



Mines

**GEOCHEMICAL AND VISIBLE/INFRARED
SPECTROSCOPY DATA RELATED TO METALLOGENIC
STUDIES OF THE AVALON ZONE, NEWFOUNDLAND
(NTS MAP AREAS 1L/13, 1M/03, 07, 16, 1N/07, 2D/01, 08)**

G.W. Sparkes

Open File NFLD/3364

**St. John's, Newfoundland
July, 2019**

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SUMMARY

This open file release contains whole-rock geochemistry results for 29 samples collected in relation to ongoing studies of precious-metal mineralization within the Avalon Zone in Newfoundland (NTS map areas 1L/13, 1M/03, 07, 16, 1N/07, 2D/01, 08; Figure 1). The database primarily consists of samples collected in the western portion of the Avalon Zone, but also includes a small subset of samples from the eastern portion of the zone, from the area known as the Eastern Avalon High Alumina Belt. The open file also contains Visible/Infrared Spectroscopy (VIRS) data, collected from drillcore, in relation to studies of Neoproterozoic epithermal alteration systems within the Avalon Zone (NTS map areas 1L/13, 1M/16, 1N/07, 2D/01, 08). A review of VIRS and its applications can be found in Kerr *et al.* (2011) and references therein.

NOTES ON THE DATABASE

This database contains the results of major, trace, and rare-earth-element analyses of 29 samples from both, outcrop and drillcore from various areas of the Avalon Zone in Newfoundland. The database includes sample-location data in Universal Transverse Mercator (UTM) eastings and northings, provided in NAD 27 (Zone 21), along with brief sample descriptions (Appendix A). Several different sample types are included within the database: these include grab samples from outcrop, float representing samples from boulders of (inferred) local origin, drillcore samples obtained from core generated through mineral exploration activities and manually drilled core from outcrop, utilizing a Pomeroy gear-reduced core drill. The data is available in digital format (*i.e.*, *.csv, comma-separated value files) through the links provided in the Appendices. A list of

abbreviations used in the database is provided in Table 1.

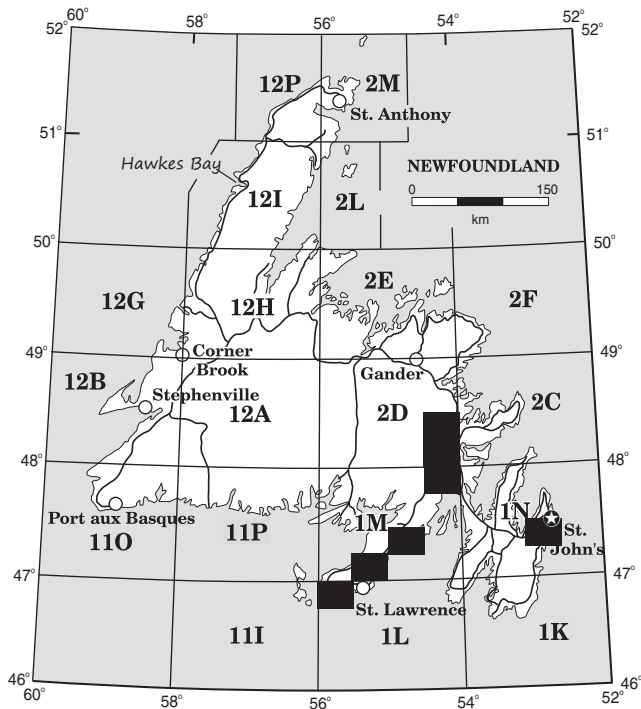


Figure 1. Location map of the study area in eastern Newfoundland.

Samples were prepared at the Geological Survey of Newfoundland and Labrador's (GSNL) Geochemistry Laboratory in St. John's. Internal analyses carried out at the GSNL laboratory follow the methods outlined by Finch *et al.* (2018). Select samples were also submitted for external Instrumental Neutron Activation Analysis (INAA) at Becquerel Laboratories/Maxxam Analytics in Ontario. The following represents a brief summary of select analytical procedures utilized in determining the elements included in this release; a more detailed description of the procedures followed at the GSNL laboratory can be found in Finch *et al.* (2018). A summary of the elements included in this release and the method by which they were determined is provided in Table 2.

Table 1. List of abbreviated terms used in this release

Abbreviation	Explanation
-99	Sample was not analyzed for that element
Analysis_Yr	Year sample was analyzed
Becq.	Becquerel Laboratories
DDH	Diamond Drillhole
Dup.	Duplicate analysis
EOH	End of hole
GSNL	Geological Survey of Newfoundland and Labrador
Grav.	Gravimetric
ICP-OES-FUS	Inductively Coupled Plasma Optical Emission Spectrometry; utilizes total digestion, lithium metaborate/tetraborate fusion technique
ICP-OES 4-acid	Inductively Coupled Plasma Optical Emission Spectrometry; utilizes HF-HCl-HNO ₃ -HClO ₄ acid digestion
ICP-MS-FUS	Inductively Coupled Plasma Mass Spectrometry; utilizes total digestion, lithium metaborate/tetraborate fusion technique
INAA	Instrumental Neutron Activation Analysis
ISE	Ion-selective electrode
LOI	Loss-on-ignition
Maxx.	Maxxam Analytics
n/a	Not available
ppb	Parts per billion
ppm	Parts per million
Ref	Reference
Sample_Yr	Year sample was collected
Std.	Standard
wt. %	Weight percent

Major elements plus select trace elements were analyzed by inductively coupled plasma optical emission spectrometry (ICP-OES) following lithium tetraborate and metaborate fusion (Appendix B). Loss-on-ignition (LOI) and ferrous iron (FeO) values are also included with the major elements, and are determined through gravimetric and titration methods, respectively (*cf.* Finch *et al.*, 2018). Select trace-elements are also provided by ICP-OES following a four acid (HF-HCl-HNO₃-HClO₄) total digestion (Appendix C). The remaining trace elements are determined by ICP-MS following lithium tetraborate and metaborate fusion (Appendix D). Fluoride values are provided by ion-selective electrode analysis following alkaline fusion (Appendix E). Silver analyses are done through ICP-OES following a nitric acid digestion (Appendix F). The procedure for external INAA analysis is summarized in Finch *et al.* (2018); INAA data for select samples is provided in Appendix G.

Note that the negative value, -99, reported for a given sample indicates that a particular element was not analyzed, whereas all other negative numbers indicate the concentration of the spe-

Table 2. List of elements contained within the database and the corresponding determining analytical method

Element	Analytical Method
SiO ₂ , Al ₂ O ₃ , Fe ₂ O ₃ total, MgO, CaO, Na ₂ O, K ₂ O, TiO ₂ , MnO, P ₂ O ₅ , Ba, Be, Cr, Sc, Zr	ICP-OES-FUS
As, Be, Cd, Co, Cu, Li, Mn, Ni, Pb, Rb, Sc, Ti, V, Zn	ICP-OES 4-acid
As, Bi, Cd, Ce, Co, Cs, Dy, Er, Eu, Ga, Gd, Ge, Hf, Ho, In, La, Lu, Mo, Nb, Nd, Pb, Pr, Rb, Sm, Sn, Sr, Ta, Tb, Th, Tl, Tm, U, V, W, Y, Yb,	ICP-MS-FUS
As, Au, Ba, Br, Ce, Co, Cr, Cs, Eu, Fe, Hf, La, Lu, Mo, Na, Rb, Sb, Sc, Se, Sm, Ta, Tb, Th, U, W, Yb, Zr	INAA
Ag	ICP-OES-HNO ₃
F	ISE
FeO	Titration
LOI	Gravimetric

cific element in the sample was below the detection limit; major elements are reported in weight percent, and trace elements are reported in ppm or ppb.

The Visible/Infrared Spectroscopy (VIRS) data contained in this release was obtained using a TerraSpec® Pro spectrometer. Location data and drillhole-collar information for holes referenced in this release are included in Appendix H. The downhole depths of the spectral measurements for individual drillholes are included in Appendix I and where possible, the drillcore box number was recorded in which the spectral measurement was collected. For some holes this information was not recorded, or was not available; note that some holes contain gaps in the spectral data due to missing core. Mineralogical interpretations of the spectral data were performed using the ‘The Spectral Geologist’ (TSG™) software program (version 7.1.0.062). This program provides the two most abundant minerals present (Mineral_1 and Mineral_2) within individual analysis by comparing the spectral data against a reference library of known minerals (Appendix I). Within this database, an estimate of the relative proportions of the two dominant mineral phases present within each spectra are also provided (Weight_1 and Weight_2), along with a corresponding error related to the overall ‘fit’ of the sample spectra relative to those in the TSG™ Pro spectral database. For these error values, the lower the number the better the match with reference spectra within the database. Appendix J contains the spliced corrected spectral files presented in the “asd.sco” spectroscopy file format.

REFERENCES

Clarke, M.

2013: Host lithologies, breccia development, alteration and gold mineralization at the Big Easy prospect. Unpublished B.Sc. thesis, Memorial University of Newfoundland, St. John's, Newfoundland, 85 pages.

Cullen, M.P.

2018: National Instrument 43-101 technical report for the Big Easy exploration property, Clarenville area, Newfoundland and Labrador, Canada. NI 43-101 Technical Report, 128 pages.

Ferguson, S.A.

2017: Late Neoproterozoic epithermal-style Au mineralization of the Burin Peninsula, Newfoundland: U-Pb geochronology and deposit characteristics. Unpublished M.Sc. thesis, Memorial University of Newfoundland, St. John's, Newfoundland, 394 pages.

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

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.

Kerr, A., Rafuse, H., Sparkes, G., Hinchey, J. and Sandeman, H.A.

2011: Visible/infrared spectroscopy (VIRS) as a research tool in economic geology: Background and pilot studies from Newfoundland and Labrador. *In* Current Research. Government of Newfoundland and Labrador, Department of Natural Resources, Geological Survey, Report 11-1, pages 145-166.

APPENDICES

Appendices A–I are available as digital comma-separated files (.csv) and Appendix J in a zip file (13.8 MB) as “asd.sco” files through [this link](#).

APPENDIX A: Sample Location and Description Data

APPENDIX B: Major-element ICP-OES-FUS Data (standard and duplicate samples)

APPENDIX C: Trace-element ICP-OES 4-Acid Data (standard and duplicate samples)

APPENDIX D: Trace-element ICP-MS-FUS Data (standard and duplicate samples)

APPENDIX E: Fluoride (F-) Ion-selective Electrode Data (standard and duplicate samples)

APPENDIX F: Silver (Ag) ICP-OES-HNO₃ Data (standard and duplicate samples)

APPENDIX G: Instrumental Neutron Activation Analysis (INAA) Data (standard and duplicate samples)

APPENDIX H: Diamond Drillhole Collar Location Data

APPENDIX I: TSG™ Pro Spectral Interpretation Results from Drillcore Data

APPENDIX J: Spliced Corrected ASD Spectral Data Files