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**GEOLOGICAL SURVEY OF CANADA
OPEN FILE 8655**

**Field data for till samples collected in 2014, 2015, and 2016 in the
Southern Core Zone, Quebec and Labrador (NTS 23-P and 23-I)**

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ABSTRACT

This Open File is a written summary of samples collected for indicator mineral and geochemical analysis during three summer field seasons (2014-2016) for the Hudson-Ungava Surficial Mapping and Geochemistry Activity. The activity was carried out under the larger Geo-Mapping for Energy and Minerals Program (GEM 2) Hudson-Ungava Core Zone project. Field data and colour photographs will be presented for samples collected as part of a reconnaissance-scale till sampling and surficial mapping activity carried out by the Geological Survey of Canada across Quebec and Labrador (NTS map sheets 23-I and 23-P) in collaboration with the Ministère de l'Énergie et des Ressources naturelles du Québec (MERNQ). This report also includes field data for previously collected samples from earlier GSC programs in 1986 and 1987 to allow for a comparison to recent samples.

INTRODUCTION

Mineral resource mapping in the remote regions of northwestern Quebec and northeastern Labrador is challenging in part because the bedrock is poorly exposed and/or is covered by glacial sediments. For significant portions of northern Quebec and Labrador, there are no existing surficial geology maps or mineralogical data to assist in mineral exploration. Additionally, the glacial sediments that blanket the bedrock have been deposited by a complex sequence of ice-flow phases related to the buildup, migration, and demise of the Ancestral Labrador ice divide, a major divide of the Laurentide Ice Sheet (LIS) (Dyke and Prest, 1987, Klassen and Thompson, 1989, 1993; Rice et al., 2019), further complicating drift prospecting efforts in the region.

To assist in future mineral exploration programs within these remote regions, the Geological Survey of Canada (GSC), as part of its Geo-mapping for Energy and Minerals 2 program (GEM 2), has produced modern publically available geoscience data to facilitate long-term decision making in these regions. Specifically, within northern Quebec and Labrador, the Core-Zone project was designed to assess the mineral potential in a previously understudied region.

This Open File reports sample site and location data for till samples collected in 2014, 2015, and 2016 as part of the reconnaissance-scale till sampling and surficial mapping carried out across the southern Core Zone. In addition to analyzing till samples collected during this activity, archival samples from GSC till sampling programs in 1986 and 1987 (Klassen and Thompson, 1993) have been analyzed using modern techniques to allow for a direct comparison between results.

LOCATION

The study area (Fig. 1), located within the southern extent of the Core Zone, is ~ 60 km east of the town of Schefferville, Quebec, in the Lac Résolution (NTS 23-P) and Woods Lake (NTS 23-I) map sheets, between 54°N and 56°N latitude and 64°W and 66°W longitude. The study area spans the drainage divide that marks the provincial boundary between Quebec and Labrador, separating northern flow to Ungava Bay and southern flow to the Labrador Sea. Bedrock investigations for the study area and surrounding regions have been carried out separately from

the surficial and geochemistry portion of this project and are summarized by Corrigan et al. (2015), Sanborn-Barrie (2016), and Corrigan et al., (2018).

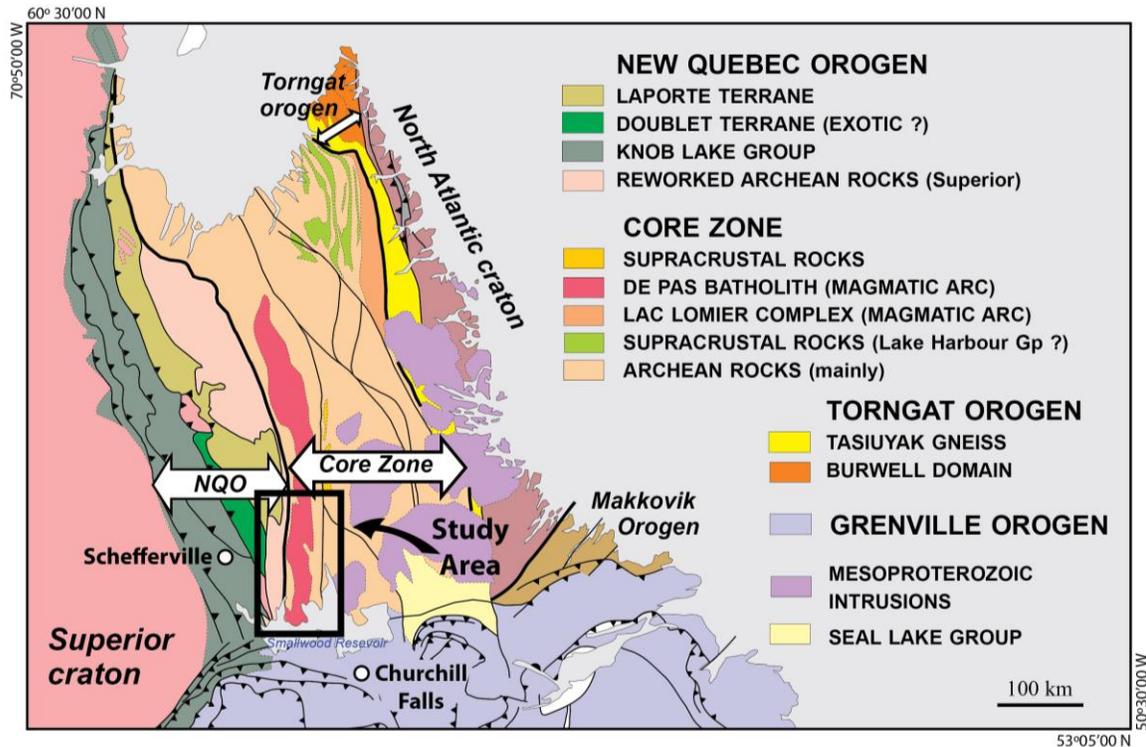


Fig. 1. Simplified bedrock geology map of the Core Zone and bounding orogens in Quebec and Labrador. The study area, within the southern Core Zone (NTS 23-P and 23-I) is outlined in black. Bedrock geology modified after James et al. (2003). Note: NQO= New Quebec Orogen.

TILL SAMPLING METHODS

Till samples were collected across the study area (Fig. 2) using established GSC protocols (Spirito et al., 2011; McClenaghan et al., 2013). Where possible, active frost boils were targeted for till sample collection at depths between 0.2 and 1.0 m. Sample sites in NTS 23-P were mainly from frost boils, as discontinuous permafrost is found throughout this map sheet. In the southern map sheet (NTS 23-I), south of the limit of discontinuous permafrost, till samples were collected by digging through the naturally developed soil profile, and sampling unoxidized till (C-horizon). Cobbles (clasts > 64 mm) were removed from till samples to maximize the amount of till matrix being collected. At each site, two samples were collected: a large till sample (averaging ~12 kg) for recovery of indicator minerals, and a ~ 3 kg sample for archiving and geochemical analysis. Locations for all till samples collected in 2014, 2015, and 2016, as well as samples reanalyzed from GSC archives from 1986-1987, are shown in Fig. 2. A single fine-sand sample (14-PTA-R055) was collected from a small hand-dug pit on a shoreline beach due to its concentration of heavy minerals and was submitted for indicator mineral assessment. Metadata for the project and samples are reported in Appendix A1. Location and other field data for till sample sites are reported in Appendix A2. Field site photos for most samples are included in Appendix B and organized by year and sample site.

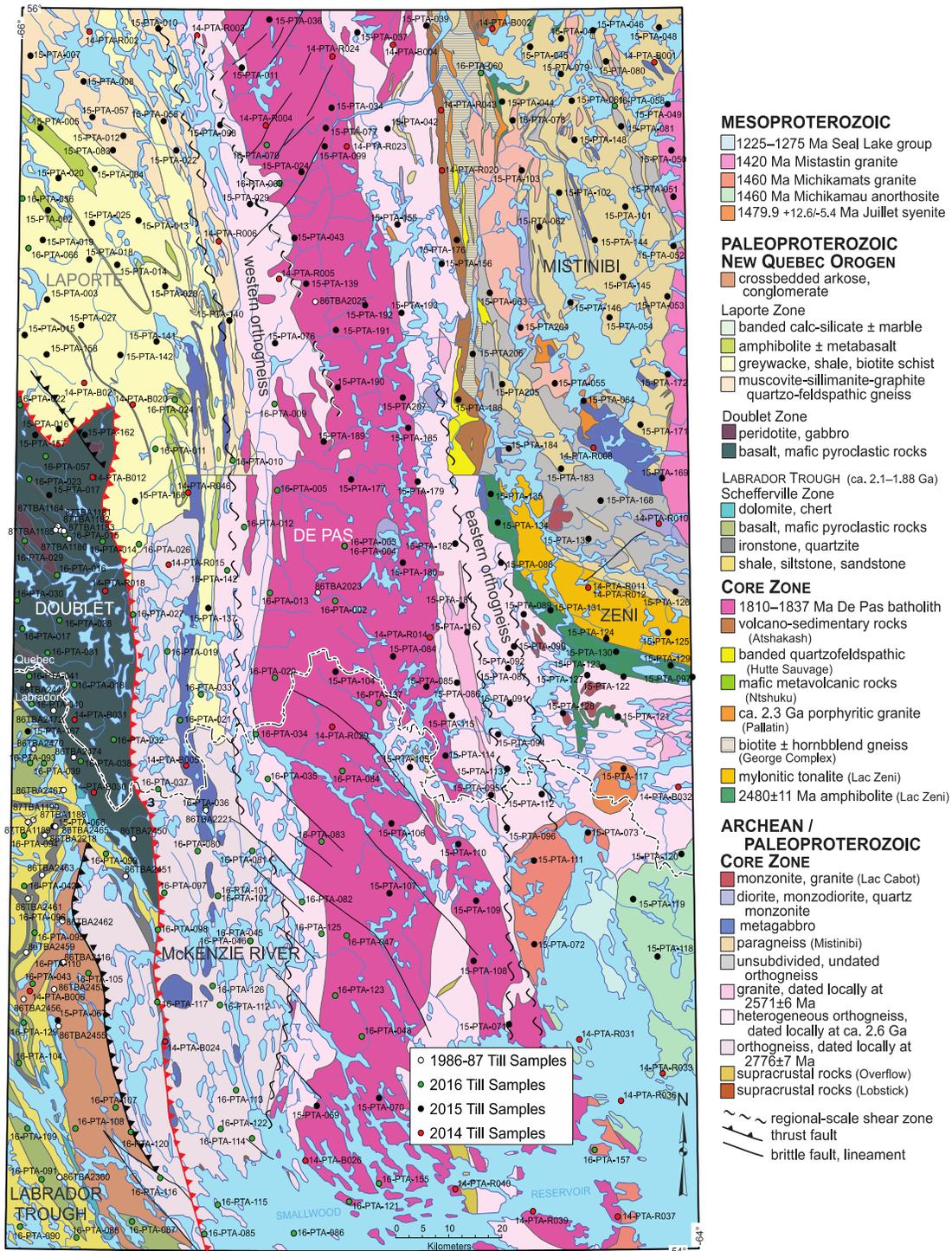


Fig. 2. Locations of till samples collected in 2014, 2015, and 2016, and archival samples (1986–1987) shown on the bedrock geology of the GEM-2 southern Core Zone project area (NTS 23-P and 23-I) highlighting crustal domains (uppercase letters) within the New Quebec Orogen and southern Core Zone. Bedrock geology is after Wardle et al. (1997), and Ministère de l'Énergie et des Ressources naturelles (2010).

RESULTS

In total, 306 till samples were collected, which includes three field-duplicate samples that were collected for quality assurance and quality control. These field-duplicates were used in conjunction with till standards, blanks, and lab duplicates to ensure the accuracy and precision during the analytical process (e.g., Plouffe et al., 2017). All of the collected samples were subjected to till matrix geochemistry analysis. Till matrix geochemistry results for 2014 are reported in McClenaghan et al. (2016a) and results for 2015, 2016, and archived (1986-87) samples are reported in Rice et al. (2017a). In addition to till matrix analyses, 259 samples were processed for indicator mineral recovery. During sample processing/indicator mineral identification, till samples 15-PTA-139 and 15-PTA-140 were inadvertently mixed and had to be discarded leaving a total of 257 samples analyzed for indicator minerals. A single beach sediment sample (14-PTA-R055) was also analyzed. Indicator mineral abundance data for 2014 samples are reported by McClenaghan et al. (2016b), 2015 by Rice et al. (2017b), and 2016 by McClenaghan et al. (2017a).

Activity reports for each field season, which include a summary of results for bedrock mapping, surficial mapping, ice-flow reconstruction, and gamma-ray spectrometry are reported by McClenaghan et al. (2014, 2015, 2016c) and most recently by McClenaghan et al. (2017b). Table 1 provides a summary of each field season report with links to the publication (links can be accessed by clicking the GEOSCAN ID number).

Overall, these exercises have provided geoscience data for a region where previously, little data existed. From this work, insights into how the Laurentide Ice Sheet operated throughout glaciation and potential regions of economic interest have been identified. Of significant note is the relatively high abundance of gold-grains identified near the contact of the Doublet and Laporte domains (Fig. 3). Within this region, sample 16-PTA-057 contains 63 gold grains and 16-PTA-112 located along the western orthogneiss (Fig. 3), contains a single, modified sand-sized gold grain. Although no source has been identified, the gold is suspected to originate from somewhere within the local mafic volcanic bedrock. Till matrix geochemistry results indicates that the Laporte, Labrador Trough (Knob Lake Group), and Doublet metavolcanics have elevated signatures of Cu, Zn, Au, Pt, Pd, and Sb. Geochemically elevated values of gold and silver are clustered around the indicator mineral sample with high gold grain counts (16-PTA-057). Overall, the indicator mineral and geochemical results show some elevated values within the western part of the study area, where mafic and ultramafic bedrock outcrop (Fig. 2). However, ice flow patterns across the region are complex and have been shown to have changing subglacial conditions that changed during ice-divide migration (Rice et al., 2019; Rice et al. *submitted*). Follow up work on the elevated geochemical and indicator mineral results should take into account the complex ice-flow history, which has dispersed these glacial materials.

Table 1. Summary information for published Open Files. Open Files accessible online: geoscan.nrcan.gc.ca/

GSC Open File #	Author	Year of sample collection	Type of Analysis	Number of Samples	GEOSCAN ID
7705	McClenaghan et al. 2014	2014	Summary	n/a	295521
7967	McClenaghan et al. 2016a	2014	Geochemistry	36	297796
7968	McClenaghan et al. 2016b	2014	Indicator Minerals	37	297379
8148	McClenaghan et al. 2016c	2014, 2015, 2016	Summary	n/a	299295
8222	McClenaghan et al. 2017a	2016	Indicator Minerals	87	300657
8331	McClenaghan et al. 2017b	2014, 2015, 2016	Project update	n/a	306137
7946	McClenaghan et al. 2015	2014, 2015	Summary	n/a	297388
8187	Rice et al. 2017a	2015	Indicator Minerals	135	299683
8219	Rice et al. 2017b	Archived, 2015, 2016	Geochemistry	31, 147, 92	304280

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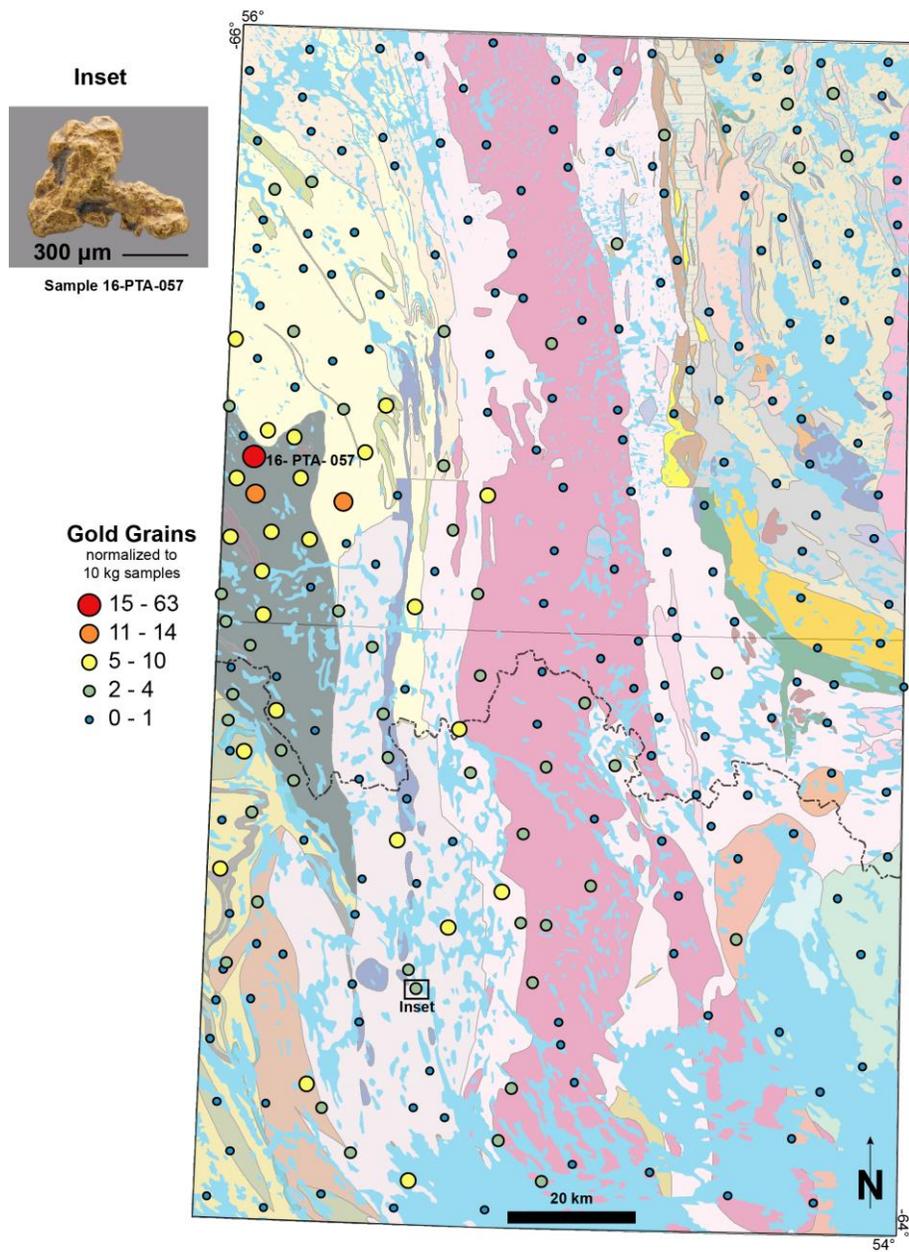


Fig. 3. Number of gold grains recovered from till samples collected in 2014, 2015, and 2016 shown on the bedrock geology from Figure 2. Inset photograph shows the reshaped sand-sized gold grain that was recovered from till sample 16-PTA-112. Photo by Michael J. Bainbridge photography.

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