Surficial Geology Activities

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Surface to Bedrock Thickness Mapping

In 2023, Sediment thickness and bedrock topography maps of southwest Nova Scotia were published (Brushett et al., 2023) advancing our understanding of the bedrock topography, surficial sediment distribution, and sediment thickness of the southwest region of Nova Scotia. Bedrock elevation and surficial sediment thickness data are valuable tools in mineral exploration, aggregate resource assessments, groundwater studies, geotechnical work, and other land-use applications. The continuation of this mapping project will provide stakeholders with valuable information when it comes to planning future work across the province.

Methodologies follow those documented by Brushett et al. (2023) to ensure consistency across maps and digital products. Bedrock-to-topography mapping procedures are outlined by the Ontario Geological Survey and are utilized as a process guide (Gao et al., 2006). Primary data sources include the Drillhole Database (O'Neill et al., 2023), Well Logs Database (Kennedy and Fisher, 2022) and provincial digital elevation models (DEM).

Currently this project is in the quality assurance and quality control (QA/QC) of data phase, focusing on verification of spatial coordinates, true vertical depth corrections of angled drill holes and confirmation of reported bedrock lithologies in water well records. QA/QC is being conducted on a county-by-county basis. Upon completion, data interpolation will be carried out using methods consistent with those applied in the southwest Nova Scotia mapping. The final deliverable will be a provincially integrated surface-to-bedrock thickness map and bedrock elevation map.

Surficial Geology Features Digitization

LiDAR imagery available across Nova Scotia provides a high-resolution framework for identifying and delineating surficial geologic features, supporting the work of DNR geoscientists in mapping geohazards, coastal erosion, and karst terrain. Enhanced characterization of surficial landforms also benefits glacial reconstructions, drift prospecting, geotechnical engineering, and aggregate resource assessments.

LiDAR-based mapping conducted in the Cobequid Highlands by Brushett (2020) demonstrates the effectiveness of this approach in refining previously mapped landforms derived from legacy datasets and field observations. In many areas, LiDAR revealed

additional details related to former ice dynamics, enabling improved identification of subglacial landforms (e.g. drumlins, fluted terrain, ribbed moraines) and meltwater features (e.g. meltwater channels, lateral channels). While remote sensing significantly enhances landform interpretation, field validation remains essential to confirm geologic interpretations.

Systematic classification of surficial landforms has direct economic implications, particularly for aggregate resource elevations. The Ministère des Forêts, de la Faune et des Parcs du Québec has demonstrated the link between surficial material types and aggregate potential. They identified kames, kame terraces, eskers, and glaciofluvial deltas as high-potential features due to favourable grain size distributions and minimal processing requirements (Dupuis et al., 2018). Given the diversity and wide range of surficial landforms in Nova Scotia, a comparable classification framework can be developed to identify, characterize, and rank features according to their aggregate resource potential.

The objectives of this project, utilizing remote sensing technology, are to:

- Refine and verify the facies boundaries in the provincial Surficial Geology Map (Stea et al., 1992), with particular emphasis on bedrock exposure delineation;
- Identify prospective surficial aggregate sources through the characterization of surficial landforms;
- Produce and disseminate digital landform datasets for stakeholder and client use.

Provincial-scale characterization of surficial landforms represents a substantial undertaking. Current work is focused on developing and validating mapping methodologies within selected study areas. Expansion to additional areas will commence once characteristics and interpretive criteria are established. Selection of future study areas will be guided by economic relevance, availability of historical data, and social considerations.

Upcoming 2026 Field Season - Expanding Till Geochemistry Coverage in Nova Scotia

Introduction

Glacially derived till accounts for 69% of the total material at surface in Nova Scotia, while exposed bedrock accounts for 10%; the remainder comprises a variety of unconsolidated

sediments (Stea et al., 1992). The majority of Nova Scotia has low density coverage of till geochemistry data with notable gaps in data. An understanding of till geochemistry plays a key role in the reconstruction of ice flow history and tracing geochemical anomalies back to their bedrock source.

Across Canada, provincial, territorial, and federal geological surveys have implemented till sampling surveys to evaluate mineral potential in regions covered by glacial sediments (Plouffe et al., 2012). Integrated regional programs also include surficial mapping, sediment thickness modeling, stratigraphic studies, and indicator mineral analysis. This multi-disciplinary approach enhances the accuracy of exploration models and improves regional geological interpretations. Resulting datasets support mineral exploration activities, academic research, regulatory decision-making, and resource management.

Previous Work

The majority of Nova Scotia's till geochemistry datasets originated from programs in the late 1970s and 1980s.The three major till sampling programs that continue to be utilized include:

- 1977-1985: Till Geochemical Survey by the Nova Scotia Department of Natural Resources over mainland Nova Scotia with 1,890 samples (Nova Scotia Department of Natural Resources, 2006a).
- 1984-1989: Regional Till and Rock Geochemical Surveys of the South Mountain Batholith by the Nova Scotia Department of Natural Resources over western Nova Scotia with 2,071 samples (Nova Scotia Department of Natural Resources, 2006b).
- 1986-1989: Seabright Resources Inc. Till and Soil Geochemical Data by the Nova Scotia Department of Natural Resources over the Meguma Terrane Nova Scotia with 4,369 samples (Nova Scotia Department of Natural Resources, 2006c).

The minerals analyzed include precious, base, and critical minerals including Au, Ag, As, Ba, Ca, Cd, Co, Cs, Cu, Cr, Fe, Ir, Mg, Mn, Mo, Ni, Pb, Rb, Sb, Sc, Se, Sn, Ta, Th, U, W and Zn. Despite the utility of these datasets, significant spatial gaps remain across the province. Given the province's emphasis on critical mineral exploration, updating and expanding these datasets is both timely and necessary.

2026 Field Season

The primary objective of the proposed till sampling program for the 2026 field season is to build on these historical datasets. By targeting areas with limited data, sampling will increase our understanding of geochemistry and sediment characteristics within glacial till. The Geological Survey of Canada (GSC) has developed and refined their till survey methods to ensure high quality and consistency of till data which can be compared to other national and provincial datasets. Their till sampling methodology classifies a sample spacing of 4 - 10 km as a low to moderate sample density at a regional survey scale (McClenaghan et al., 2020). Given the spatial distribution of existing samples, a moderate sample spacing is appropriate for identifying underrepresented regions. Delineation of areas lacking adequate spatial coverage were identified by creating a 5km radius around samples from the three major sample programs (Figure 11). The GSC methodologies will be followed to achieve an unbiased and consistent sampling distribution. Subglacial till will be targeted as it has a high suitability for sampling due to its more local provenance and therefore a better representation of bedrock emplaced mineral resources. Standardized procedures will be implemented for, not limited to, sample site selection, sample collection methods, field descriptions, sample preparation, laboratory analysis, and metadata reporting.

Understanding the range and spatial variability of naturally occurring elements within surficial sediments, along with their concentrations, is essential for characterizing surface and near-surface geochemical conditions. Establishing baseline geochemical datasets provides critical context when assessing groundwater chemistry and interpreting environmental conditions. This information supports land-use planning, contaminant evaluation, and future development decisions by grounding them in the inherent characteristics of the local geological environment.

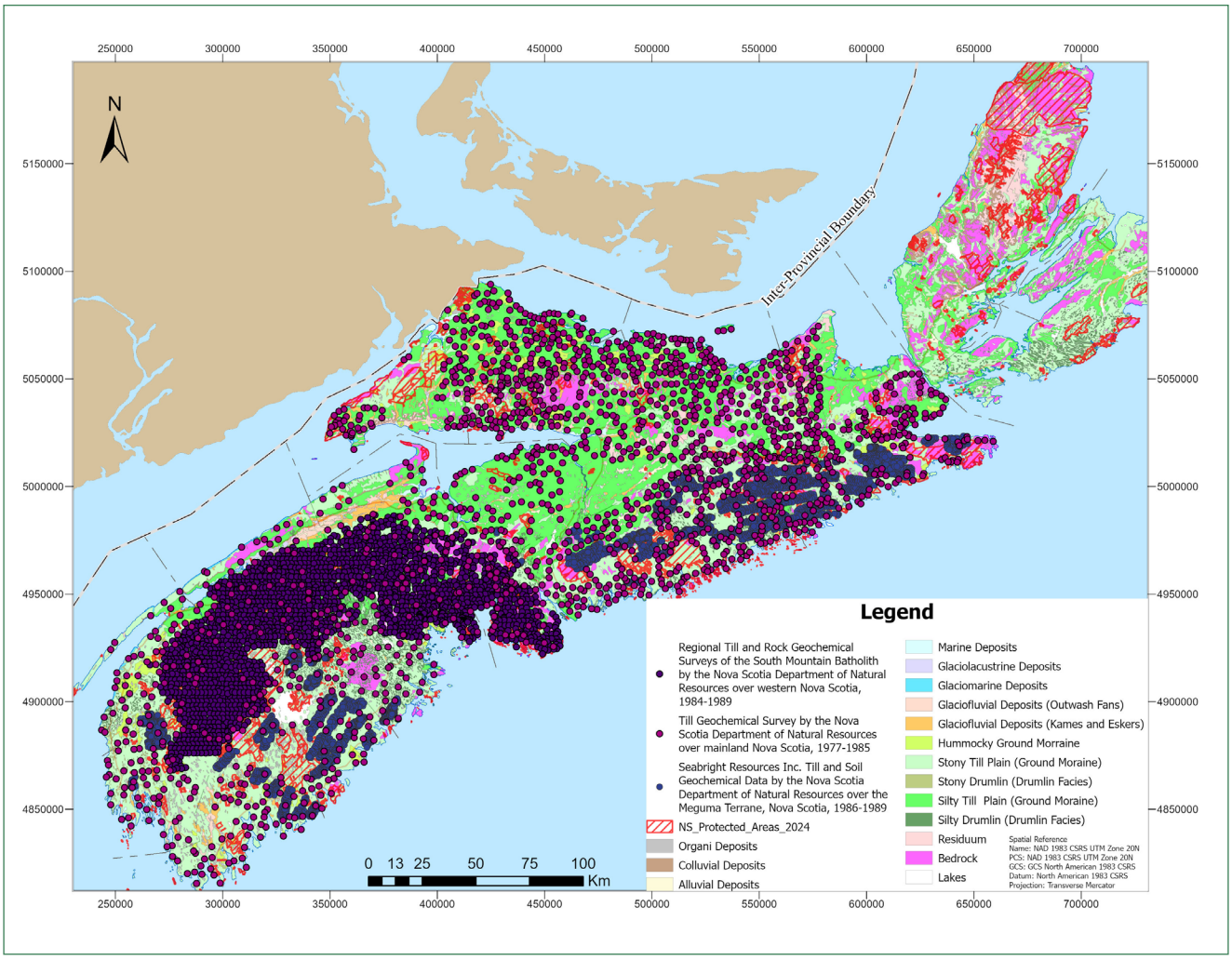

Figure 11. Map of Surficial Geology of Nova Scotia with Regional Till geochemistry sample locations.

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