Newfoundland & Labrador

Industry, Energy and Technology

Mines

WHOLE-ROCK LITHOGEOCHEMICAL DATA OF ROCKS FROM THE SOUTHERN BURIN PENINSULA AND NORTHERN FORTUNE BAY AREAS, AVALON ZONE, NEWFOUNDLAND (NTS MAP AREAS 1L/13, 14, 1M/03, 04 AND 11))

A.J. Mills

Open File NFLD/3468

St. John's, Newfoundland
February, 2025

NOTE

Open File reports and maps issued by the Geological Survey Division of the Newfoundland and Labrador Department of Industry, Energy and Technology are made available for public use. They have not been formally edited or peer reviewed, and are based upon preliminary data and evaluation.

The purchaser agrees not to provide a digital reproduction or copy of this product to a third party. Derivative products should acknowledge the source of the data.

DISCLAIMER

The Geological Survey, a division of the Department of Industry, Energy and Technology (the "authors and publishers"), retains the sole right to the original data and information found in any product produced. The authors and publishers assume no legal liability or responsibility for any alterations, changes or misrepresentations made by third parties with respect to these products or the original data. Furthermore, the Geological Survey assumes no liability with respect to digital reproductions or copies of original products or for derivative products made by third parties. Please consult with the Geological Survey in order to ensure originality and correctness of data and/or products.

Departmental website: https://www.gov.nl.ca/iet
Geological Survey website: https://www.gov.nl.ca/iet/mines/geoscience
Email: pub@gov.nl.ca

Recommended citation:
Mills, A.J.
2025: Whole-rock lithogeochemical data of rocks from the southern Burin Peninsula and northern Fortune Bay areas, Avalon Zone, Newfoundland (NTS map areas 1L/13, 14, 1M/03, 04 and 11). Government of Newfoundland and Labrador, Department of Industry, Energy and Technology, Geological Survey, Open File NFLD/3468, 10 pages.

CONTENTS

FIGURE

TABLES

SUMMARY

This open file data release consists of whole-rock geochemical data of 225 rock samples collected from the southern Burin Peninsula and northern Fortune Bay areas of the Avalon Zone of Newfoundland (Figure 1, NTS 1L/13, 14, 1M/03, 04 and 11). Previous regional bedrock mapping in the southern Burin Peninsula area includes works by van Alstine (1948; 1:63 360 scale), Walthier (1948; 1:63 360 scale), O'Brien *et al.* (1977; 1:50 000 scale) and Strong *et al.* (1978; 1:50 000 scale). More recent bedrock mapping has been initiated by the Geological Survey of Newfoundland and Labrador as part of a multi-year project (Mills and Jones, 2024). In northern Fortune Bay, the Belleoram area (NTS sheet 1M/11) was mapped by Williams (1972; 1:50 000 scale).

The Burin Peninsula has long been known for its fluorspar deposits (*see* Magyarosi, 2018), but it also has significant potential for high- and low-sulphidation epithermal- and porphyry-related mineralization systems (*see* reviews by Sparkes 2012; Sparkes and Dunning, 2014; Sparkes *et al.*, 2016). Previous work has also outlined moderate potential for silica (Bartlett, 1967; Butler and Greene, 1976), uranium (Davenport, 1978) and rare-earth elements (Miller, 1994).

Previous whole-rock lithogeochemical data in the southern Burin Peninsula area (Figure 1) are mainly concentrated within Devonian plutonic and volcanic rocks of the Grand Beach Complex and St. Lawrence Granite, with some analyses available for rocks of the Burin and Marystown groups. These data are available on the Geoscience Atlas (https://geoatlas.gov.nl.ca), and are considered 'antiquated', as they lack analyses for key trace elements. Current geochemical analyses of rocks of the Grand Beach Complex (Dostal *et al.*, 2024) and the St. Lawrence Granite (Magyarosi *et al.*, 2019) have recently been published. This data release provides lithogeochemical data with no interpretation.

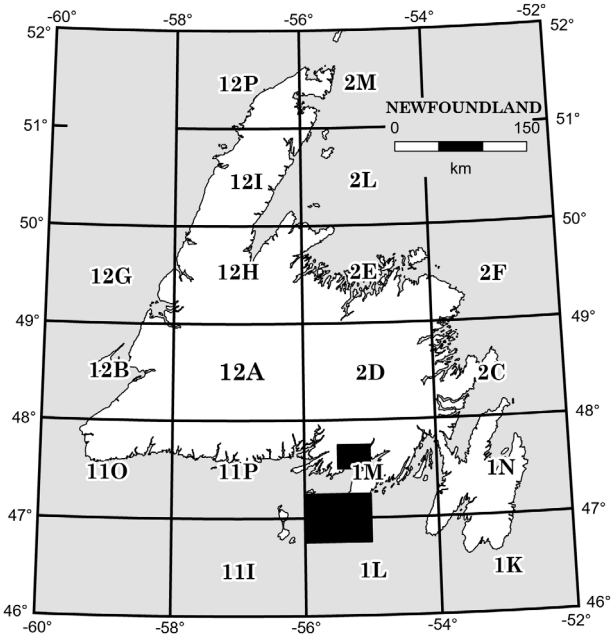

Figure 1. *Location of study area.*

NOTES ON THE DATABASE

For ease of plotting, location data is reported in both Latitude/Longitude, as well as NAD83, Zone 21 UTM coordinates. Appendix A contains details including the rock type and its interpreted relative stratigraphic position (Group, Formation; based on the mapping of O'Brien *et al.*, 1977 and Strong *et al.*, 1978), location data, as well as major- and trace-element, whole-rock geochemical data for 225 rock samples. Analytical duplicates were selected at random and inserted at a frequency of one in 20 (Appendix B). Reference materials (Standards) were also analyzed (Appendix C) as part of the Geological Survey of Newfoundland and Labrador's internal qual-

Table 1. List of abbreviations

Abbreviation	Explanation
-99	Samples not analyzed for that element
Avg	Average value
Dup	Duplicate analysis
Fe_2O_3T	Total measured iron
ICP-OES-4-ACID	Inductively Coupled Plasma-Optical Emission Spectrometry following HF-HCl-HNO_3-$HClO_4$ acid digestion
ICP-OES-FUS	Inductively Coupled Plasma-Optical Emission Spectrometry following lithium metaborate/tetraborate fusion
ICP-OES-HNO_3	Inductively Coupled Plasma-Optical Emission Spectrometry following nitric acid digestion
ICP-MS-FUS	Inductively Coupled Plasma-Mass Spectrometry following lithium metaborate/tetraborate fusion
ISE	Ion-selective electrode
LCL	Lower control limit
LOI	Loss-on-ignition
negative detection limit	Below detection limit
pct	Percent
ppm	Parts per million
Rec_Val	Recommended value
UCL	Upper control limit
wt_pct	Weight percent

ity control measures. Details of the analytical methods used are provided by Finch *et al.* (2018) and summarized in Table 2. The data are available in digital format (*i.e.*, comma separated value files; *.csv).

Major-element compositions (plus Ba, Be, Cr, Sc and Zr) were analyzed by ICP-OES methods, following lithium tetraborate and metaborate fusion. REE and selected trace elements were determined by ICP-MS analysis following lithium tetraborate and metaborate fusion, whereas other trace elements (As, Cd, Co, Cu, Li, Mo, Ni, Pb, S, V and Zn) were analyzed by ICP-OES after total 4-acid digestion. Volatiles are represented as loss-on-ignition (LOI) at 1000°C, which represents the breakdown of all minerals and release of all volatiles. The ferrous-iron content (FeO) of silicate rocks is determined by the Wilson Method (Wilson, 1960), as outlined by Finch *et al.* (2018). For silver analysis, 0.5 g of sample powder was weighed into a 15 ml digestion tube with 2 ml of concentrated nitric acid, and digested for two hours and then analyzed by ICP-OES (Finch *et al.*, 2018). Flouride content is determined as described by Ficklin (1970) and Finch *et al.* (2018).

Major elements are reported in weight percent (wt. %), and minor and trace elements are reported in parts per million (ppm). A negative number indicates that the concentration was below the detection limit (*e.g.*, -0.01 indicates the measured value was below the detection limit of 0.01).

Table 2. Analytical methods for the geochemical analyses

Element	Analytical Method	Preparation/Digestion
Al_2O_3, Ba, Be, CaO, Cr, Fe_2O_3T, Fe_2O_3, K_2O, MgO, MnO, Na_2O, P_2O_5, Sc SiO_2, TiO_2, Zr	ICP-OES	50-50 Lithium Tetraborate Lithium Metaborate Fusion
Fe_2O_3	Calculation	
FeO	Titration	NH_4VO_3, HF, H_2SO_4, H_3PO_4
As, Cd, Co, Cu, Li, Mo, Ni, Pb, S, V, Zn	ICP-OES-4-ACID	HF-HCl-HNO_3-$HClO_4$ (total digestion)
Bi, Ce, Cs, Dy, Er, Eu, Ga, Gd, Ge, Hf, Ho, La, Lu, Nb, Nd, Pr, Rb, Sm, Sn, Sr, Ta, Tb, Th, Tl, Tm, U, W, Y, Yb	ICP-MS-FUS	50-50 Lithium Tetraborate Lithium Metaborate Fusion
F	ISE	Na_2CO_3 and KNO_3 fusion
Ag	ICP-OES	HNO_3 digestion
LOI	Gravimetric (Grav) at 1000°C	None

Detection limits are listed for each element in the .csv files. Detection limits vary between analytical batches. Recovery may be variable for chalcophile elements. The code -99 indicates the sample was not analyzed for that element.

Within the Duplicates Table (Appendix C):

$$\%\_difference = (Original\ Value - Lab\ Split\ Value)/[(Original\ Value + Lab\ Split\ Value)/2] * 100.$$

ACKNOWLEDGMENTS

Chris Finch and the staff at the Geological Survey of Newfoundland and Labrador geochemical laboratory continually provide high-quality lithogeochemical data in a timely fashion. Vanessa Jones provided excellent assistance both in the field and with sample preparation. Thanks also go to Daniela Mendoza Marin and Megan Reardon for thorough review of the data for quality assurance.

REFERENCES

Bartlett, G.

1967: Silica assessment, Fortune area. Government of Newfoundland and Labrador, Department of Mines, Agriculture and Resources, Mineral Resources Division, 36 pages.

Butler, A.J. and Greene, B.A.

1976: Silica resources of Newfoundland. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Report 76-2, 68 pages.

Davenport, P.H.

1978: Uranium distribution in the granitoid rocks of eastern Newfoundland. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Open File NFLD/946, 47 pages.

Dostal, J., Solari, L. and Ma, C.

2024: Petrogenesis of Late Devonian felsic volcanic rocks of Avalonia from Burin Peninsula, Newfoundland: Relation to A-type granites and fluorite mineralization. International Journal of Earth Sciences, Volume 113, pages 539-554. https://doi.org/10.1007/s00531-023-02375-6

Ficklin, H.E.

1970: A rapid method for the determination of fluorine in rocks and soils, using an ion selective electrode. U.S. Geological Survey, Paper 700C, pages 186-188.

Finch, C., Roldan, R., Walsh, L., Kelly, J. and Amor, S.D.

2018: Analytical methods for chemical analysis of geological materials. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Open File NFLD/3316, 67 pages.

Magyarosi, Z.

2018: Preliminary investigations of the fluorite mineralization in the sediment- and rhyolite-hosted AGS Vein system, St. Lawrence, Newfoundland. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 18-1, pages 95-121.

Magyarosi, Z., Sparkes, B.A., Conliffe, J. and Dunning, G.R.

2019: The AGS fluorite deposit, St. Lawrence: Paragenetic sequence, fluid-inclusion analysis, structural control, host rock geochronology and implications for ore genesis. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 19-1, pages 59-83.

Miller, R.R.

1994: Rare-metal metallogeny in Newfoundland and Labrador, a preliminary report. Final report, Geoscience Contract Project NC.1.2.1, Canada-Newfoundland Cooperation Agreement on Mineral Development, GeoFile Number NFLD/2727, 352 pages.

Mills, A. and Jones, V.
2024: New structural observations on the southern Burin Peninsula, Avalon Zone, Newfoundland. *In* Current Research. Government of Newfoundland and Labrador, Department of Industry, Energy and Technology, Geological Survey, Report 24-1, pages 181-204.

O'Brien, S.J., Strong, P.G. and Evans, J.L.
1977: The geology of the Grand Bank (1M/4) and Lamaline (1L/13) map areas, Burin Peninsula, Newfoundland. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Report 77-7, 20 pages.

Sparkes, G.W.
2012: New developments concerning epithermal alteration and related mineralization along the western margin of the Avalon Zone, Newfoundland. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 12-1, pages 103-120.

Sparkes, G.W. and Dunning, G.R.
2014: Late Neoproterozoic epithermal alteration and mineralization in the western Avalon Zone: a summary of mineralogical investigations and new U/Pb geochronological results. In Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 14-1, pages 99-128.

Sparkes, G.W., Ferguson, S.A., Layne, G.D., Dunning, G.R., O'Brien, S.J. and Langille, A.
2016: The nature and timing of Neoproterozoic high-sulphidation gold mineralization from the Newfoundland Avalon Zone: Insights from new U–Pb ages, ore petrography and spectral data from the Hickey's Pond prospect. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 14-1, pages 91-116.

Strong, D.F., O'Brien, S.J., Taylor, S.W., Strong, P.G. and Wilton, D.H.
1978: Geology of Marystown (1M/3) and St. Lawrence (1L/14) map areas, Newfoundland. Government of Newfoundland and Labrador, Department of Mines and Energy, Mineral Development Division, Report 77-8, 81 pages.

van Alstine, R.E.
1948: Geology and mineral deposits of the St. Lawrence area, Burin Peninsula, Newfoundland. Newfoundland Geological Survey, Bulletin Number 23, 73 pages.

Walthier, T.N.
1948: Field report for the season of 1948 – Geology of the Grand Bank quadrangle, and geology on the sulphide ore deposits at Lawn, Burin Peninsula, southeastern Newfoundland. Newfoundland and Labrador Geological Survey, Geofile Number NFLD/0391, 24 pages.

Williams, H.
1972: Geology, Belleoram, Newfoundland. Geological Survey of Canada, “A” Series Map, 1323A. https://doi.org/10.4095/124164

Wilson, A.D.
1960: The micro-determination of ferrous iron in silicate minerals by a volumetric and a colorimetric method. Analyst, Volume 85, Issue 1016, pages 823-827.

APPENDICES

Appendices A–C are included in the OF_NFLD_3468 zip folder as comma separated value (.csv) files.

APPENDIX A: Major-element and Trace-element Data

APPENDIX B: Major-element and Trace-element Data for Duplicates

APPENDIX C: Major-element and Trace-element Data for Standards, with Certified Reference Materials