

Project Title: Periglacial Geomorphology investigation study in permafrost at the Houghton impact structure and surrounding terrains, Devon Island, Nunavut

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Location: Houghton Impact Structure on Devon Island, Nunavut (75.403° N, 89.747° W), 175 km from Resolute Bay, the nearest community.

Time Frame: From July 17, 2019, to August 4, 2019.

Number of people involved: 6

Project Description:

The Houghton Impact Structure (HIS) located on Devon Island, NU, is a 23 km diameter, 39 Ma meteoritic impact crater. This area and its surroundings is what can be qualified as a cold and dry polar desert, which is ideal conditions to study the crater geology and the geomorphology of the active periglacial processes. Well developed periglacial landforms are present on the site: gullies, patterned ground and polygons. Such landforms found inside the crater were noted as quite different in their geometry and active processes compared to those found outside the crater. We want to deepen our understanding of what the main controls shaping these differences. Also, those landforms are strikingly similar to other found in and around crater rims on Mars; thus their study on Devon provides answers as those are similar to their Martian analogues.

Our objective this year is to investigate the underground in relation to the periglacial landforms and ground ice using a geophysical approach such as field sampling, ground surveying and mapping with a focus on in-crater and out of crater differentiation.

Our base camp will be in the Houghton River Valley. Transportation to the site will be by Twin Otter to a landing strip near the camp. While on site, access to scientific sites will be accomplished using All Terrain Vehicles (ATV) and by walking. Propane will be used for cooking. Unleaded fuel in jerrycans to refuel ATV's will be stored at a secure distance from our tents in a designated spill-secure platform.

As a continuing project from previous years, no new consultation with communities was scheduled at this time, but we are aware of the following possible concerns expressed during previous consultations and discussions. The study site is located far from protected areas and parks but nevertheless, wildlife may be present, such as polar bears, foxes or migratory birds. If found or sighted, nests, dens or animals of any type will not be disturbed nor interacted with. No archeological sites are known to be located in the area – if we find a site, the location will be recorded and communicated to proper authority for further investigation. If using ATV's and an animal is sighted, alternative paths will be used.

Field supplies such as ammunition and fresh food will be bought at Tudjaat Co-op store at Resolute.

Water for camp use (approx. 0.1 m³ per day) will be collected from the nearby Houghton River. All combustible waste will be incinerated while all non-combustible waste will be returned to Polar Continental Shelf facilities for disposal.

At the conclusion of the field campaign, everything will be cleaned up and restored as it was when we arrived.

Methodology:

The specific objective of this project is to investigate the underground in relation to the periglacial landforms and ground ice using a geophysical approach such as field sampling, ground surveying and mapping.

Using high-resolution satellite imagery of gullies and polygons, we identify sites to visit in the field, in the crater and outside the crater. Before doing any fieldwork, we scan the landscape using a tripod-mounted LIDAR (Laser pointing device) to model the surface of interest. Further the morphologies observed in the satellite image will be ground truth in the field using a GPS. All numerical data will be processed using geographical information systems (GIS) in our laboratory at Western Ontario. We have a special interest in ice found underground: we will survey for ground ice using a ground-penetrating radar (GPR) and validate radar surveys by shallow permafrost coring, using a hand-portable drill. Cores will be frozen and analyzed for ice content and size of the grains in the soil. Finally, we will access the three weather stations to collect and download data for our long-term climate monitoring in the area.