

Geochemical Characterization of Historical Drill Core Throughout Nova Scotia, Canada

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Introduction

Nova Scotia has been a historical producer of several critical minerals and has the potential to contribute to Canada's supply of critical minerals. Through the Critical Minerals Geoscience and Data Initiative (CMGD), supported by Natural Resources Canada through the Geological Survey of Canada (GSC), the Geological Survey Division of the Nova Scotia Department of Natural Resources has received funding to analyze drill core from throughout the province. This funding provides the opportunity to identify potential critical mineral prospects that were either overlooked in the past due to lack of economic interest or were not analyzed for the critical minerals of importance today. This geochemical characterization project will enhance the Nova Scotia Mineral Occurrence Database (MacRae et al., 2024) to better assess the critical mineral potential in the province and expand and enhance publicly available geochemical data across Nova Scotia to better support the mineral exploration industry.

Sample Selection

Six hundred sixty-seven samples taken from 99 drill cores held at the Stellarton Core Library were chosen for geochemical characterization to enhance the data presented in historical drilling records around known mineral occurrences of Nova Scotia. This was done with an emphasis on modernizing some of the province's drillhole geochemical data and with a focus on highlighting previously unidentified critical minerals that may not have been analyzed by past operators and explorers at that time. Samples were selected to represent diverse geological environments for various mineral deposits found in Nova Scotia.

The process for diamond drillhole (DDH) selection and sampling involved compiling an initial list of mineral occurrences across the province using the Mineral Occurrence Database (MacRae et al., 2024) in tandem with the Diamond Drillhole Database (O'Neill et al., 2023) to identify which occurrences had been historically drilled and what holes are available at the Core Library in Stellarton, Nova Scotia. Following the selection of occurrences and areas, assessment reports associated with the selected DDH were compiled and examined to assess previous geochemical results and to identify potential zones of unsampled mineralization based on the drill logs. Many assessment reports only have results for elements of economic interest at the time of drilling (e.g., only Sn and Cu), leaving large and inconsistent gaps in our understanding of what critical minerals might be contained in those deposits.

Based on previous geochemical results and drill logs, several holes from each occurrence were selected to be characterized in detail. Additionally, DDH in the database not associated with mineral occurrences were selected for examination. DDH were examined at the Core Library to identify the previously sampled zones and other intervals containing interesting mineralization that were not sampled. Considerations were made in choosing intervals for sampling such as quality, preservation, and quantity of available core (whole, half, or quarter core).

After the initial desktop assessment and core examination, 99 DDH were sampled and a total of 667 samples were selected for geochemical analysis. This comprised 50 mineral occurrences across the province in addition to numerous regional samples not associated with a specific mineral occurrence.

A variety of mineral deposits styles were sampled including:

- intrusion-related,
- pegmatites,
- porphyry Cu-Au-Mo,
- Mississippi Valley Type,
- volcanogenic massive sulphide,
- manganese,
- epithermal Au,
- sediment-hosted Cu and Pb,
- skarn systems, and
- iron-oxide-copper-gold occurrences.

Analytical Methods

Samples were sent to AGAT Laboratories Ltd. for analysis. All samples were analyzed by lithium borate fusion (whole rock analysis) with X-ray fluorescence (XRF) to determine their major element oxide composition (AGAT package 11-320). A four-acid digest followed by ICP-OES/ICP-MS for metal and trace element compositions (AGAT package 201-071), and lithium borate fusion with an ICP-MS finish for metals and full rare earth element compositions (AGAT package 201-078) was also completed. Select samples were analyzed by ICP-OES via fire assay for Au (AGAT package 202052) and by halogen ion chromatography for F concentrations (AGAT package 201-200). Deposit specific certified standards from Ore Research & Exploration Pty Ltd and quartz blank samples were included for quality control.

Results

The full data set is available as a digital download in several formats as DP ME 550. Statistical examination of the results from this study at the 90th percentile reveals anomalous high values in many critical minerals and elements of economic interest including gold, silver, base metals, tin, antimony, cobalt, tungsten, REE, lithium and uranium that were not previously identified from their original analyses.

Many cores examined within this release have no relationship with one another, either genetically or spatially. Care should be taken to interpret this data as it relates to the mineral occurrence that the drillhole represents rather than as a part of the complete dataset presented in this drill core characterization study. Additionally, caution should be used when interpretations rely on data close to the detection limit.

Acknowledgments

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