

Annual Summary Report – Nunavut Research Institute
Geological Survey of Canada GEM-GeoNorth - *Geological Mapping of Boundary Structures*
License Number 03 021 23N-M

Project background

This activity proposes to develop new field and laboratory approaches to better understand the evolution of metamorphic rocks associated with ancient mountain belts. The area north of Rankin Inlet represents a major boundary between two large crustal blocks (the Rae and the Hearne cratons) that collided together 1.9 billion years ago. The rocks in this region are thought to preserve a prolonged record of this collisional process – yet, they have not been studied in detail and their record is poorly constrained.

The research undertaken as part of this project will result in the creation of modern geological maps of the bedrock exposed north of Rankin Inlet. The existing geological maps of the region are outdated and were mapped at low spatial resolution, having been created 50 years ago from very widely spaced observations and sampling (5-10 kilometers between sites). The techniques to classify, analyze and interpret a rock's history have changed significantly since the rocks were last mapped, such that these modern tools will provide a better understanding of the geology in this area. This research will provide baseline information about a 30 x 40 km site within region, including what types of rocks occur, when and how the rocks formed, and how the minerals and elements in the rocks were affected during metamorphism. Understanding of metamorphic processes in this area could help with identification of different mineral occurrences, including locations of carving stones and other building materials.

Fieldwork 2023

To update and improve our understanding of the bedrock geology north of Rankin Inlet, two weeks of fieldwork took place from July 7th to July 22nd, 2023. Dr. Daniele Regis, Dr. Duane Petts, Postdoctoral Researcher Dr. Riccardo Graziani, Prof. Desmond Moser and MSc student Trevor Matterson (Western University) were based in the community of Rankin Inlet. Bedrock mapping was supported by a wildlife monitor, Gordon Aupilarjuk, from Rankin Inlet (**Figure 1**).

Following the input from the Kangiqliniq HTO, the researchers conducted fieldwork from July 15th to July 18th and examined rocks in an area located 30-40 km north of Rankin Inlet (**Figure 2**). The crew was set out daily by helicopter from Rankin Inlet and conducted short hikes (5-10 kilometers) making observations of exposed bedrock, collecting information about the rock types, minerals, and recording these observations on small hand-held tablets (**Figure 1**). The research also utilized non-destructive, low-impact instruments such as GPS, digital cameras to take photos, compasses to take measurements, and rock hammers to collect samples of rocks. The samples collected ranged in size but were usually about the size of a human fist. All operations were carried out in a manner to minimize surface disturbances.



Figure 1: Fieldwork for this project consisted of examination of exposed rocks and entering of data into hand-held tablets and sample collection to contribute to a geoscience database for the area north of Rankin Inlet. This new field- and laboratory- based information will be incorporated into updated geology maps of the area as well as open data for public release.

Preliminary results have significantly improved and revised the geoscience knowledge of the area; our field observations revealed a complex geology with several, previously undocumented rock types, units and geologic structures. In total, 89 locations were mapped, and a total of 103 hand-sized samples were collected (site locations listed on **Figure 2**). The collected samples were shipped back to the Geological Survey of Canada laboratories in Ottawa where they were organized, described, and slabbled. Analyses are currently underway.

Fieldwork 2024

The team is proposing a second field season in late July 2024 to allow for further targeted sampling in the same area (**Figure 2**). Following discussions in July 2023 with the Kangiqliniq HTO, the proposed fieldwork will take place at the end of July when the caribou herd will have disseminated and dispersed away from the area of interest. We plan to be based in the community of Rankin Inlet approximately

between July 17th and July 30th, 2024, with helicopter-assisted fieldwork between July 22nd and July 26th. The research undertaken will result in the creation of detailed geological maps of the bedrock exposed north of Rankin Inlet, and more rock samples will be collected for analytical work.

In addition to creating detail geological maps, our research will contribute to an understanding of the geological history of the region, and how it relates to other parts of Nunavut.

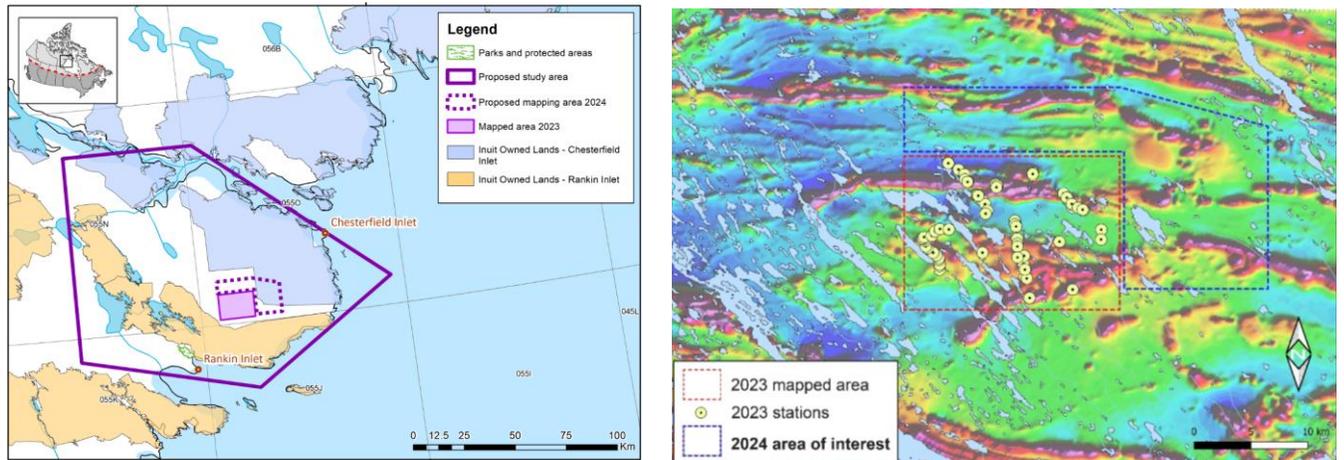


Figure 2: Map showing the area mapped in 2023 (with the location of stations where fist-sized samples were collected), and the area of interest for 2024 fieldwork.