2015 Nunavut Research Licence Renewal Application: Wayne Pollard

2014 Scientific Research #02 009 14R-M (multi-year)

Project Title: The permafrost hydrology and environmental significance of perennial springs in the Expedition Fiord area, Axel Heiberg Island

Project Leader: Wayne Pollard, Department of Geography, McGill University,
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2015 Research Team: Wayne Pollard, Chris Omelon, Denis Lacelle, Dale Andersen, and 1 student field assistant.

2015 Fieldwork: Planned fieldwork includes April 17-24, July 5-10

2015 Field sites: Sites on Axel Heiberg Island, including Expedition Fiord area (79º 25'N; 90º 45'W), Strand Fiord (79º 05'N; 90º 00'W), Whitsunday Bay (79º05'N; 87º00'W), – same as previous years

Funding source: Natural Science and Engineering Research Council of Canada (NSERC) with logistical support from the Polar Continental Shelf Program.

Project Overview: This is an ongoing project concerned with the study of the hydrology and geomorphology of cold hyper-saline groundwater flow at several locations on Axel Heiberg Island. These springs are very unusual and provide valuable insights in to permafrost conditions and the hydrology in cold deep permafrost. Our results indicate that there are 3 distinct types of springs and that the local geology, specifically the diapiric formation of salt domes may modify permafrost conditions and create conditions that support ground water flow. The main objective of this research is to understand how cold (~0ºC), salty groundwater interacts with permafrost and the high Arctic polar desert environment (ecosystem). A second goal is to determine how these springs modify their surrounding landscape, and a third goal is to explain the unusual landforms associated with salt precipitates. Specific aims for 2015 are: (1) to determine if the main source of the groundwater is sub-permafrost recharge by local glaciers, (2) to characterize the tuffa-like salt structures found at 2 hyper-saline sites, and (3) to characterize the microbiology of springs and determine the role of bacteria in mineral precipitation. Over the past few years our studies have provided new information about the limiting conditions of water and microbial life related to cold temperatures, on meta-stable minerals like hydrohalite. These springs have no commercial value and our research is driven entirely by purely scientific questions.

Progress Report – 2014 Fieldwork. In 2014 we focused mainly on 2 hyper-saline springs at Whitsunday Bay and Strand Fiord. These springs are the focus of M,Sc. Research of M. Ward. Ms Ward has finished her fieldwork and is in the process of writing her thesis. In April 2014 we spent 5 days at the Whitsundy Bay site exploring the way cold air temperatures influence the type and pattern of mineral formation. A second day field trip on July 10 was also undertaken.

Ms Ward was able to measure temperature and flow rate measurements, collect water and salt samples, and make detailed measurements of the morphology of the various landforms produced by salt precipitation. We completed annual dGPS surveys of the ice and mound formations around the springs at Gypsum Hill, collected data from automatic weather stations as well as completing snow surveys (the latter are baseline data that form the core of environmental monitoring and climate change studies). Aerial surveys of springs in other locations on Axel Heiberg Island planned for June were not possible due to lack of aircraft support.. Analyses of salt deposits indicate the presence of a hydrated form of salt called hydrohalite, although not uncommon chemically the formation of large hydrohalite tufa structures is considered very unusual.

2015 Field Program: For 2015 we are planning a late winter visit – daytrip to collect hydrohalite material to replace samples lost due to a malfunction of my -20C freezer. Fieldwork in April will involve Pollard and Omelon. We will be based at the McGill Field Station at Expedition Fiord. The April observations are extremely important because it allows us to observe the nature and pattern of groundwater flow under cold conditions as well as allowing me to evaluate processes that occurred during the previous dark season. Pollard and Omelon will will focus on understanding the behaviour of saline groundwater under cold air temperatures and in particular the formation of surface ice deposits, frost mound structures and hydrohalite precipitates. We will collect water samples (~1 litre) for isotopic and major ion analyses that will be compared with previous year's observations. These analyses help us document changes underground flow systems and the importance of chemistry on both physical and biological processes. The isotope data will also help determine the origin and age of the groundwater. These studies improve our understanding about the physical, chemical and biological processes occurring within these spring systems. Field activities will also include mapping of ice and spring deposits, snow surveys and the collection of data from several automatic weather stations.

Significance: The results of this research provide new and valuable information about the behaviour of water in cold permafrost. Together with my students and colleagues we have identified important geological characteristics related to perennial spring occurrence as well as new and unusual biological features. The results of this work have lead to partnerships with NASA who believe that these springs may help in the planning for the exploration of Mars.

2015 ᓄᓇᕗᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᐱᓇᓱᑎ ᓄᑕᖑᓂᐊᕐᑎᑦᑎᓇᓱᒃᑐᖅ : ᕗᐊᐃᓐ ᐳᓚᑦ Wayne Pollard

2014 Scientific Research #02 009 14R-M (multi-year)

ᐱᓕᕆᐊᖓᑕ ᑕᐅᔭᐃᓂᖓ: ᖁᐊᖑᓂᖓᑕ ᐃᒥᖑᕐᐸᓪᓕᐊᓂᖓ ᐊᒻᒪᓗ ᐊᕙᑎᖓᑕ ᐊᒃᑐᐃᓯᒪᓂᖓ ᑯᓕᖅᐸᓪᓕᐊᔪᑦ ᓄᓇᖓᓂ Expedition Fiord area, ᕿᑭᖅᑕᒥ Axel Heiberg Island

ᖃᐅᔨᓴᖅᑎᐅᔪᖅ: ᑑᒃᑖᖅ ᕗᐊᐃᓐ ᐳᓚᑦ Dr. Wayne Pollard, ᐃᓕᓴᐃᔨᒻᒪᕆᒃ, ᓄᓇᒥᐅᑕᓕᕆᓂᕐᒧᑦ, ᐃᓕᓐᓂᐊᕐᕕᒃᔪᐊᒥ ᒪᒃᒋᐅᓪ McGill University, 805 Sherbrooke St. W. ᒪᓐᑐᕆᐊ, ᑯᐱᒃ. H3A 0B9

2015 ᖃᐅᔨᓴᖅᑎᐅᖃᑕᐅᔪᑦ: ᕗᐊᐃᓐ ᐳᓚᑦ Wayne Pollard, ᑯᕆᔅ ᐅᒥᓚᓐ Chris Omelon, ᑎᓂᔅ ᓚᓯᐅᓪ Denis Lacelle, ᑕᐃᐅᓪ ᐊᓐᑐᓴᓐ Dale Andersen, ᐊᒻᒪᓗ ᐊᑕᐅᓯᖅ ᐃᓕᓐᓂᐊᑎ ᐃᑲᔪᖅᑎ.

2015 ᐊᑐᖅᑕᐅᓂᐊᖅᑐᑦ ᖃᖓᒃᑯᑦ: ᐱᓕᕆᓂᐊᖅᑐᑦ ᐊᐃᕆᓕᑦ 17-24, ᔪᓚᐃ 5-10

2015 ᓄᓇᐃᑦ ᖃᐅᔨᓴᖅᕕᐅᔪᒪᔪᑦ: ᕿᑭᖅᑕᖓᓂ Axel Heiberg Island,ᐱᖃᓱᐅᑎᓗᒋᑦ Expedition Fiord area (79º 25'N; 90º 45'W), Strand Fiord (79º 05'N; 90º 00'W), Whitsunday Bay (79º05'N; 87º00'W), – ᐊᕋᓂᑐᑦ ᐅᐸᒃᑕᐅᓚᐅᖅᑐᑦ

ᑭᓇᐅᔭᖃᖅᑎᑕᐅᔪᖅ: ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᑐᓐᓂᖅᑯᑕᐅᕙᒃᑐᑦ ᓄᓇᒥᐅᑕᓕᕆᓂᕐᒧᑦ ᑭᒃᓕᓯᓂᐊᕐᓂᕐᒧᑦ ᐊᒻᒪᓗ ᐃᓗᓕᖕᒋᓐᓂᒃ ᐋᖅᑭᒃᓱᐃᓂᕐᒧᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ ᑲᑎᒪᔨᖕᒋᓐᓂᑦ Natural Science and Engineering Research Council (NSERC). ᓇᒧᖓᐅᔭᐅᑲᑕᒃᓂᖏᑦ ᐃᑲᔪᖅᑐᖅᑕᐅᔪᑦ ᐅᑯᓇᖓᑦ ᐅᑭᐅᖅᑕᖅᑐᒥ ᑲᓇᑕᐅᑦ ᓄᓇᖓᓂ ᐊᐅᓚᑕᐅᔪᑦ Polar Continental Shelf Program

ᐱᓕᕆᐊᖑᔪᖅ ᑕᑯᓕᒫᖅᑐᒍ: ᑲᔪᓯᓂᐊᖅᑐᖅ ᐱᓕᕆᐊᕆᔭᐅᖃᑦᑕᖅᓯᒪᔪᖅ ᖃᐅᔨᓴᕐᓂᐅᔪᖅ ᐃᒪᖑᕐᐸᓪᓕᐊᓂᖓ ᐊᒻᒪᓗ ᓄᓇᖓ ᓂᓚᓱᒃᑐᖅ ᒪᓂᕋᕐᒥᑦᑐᖅ ᐊᐅᒃᐸᓪᓕᐊᑎᓪᓗᒍ ᑯᓕᕐᐸᓪᓕᐊᔪᖅ ᐊᑕᐅᓯᐅᖑᑦᑐᓂ ᓄᓇᓂ ᕿᑭᖅᑕᒥ Axel Heiberg Island. ᑯᒃᐸᓪᓕᐊᔪᑦ ᐊᔾᔨᐅᖑᑦᑐᒃᒪᑕ ᐊᒻᒪᓗ ᖃᐅᔨᔭᐅᓇᓱᒃᑐᑦ ᖁᐊᖑᓂᖓ ᓄᓇᐅᑦ ᖃᓄᑎᒋ ᑕᐅᓄᖓᑎᒋᖅᓯᒪᒃᒪᖔᑦ. ᖃᐅᔨᓴᖅᑕᐅᓯᒪᔪᑦ ᐱᖃᓱᓂᕋᐃᓯᒪᒃᒪᑕ ᐊᔾᔨᒌᖏᑦᑐᑦ ᑯᒃᐸᓪᓕᐊᔪᑦ ᐊᒻᒪᓗ ᓄᓇᖓ, ᐱᑐᐊᖅᑐᒥᒃ ᓴᓇᖅᖃᔪᑦ ᑕᑯᐅᖑᖅᓯᒪᔪᑦ ᐊᓯᓪᓕᐅᑎᖃᖅᑕᖅᒪᖓᑕ ᖁᐊᖑᓂᖓᓄᑦ ᓄᓇᒥᑦᑐᓄᑦ ᐊᒻᒪᓗ ᑯᓕᕈᑕᐅᕙᒃᒪᖓᑕ. ᑐᕋᖓᖃᓗᐊᖅᑐᑦ ᖃᐅᔨᓴᕐᓂᕐᒥᒃ ᑐᑭᓯᔭᐅᓇᓱᒃᓗᓂ ᖃᓄᑎ ᓂᒃᓚᓱᒃᑎᑭᑎᓪᓗᒍ (~0ºC), ᑕᓇᐅᕈᔪᒃ ᐃᒪᖑᖅᓯᒪᔪᖅ ᖁᐊᖑᓂᖓᓄᐊᖅᑎᒋᖃᑦᑕᖅᒪᖔᑦ ᐊᒻᒪᓗ ᖁᑦᑎᒃᑐᒥ ᓄᓇᖓ ᐸᓂᖅᑐᒥᑎᓪᓗᒍ. ᐱᖃᑕ ᑐᕋᖓᐅᔪᖅ ᖃᐅᔨᓇᓱᒃᓗᑎᒃ ᑯᓕᖅᐸᓪᓕᐊᔪᑦ ᐊᖅᑭᒍᑎᕙᓪᓕᐊᒃᒪᖓᑕ ᓄᓇᖓ ᐋᖅᑭᒃᓯᒪᓂᖓᓄᑦ ᐱᖓᔪᖓᑦ ᑐᕋᖓᐅᔪᖅ ᑐᑭᓯᔭᐅᓇᓱᒃᓗᓂ ᓄᓇᖓ ᐋᖅᑭᒃᓯᒪᓂᖓ ᖃᓄᐃᒻᒪᑦ ᑕᐃᒪᐃᓕᖓᒃᒪᖔᑦ ᑕᓇᐅᖑᓂᖓᓂᑦᑐᑦ. ᑐᕋᖓᓂᓪᓗᑎᒃ ᐊᕋᒍᒧᑦ 2015 sfxaJ5: (1) ᖃᐅᔨᓇᓱᒃᓗᑎᒃ ᑯᓕᕐᐸᓪᓕᐊᓂᖓ ᐱᕆᐊᖅᓯᒪᒃᒪᖔᑦ ᐊᑖᓂᑦᑐᒥᑦ ᓄᓇᒥᒃ ᖁᐊᖑᓂᖓᓂᑦ ᓯᕐᒥᒥᖓᖅᑐᒥᒃᑐᓐᓂᑦ, (2) ᑐᑭᓯᔭᐅᓇᓱᒃᓗᑎᒃ ᑕᓇᐅᖑᓂᖏᑦ ᒪᓂᖃᕐᒥᑦᑐᑦ ᒪᕈᒃ ᑕᑯᔭᐅᓯᒪᔪᒃ ᑕᓇᐅᖃᕐᓂᖏᑦ, ᐊᒻᒪᓗ (3) ᑐᑭᓯᔭᐅᓇᓱᒃᑐᓂ ᐃᓗᓕᖏᑦ

ᑭᓱᒫᖓᑕ ᑯᓕᕐᐸᓪᓕᐊᒧᑦ ᐃᒪᖑᕐᐸᓪᓕᐊᔪᑦ ᐊᒻᒪᓗ ᐊᑐᐊᓂᖅᑎᑦ ᖁᐱᕆᕋᓛᑦ ᐅᔭᕋᖏᖓᕐᑐᑦ. ᐊᕋᒍᓂ ᐊᓂᒍᕐᑐᓂ ᖃᐅᔨᓴᕐᓂᕐᐹᑦ ᑐᑭᓯᕙᓪᓕᕈᑕᐅᓚᐅᕐᑐᖅ ᐃᒥᐅᓂᖓ ᐊᒻᒪᓗ ᖁᐱᕈᐃᑦ ᑭᒃᓕᒋᔭᖅᑎᓐᓂᒃ ᓂᒃᓚᓱᒃᑐᒥ, ᐅᔭᕋᒃᓂᓗ. ᑯᓕᕐᐸᓪᓕᐊᔪᑦ ᐃᒪᐅᓕᕐᐸᓪᓕᐊᔪᑦ ᑭᓇᐅᔾᔅᐅᑕᐅᔪᓐᓇᖅᑎᑦᑐᑦ ᖃᐅᔨᓴᕐᓂᓐᓪᓕ ᑭᒃᓕᓯᓂᐊᕐᓂᕐᒧᑐᐊᖅ ᐊᑐᕐᑕᐅᓂᐊᕐᑐᖅ.

ᖃᓄᐃᑉᐸᓪᓕᐊᓂᖓᑕ ᐅᓂᒃᑲᓕᐊᖑᔪᑦ - 2014 ᐱᓕᕆᐊᕆᔭᐅᔪᑦ 2014-ᒥ ᑐᕋᖓᖅᑲᓚᐅᕐᑐᒍᑦ ᒪᕈᒃᓂᒃ ᑕᕆᐅᖑᕐᓯᒪᔾᔪᒃᓂᒃ ᑯᓕᕐᐸᓪᓕᐊᔾᔪᒃᓂᒃ ᓄᓇᖓᓂ Whitsunday Bay ᐊᒻᒪᓗ Strand Fiord. ᑕᒃᑯᐊ ᑯᓕᕐᐸᓪᓕᐊᔪᑦ ᐱᓕᕆᐊᖑᒍᓂᐊᕐᑐᑦ ᐃᓕᓴᕆᔭᐅᓯᒪᔪᒧᑦ ᖃᐅᔨᓴᕐᑎᒧᑦ ᒥᓕᓴ ᑲᐊᑦ. ᑲᐊᑦ ᐱᔭᕆᕐᓯᓯᒪᔪᖅ ᐱᓕᕆᐊᒥᓂᒃ ᑎᑎᕋᕐᐸᓪᓕᐊᓕᕐᑕᖓᓗ ᐅᓂᒃᑳᖅᑎᑦ. ᐊᐃᕆᓕᒥ 2014 ᐅᓪᓗᓄᑦ 5 ᑕᕙᓂᓚᐅᕐᑐᒍ ᓄᓇᒥ Whitsundy Bay ᖃᐅᔨᓴᕐᓗᑎᒃ ᓂᒃᓚᓱᒃᑐᖅ ᐃᒃᐱᒃᓇᐅᑎᖕᒪᖓ ᑦᐅᔭᕋᒃᓄᑦ ᐊᓯᓪᓕᕐᐸᓪᓕᐊᓂᖓᓄᑦ. ᐱᖃᑕ ᐅᐸᒃᓂᕆᓚᐅᕐᑕᕗᑦ ᐅᓪᓗᖓᓂ ᔪᓚᐃ 10 ᑲᔪᓯᐊᓚᐅᕐᒥᔪᖅ. ᑲᐊᑦ ᐅᒃᑐᕋᕈᓴᓚᐅᕐᑐᖅ ᐅᖅᑯᓂᖓᓂᒃ ᑯᒃᐸᓪᓕᐊᓂᖓᓂᒃᓗ, ᐃᒥᕐᒥᒃᓗ ᖃᐅᔨᓴᖓᒃᓴᒥᒃ ᐱᓪᓗᓂ ᑕᕆᐅᕐᒥᒃᓗ ᐱᓪᓗᓂ, ᐊᒻᒪᓗ ᐅᒃᑐᕐᓗᓂ ᓄᓇᖓ ᐊᓯᓪᓕᕐᐸᓪᓕᐊᓂᖓ ᑕᕆᐅᕐᒧᑦ ᐊᓯᓪᓕᕐᑕᐅᓪᓗᓂ. ᐱᔭᕆᓚᐅᕐᑕᕗᑦ ᐊᖃᒍᑕᒪᑦ ᖃᐅᔨᓴᕐᓂᕗᑦ ᓂᓚᐅᓂᖓᓂᒃ ᐊᒻᒪᓗ ᖃᑦᑎᒃᓯᓕᕐᓯᒪᔪᑦ ᑯᒃᐸᓪᓕᐊᔪᒥᖓᕐᑐᑦ ᓲᕐᓯᓐᓂᐅᔪᑦ ᓯᕙᖓᔪᒥ ᓄᓇᒥ ᐊᑎᖅᑲᕐᑐᖅ Gypsum Hill, ᑲᑎᑦᑎᓚᐅᕐᑐᑦ ᖃᐅᔨᓴᖓᒃᓴᓂᒃ ᓯᓚᓐᓂᐊᕐᕙᒃᒥᑦ ᐊᒻᒪᓗ ᐊᐳᑎᒥᒃ ᖃᐅᔨᓴᕐᖓᒃᓴᓂᒃ (ᐊᐳᑎ ᐱᑎᐊᕐᕙᐅᓇᓱᒃᓂᖓ ᖃᐅᔨᓴᕐᓂᒃᑯᑦ ᐊᕙᑎᖓᓄᑦ ᖃᐅᔨᓴᕐᑕᐅᕙᓪᓕᐊᓂᖓᓄᑦ ᓯᓚᐅᓪᓗ ᐊᓯᓪᓕᕐᐸᓪᓕᐊᓂᖓᓄᑦ ᖃᐅᔨᓴᕐᓂᕐᒧᑦ). ᖃᖓᑕᓱᒃᑯᑦ ᐊᐢᐲᓕᐅᖓᐃᑦ ᑯᒃᐸᓪᓕᐊᓂᖅᑎᓐᓂᒃ ᕿᑭᕐᑕᒥ Axel Heiberg Islandᐸᕐᓴᒃᑕᐅᔪᑦ ᔪᓂᒥ ᑲᔪᓯᔪᓐᓇᓚᐅᖅᑎᑦᑐᑦ ᖃᖓᑕᓱᕐᑕᖅᑲᖅᑎᓐᓂᖓᓄᑦ. ᖃᐅᔨᓴᕐᓯᒪᔪᑦ ᑕᕆᐅᖑᓂᖓᓂᑦ ᐅᖅᑲᕐᓯᒪᔪᑦ ᐸᓂᕐᓯᒪᔪᑦ ᑕᕆᐅᑦ ᐱᑕᖅᑲᕐᓂᖓᓂᒃ, ᐱᑕᖅᑲᖅᑦᑕᕐᑐᖓᓗᐊᑦ ᑭᓯᐊᓂ ᐊᖅᑭᓇᕐᓘᑎᒃ ᑕᑯᒃᓴᐅᒃᑲᓚᖅᑭᒪᑕ ᐊᐢᐲᐅᖅᑎᑦᑐᐢᔪᑎᑭᔭᖅᑎᑦ.

2015 ᐱᓕᕆᓂᐅᓂᐊᕐᑐᖅ. 2015 ᐸᕐᓇᒃᑐᒍᑦ ᐅᑭᐅᒃᑯᑦ ᑕᑯᔭᕐᑐᕈᒪᓪᓗᑕ – ᐅᓪᓗᐃᓐᓇᕐᒥ ᑲᑎᑦᑎᓗᑕ ᒪᓂᕋᕐᒥᑦ ᐊᐳᑎᓂᒥᒃ ᐊᓱᐅᔩᔭᐅᓚᐅᕐᑐᓂᒃ ᖃᐅᔨᓴᖓᒃᓴᓂᒃ ᖁᐊᕐᑯᕙᖓ ᐱᐅᔪᓐᓂᓚᐅᕐᓂᖓᓄᑦ. ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᐊᐃᕆᓕᒥ ᐃᓚᐅᓂᐊᕐᑐᑦ ᐳᓚᑦ ᐊᒻᒪᓗ ᐅᒥᓚᓐ. ᐱᑎᐊᖅᑲᑦᑕᕐᓗᑎᒃ ᖃᐅᔨᓴᕐᕙᒃᒥᑦ ᒪᒃᑎᐅᓪ ᑲᖏᕐᓗᖓᓂ ᓄᓇᖓᓂ Expedition Fiord. ᐊᐃᕆᓕᓪ ᒥ ᖃᐅᔨᓴᕐᓂᐅᔪᑦ ᐱᒻᒪᕆᐅᒃᒪᑕ ᐱᔾᔪᑎᒋᓪᓗᒍ ᑕᑯᔭᐅᔪᓐᓇᕐᓂᐊᕐᒪᑕ ᖃᓄᑎᒋ ᖃᓄᐃᓕᐅᕐᐸᓪᓕᐊᓂᖅᑎᓪᓗ ᒪᓂᕋᕐᒥᑦᑐᑦ ᐃᒥᖑᕐᐸᓪᓕᐊᔪᑦ ᓂᒃᓚᓱᒃᑎᓪᓗᒍ ᖃᐅᔨᓴᕐᑕᐅᓗᓂᓗ ᐊᐅᓚᓂᖅᑎᑦ ᑖᕐᑎᓪᓗᒍ ᓯᓚ. ᐳᓚᑦ ᐊᒻᒪᓗ ᐅᒥᓚᓐ ᑐᑭᓯᓇᓱᒃᓂᐊᕐᑑᒃ ᑕᕆᐅᖑᓂᖓᓂᒃ ᒪᓂᕋᕐᒥᑦᑐᖅ ᓂᒃᓚᓱᒃᑎᓪᓗᒍ ᖃᑦᑎᒃᓯᓕᕐᓯᒪᔪᑦ ᓂᓚᐅᓂᖅᑎᑦ, ᓲᕐᓯᓐᓂᐅᔪᓪᓗ ᐊᒻᒪᓗ ᐊᐅᒃᐸᓪᓕᐊᑎᓪᓗᒍ ᐃᒪᖑᕐᐸᓪᓕᐊᔪᖅ. ᐃᒥᕐᒥᒃ ᐱᑲᑦᑕᓂᐊᕐᑐᑦ ᖃᐅᔨᓴᖓᒃᓴᓂᒃ (~1 litre) ᖃᐅᔨᓴᕐᑕᐅᓂᐊᕐᑐᓂᒃ, ᑕᒃᑯᐊ ᖃᐅᔨᓴᕐᑕᐅᔪᑦ ᐃᑲᔪᑕᐅᓂᐊᕐᒪᑕ ᑎᑎᕋᕐᑕᐅᔪᓐᓇᕐᓗᑎᒃ ᐊᓯᓪᓕᕐᐸᓪᓕᐊᔪᑦ ᒪᓂᕋᐅᑦ ᐊᑖᒍᖓᔪᑦ ᐃᒪᖑᕐᐸᓪᓕᐊᔪᑦ ᐊᒻᒪᓗ ᐃᓗᓕᖅᑎᑦ ᑕᑯᒃᓴᐅᔾᔪᒃᑯᑦ ᑕᑯᒃᓴᐅᖅᑎᑦᑐᒃᑯᓪᓗ. ᐃᑲᔪᑕᐅᓂᐊᕐᒥᔪᖅ ᓇᑭᖓᕐᓯᒪᒃᒪᖓᑦ ᖃᓄᑎᒋᓗ ᐱᑐᖃᐅᑎᒋᒃᒪᖓᑦ ᐃᒪᐅᓂᖓ. ᖃᐅᔨᓴᕐᓂᐅᔪᖅ ᑐᑭᓯᕙᓪᓕᕈᑕᐅᓂᐊᕐᑐᖅ ᑕᑯᒃᓴᐅᔪᑦ, ᐃᓗᓕᖅᑎᓪᓗ ᑕᑯᒃᓴᐅᖅᑎᑦᑐᓪᓗ ᐊᐅᓚᓂᖅᑎᑦ ᐃᒪᖑᕐᐸᓪᓕᐊᓂᖓᑕ. ᖃᐅᔨᓴᕐᓂᐅᔪᖅ ᓄᓇᖑᐊᓕᐅᕐᐸᓪᓕᐊᓗᑎᒃᓗ ᓂᓚᐅᓂᖅᑎᓐᓂᒃ ᐃᒪᖑᕐᐸᓪᓕᐊᔪᓪᓗ, ᐊᐳᑎᒥᒃᓗ ᓯᓚᓐᓂᐊᕐᕙᒃᒥᖓᕐᑐᑦ.

ᐊᑐᑎᖃᕐᓂᖏᔭᖓ: ᖃᐅᔨᓴᕐᓂᐅᔪᖅ ᓄᑕᓂᒃ ᐊᑐᑎᖃᕐᑐᓂᒃ ᑐᑭᓯᔭᐅᔾᔪᑕᐅᓂᐊᕐᑐᖅ ᐃᒥᖅ ᓂᒃᓕᓇᕐᑐᒥ ᖃᓄᕐ ᐊᐅᓚᓂᖃᓱᖑᖕᒪᖕᖓᑦ. ᐃᓕᓐᓂᐊᕐᑎᐅᔪᑦ ᐅᕙᖓᓗ ᐃᖅᑲᓇᐃᔭᕐᑐᓪᓗ

ᓇᓗᓇᐃᖏᓱᓕᐅᖏᑐᑦ ᓄᓇᖅᑐᓂᒃ ᖃᐅᔨᓴᖏᑕᐅᔪᒪᔪᓂᒃ ᑯᖓᖏᑦᑐᓕᐊᔪᓂᒃ ᐊᖏᔨᐅᖅᑎᑐᑦᓗ ᖃᐅᑎᒃᓯᓕᖏᑦᓂᒃ. ᐃᑲᔪᑕᐅᔪᓐᓇᖏᓂᐊᖏᒪᑕ ᖃᐅᐅᔨᐅᔪᑦ ᓯᓕᐃᓐᓇᐃᖏᑲᖏᑦᑐᓗᓄᑦ ᐃᒪᖓᖏᑦᑐᓕᐊᓂᖅᑐᒃ ᑐᑭᓯᔪᐅᔾᔪᓂ ᓄᓇᖏᔪᐊᑦ ᐊᓯᐊᓄᑦ ᐊᐅᑕᓴᕈᐅᔪᓐᓇᖏᖏᓐᓇᖅᑐᒥᑦ.