᒃᐸᓪᓕᐊᔪᑦ ᐊᒻᒪ ᐅᖓᓯᖏᕐᓂᖏᑦ ᓯᑯᒥ−ᑰᖅᑐᑦ ᓇᓗᓇᐃᒃᑯᑕᑦ 6−ᖑᔪᑦ ᐊᔾᔨᒌᙱᓐᓂᖏᑦ ᑰᖕᓂᐅᓪᓗᐊᑕᖅᑐᑦ ᑎᑎᕋᖅᑕᐅᔪᓐᓇᕐᓂᖏᓐᓂᒃ.

ᕿᖑᓪᓕᕐᒥ ᐱᓕᕆᐊᖑᔪᒃᓴᑦ ᖃᐅᔨᓴᕆᐊᖃᓛᖅᑐᑦ ᑖᒃᑯᓂᖓ ᖃᐅᔨᓴᒐᒃᓴᓂᒃ ᖃᐅᔨᓴᕐᕕᖕᒥ ᐊᒻᒪ ᐃᓚᓕᐅᔾᔭᐅᓗᑎᒃ ᖃᓄᐃᓕᖓᓕᕐᓂᕆᔭᖕᒋᑦ ᓄᓇᒥ ᑎᑎᕋᖅᓯᒪᔪᓂᒃ ᑐᑭᓯᒃᑲᓐᓂᕈᒪᓗᒋᑦ ᐊᕕᒃᑐᖅᓯᒪᔪᓂ ᓯᕐᕖᑦ ᐱᐅᓯᕆᕙᓚᐅᖅᑕᖏᓐᓂᒃ. ᑕᒪᓐᓇ ᐃᑲᔪᕐᓂᖃᕐᓂᐊᖅᑐᖅ ᕿᓂᕐᓂᕐᒥᒃ ᐊᒻᒪᓗ ᑐᑭᓯᐅᒪᓂᕐᒥᒃ ᐊᓯᔾᔨᖅᐸᓪᓕᐊᖏᓐᓇᖅᑐᓂᒃ ᑕᒫᓂ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑲᓇᑕᒥ. ᓇᓗᓇᐃᔭᖅᓯᒪᔪᑦ ᑐᓴᐅᒪᔭᒃᓴᑦ ᐱᔾᔪᑎᓖᑦ 2023−ᒥᑦ ᓯᓚᒥᑦ ᖃᓄᐃᓕᐅᖕᓂᐅᔪᑦ ᑭᒃᑯᓕᒫᓄᑦ ᐊᑐᐃᓐᓇᐅᑎᑕᐅᓛᖅᑐᑦ ᓄᓇᙳᐊᓕᕆᔨᒃᑯᑦ ᑲᓇᑕᒥᑦ ᓄᓇᒥᙵᖅᓯᒪᔪᓕᕆᔨᒃᑯᑦ ᑲᓇᑕᒥᑦ, ᐅᒃᑯᐃᖓᓗᓂ 2023 ᐃᓱᖅᐸᓯᐊᓂ 2024−ᒥᓪᓘᓐᓂᑦ.