Newfoundland Labrador

Natural Resources

Mines

TILL-GEOCHEMISTRY SURVEY IN THE GREAT BURNT LAKE (NTS 12A/08), BURNT HILL (NTS 2D/05), NORTHERN COLD SPRING POND (NTS 12A/01) AND ADJACENT MAP AREAS

H. Campbell

Open File NFLD/3341

St. John's, Newfoundland
October, 2018

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SUMMARY

This report provides the results of a 2016 till-geochemistry survey in the Great Burnt Lake (NTS 12A/08), Burnt Hill (NTS 2D/05) and northern Cold Spring Pond (NTS 12A/01) map areas (Figure 1), as well as supplemental sites sampled in NTS map areas 2D/06, 2D/11 and 2D/12. Also presented are previously unreleased till-geochemistry results from surveys in 1987−88 from the St. Alban's (NTS 1M/13), Twillick Brook (NTS 2D/04), Burnt Hill (NTS 2D/05), Great Gull Lake (NTS 2D/06), Miguels Lake (NTS 2D/12) and Eastern Pond (NTS 2D/11) map areas. The surveys were conducted using helicopter, ATV and truck. A backhoe was used to collect some of the samples in the 1987−88 survey.

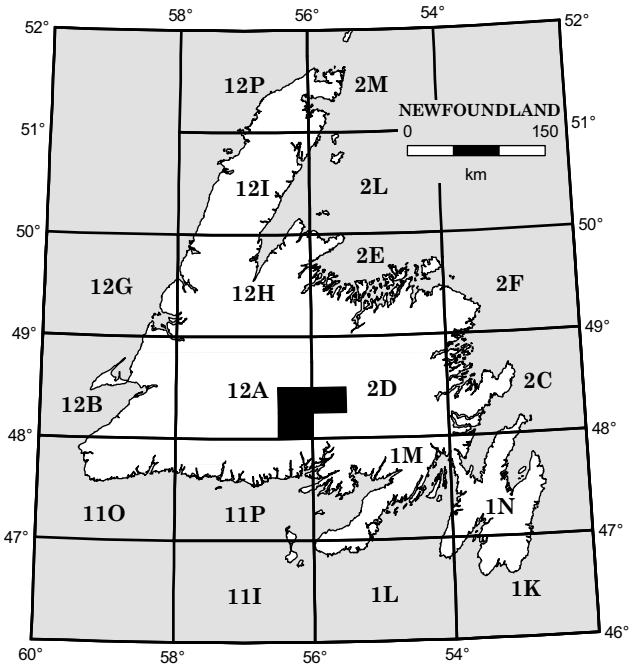

Figure 1. *Location of study area.*

The purpose of the 2016 mapping and sampling study was to investigate the till-geochemical signatures and Quaternary geology of the aforementioned NTS map sheet areas, and to provide data for the provincial till-geochemical database to assist in ongoing exploration efforts within the study area. The 1987–88 study, in which detailed landform and pebble orientation analysis were conducted (Proudfoot *et al.*, 1990), was aimed at better understanding landforms and ice-flow regime throughout the NTS map areas listed above.

NOTES ON DATABASE

This database includes the results of geochemical analysis of 60 elements from the <180 µm sieve fraction of 771 BC- or C-horizon samples collected in 2016. Analyses by inductively coupled plasma-optical emission spectrometry (ICP-OES) following a 4-acid digestion were carried out at the Geological Survey of Newfoundland and Labrador's (GSNL) laboratory in St. John's for aluminum, arsenic, barium, beryllium, cadmium, calcium, cerium, chromium, cobalt, copper, dysprosium, iron, lanthanum, lead, lithium, magnesium, manganese, molybdenum, nickel, niobium, phosphorus, potassium, scandium, sodium, strontium, titanium, vanadium, yttrium, zinc, and zirconium.

Analyses by instrumental neutron activation analysis (INAA) at Maxxam Laboratories in Mississauga, ON, were for antimony, arsenic, barium, bromine, cerium, cesium, chromium, cobalt, europium, gold, iron, hafnium, lanthanum, lutetium, molybdenum, rubidium, scandium, samarium, selenium, sodium, strontium, tantalum, terbium, thorium, tungsten, uranium, ytterbium, and zirconium.

Silver, fluoride and loss-on-ignition (LOI) analyses were also completed at the GSNL laboratory. Silver was analyzed by ICP-OES after nitric acid digestion. Fluoride was analyzed by ion-selective electrode after an alkaline fusion, and LOI was analyzed by gravimetry. A detailed description of the above analytical methods is provided in Finch *et al.* (2018).

Previously unpublished data of 58 elements from the <63 µm sieve fraction of 276 BC- or C-horizon samples from the 1987–88 survey are included in this study. Note that silver was not analyzed and the gold results are considered problematic and have been omitted.

The location data for each sample is given in Universal Transverse Mercator (UTM) eastings and northings (Zone 21; NAD 27). A brief sample and site description is also provided. To distinguish the different analytical methods, the trace-element variables are labelled with a combination of the element symbol name and a numeric suffix (*e.g.*, Cu2) indicating the type of digestion or preparation and the instrument used to analyze the element:

- Suffix 1 for INAA with no digestion
- Suffix 2 for ICP-OES after 4-acid digestion,
- Suffix 6 for ICP-OES after HNO_3 digestion, and
- Suffix 9 for ion-selective electrode after alkaline fusion

(*see* http://geoatlas.gov.nl.ca/Custom/help/Till_geochem_help_tables/Table2_AnalyticalMethods.html). A complete list of variables, detection limits and range of values are given in Tables 1 and 2, for the 2016 and 1987−88 surveys, respectively. Detection limits in the database are replaced by a value that is ½ of the detection limit. A full listing of geochemical data is contained in Appendices A and B. These are available in digital format (*i.e.*, *.csv comma-separated value files).

Standards and duplicates data, similar to those reported in other till-sampling programs (*e.g.*, Brushett and Amor, 2016; Organ and Amor, 2016a, b) will be released later, along with maps and a discussion of the bedrock, mineralogical and surficial framework for the study.

Table 1. Geochemical elements for the 2016 survey, their analysis method, measurement units, detection limits (D.L.), number of samples that are less than the DL (<D.L.) and range of data values

Element	Method	Units	D.L.	<D.L.	Max	Min	Element	Method	Units	D.L.	<D.L.	Max	Min
Ag6	ICP-OES	ppm	0.1	760	0.6	<0.1	Mg2	ICP-OES	%	0.01	0	13.26	0.05
Al2	ICP-OES	%	0.01	0	9.65	1.16	Mn2	ICP-OES	ppm	1	0	11672	170
As1	INAA	ppm	0.5	2	1040.0	<0.5	Mo1	INAA	ppm	1	736	131	<1
As2	ICP-OES	ppm	2	16	923	<2	Mo2	ICP-OES	ppm	1	710	119	<1
Au1	INAA	ppb	1	557	98	<1	Na1	INAA	%	0.1	0	3.7	0.5
Ba1	INAA	ppm	50	0	790	58	Na2	ICP-OES	%	0.01	0	3.78	0.37
Ba2	ICP-OES	ppm	1	0	781	54	Nb2	ICP-OES	ppm	1	4	34	<1
Be2	ICP-OES	ppm	0.1	0	3.2	0.3	Ni2	ICP-OES	ppm	1	0	1790	4
Br1	INAA	ppm	1	30	228	<1	P2	ICP-OES	ppm	1	0	4194	59
Ca2	ICP-OES	%	0.01	0	3.14	0.08	Pb2	ICP-OES	ppm	1	7	1326	<1
Cd2	ICP-OES	ppm	0.1	447	1.6	<0.1	Rb1	INAA	ppm	5	0	200	7
Ce1	INAA	ppm	3	0	270	11	Rb2	ICP-OES	ppm	1	0	212	11
Ce2	ICP-OES	ppm	1	0	190	7	Sb1	INAA	ppm	0.1	2	16.8	<0.1
Co1	INAA	ppm	2	160	160	<2	Sc1	INAA	ppm	0.1	0	41.8	4.8
Co2	ICP-OES	ppm	1	1	181	<1	Sc2	ICP-OES	ppm	0.1	0	37.6	2.2
Cr1	INAA	ppm	10	1	1430	<10	Se1	INAA	ppm	1	771	<1	<1
Cr2	ICP-OES	ppm	1	0	518	9	Sm1	INAA	ppm	0.1	0	25.8	1.7
Cs1	INAA	ppm	0.5	4	60.3	0.9	Sr2	ICP-OES	ppm	1	0	242	28
Cu2	ICP-OES	ppm	1	5	160	<1	Ta1	INAA	ppm	0.2	1	3	<0.2
Dy2	ICP-OES	ppm	0.1	0	11.5	1	Tb1	INAA	ppm	0.5	9	4.3	<0.5
Eu1	INAA	ppm	0.5	189	3.6	<0.5	Th1	INAA	ppm	0.5	0	52.3	1.4
F9	ISE	ppm	40	0	687	29	Ti2	ICP-OES	ppm	1	0	17153	950
Fe1	INAA	%	0.1	0	25.6	0.7	U1	INAA	ppm	0.1	0	10.1	0.8
Fe2	ICP-OES	%	0.01	0	25.55	0.65	V2	ICP-OES	ppm	1	0	477	18
Hf1	INAA	ppm	1	2	44	<1	W1	INAA	ppm	1	157	186	<1
K2	ICP-OES	%	0.01	0	3.07	0.15	Y2	ICP-OES	ppm	1	0	52	5
La1	INAA	ppm	1	0	130	4	Yb1	INAA	ppm	0.5	1	14	<0.5
La2	ICP-OES	ppm	1	0	93	4	Zn2	ICP-OES	ppm	1	0	624	10
Li2	ICP-OES	ppm	0.1	0	102.7	2.7	Zr1	INAA	ppm	100	190	1500	<100
LOI	Gravimetric	%	0.1	0	38.6	1.0	Zr2	ICP-OES	ppm	1	0	147	14
Lu1	INAA	ppm	0.05	0	2.1	0.1							

Table 2. Geochemical elements for the 1987–88 survey, their analysis method, measurement units, detection limits (D.L.), number of samples that are less than the DL (<D.L.) and range of data values

Element	Method	Units	D.L.	<D.L.	Max	Min	Element	Method	Units	D.L.	<D.L.	Max	Min
Al2	ICP-OES	%	0.01	0	8.41	1.00	Mn2	ICP-OES	ppm	1	0	2730	336
As1	INAA	ppm	0.5	0	656.0	3.1	Mo1	INAA	ppm	1.5	212	9	<1
As2	ICP-OES	ppm	0.5	0	635	5	Mo2	ICP-OES	ppm	1	264	7	<1
Ba1	INAA	ppm	50	0	850	85	Na1	INAA	%	0.1	0	2.3	0.30
Ba2	ICP-OES	ppm	1	0	1319	95	Na2	ICP-OES	%	0.01	0	2.52	0.18
Be2	ICP-OES	ppm	0.1	0	11.5	0.4	Nb2	ICP-OES	ppm	1	0	30	3
Br1	INAA	ppm	1	134	74	<0.1	Ni2	ICP-OES	ppm	1	0	2061	6
Ca2	ICP-OES	%	0.01	0	1.43	0.07	P2	ICP-OES	ppm	1	0	1283	115
Cd2	ICP-OES	ppm	0.1	210	0.9	<0.1	Pb2	ICP-OES	ppm	1	0	203	6
Ce1	INAA	ppm	3	0	210	19	Rb1	INAA	ppm	5	0	410	25
Ce2	ICP-OES	ppm	1	0	217	24	Rb2	ICP-OES	ppm	1	0	497	30
Co1	INAA	ppm	2	0	100	1	Sb1	INAA	ppm	0.1	0	131.0	0.2
Co2	ICP-OES	ppm	1	0	94	5	Sc1	INAA	ppm	0.1	0	33.1	3.7
Cr1	INAA	ppm	10	0	750	48	Sc2	ICP-OES	ppm	0.1	0	32.8	3.5
Cr2	ICP-OES	ppm	1	0	405	11	Se1	INAA	ppm	1	325	<1	<1
Cs1	INAA	ppm	0.5	0	40.0	1.4	Sm1	INAA	ppm	0.1	0	16.9	1.7
Cu2	ICP-OES	ppm	1	0	195	4	Sr2	ICP-OES	ppm	1	0	236	16
Dy2	ICP-OES	ppm	0.1	2	9.9	<0.1	Ta1	INAA	ppm	0.2	0	5.4	0
Eu1	INAA	ppm	0.5	6	2.5	<0.1	Tb1	INAA	ppm	0.5	0	2.4	<0.5
F9	ISE	ppm	40	0	1754	0	Th1	INAA	ppm	0.5	0	102.0	2.7
Fe1	INAA	%	0.1	0	7.7	0.70	Ti2	ICP-OES	ppm	1	0	7244	925
Fe2	ICP-OES	%	0.01	0	7.33	0.81	U1	INAA	ppm	0.1	0	23.4	0.6
Hf1	INAA	ppm	1	1	28	2	V2	ICP-OES	ppm	1	0	231	13
K2	ICP-OES	%	0.01	0	4.12	0.50	W1	INAA	ppm	1	24	54	<1
La1	INAA	ppm	1	0	95	9	Y2	ICP-OES	ppm	1	0	56	4
La2	ICP-OES	ppm	1	0	58	9	Yb1	INAA	ppm	0.5	0	8.4	0.9
Li2	ICP-OES	ppm	0.1	0	119.1	8.3	Zn2	ICP-OES	ppm	1	0	115	18
LOI	Gravimetric	%	0.1	0	32.4	0.6	Zr1	INAA	ppm	100	3	1000	100
Lu1	INAA	ppm	0.05	2	1.1	<0.05	Zr2	ICP-OES	ppm	1	0	201	20
Mg2	ICP-OES	%	0.01	0	15.86	0.20							

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APPENDICES

The data are available as digital comma-separated files (.csv) through this link.

APPENDIX A: Till Geochemistry 2016

APPENDIX B: Till Geochemistry 1987–88