6070205 CANADA INC.

and

6378366 CANADA INC.

REPORT OF SAMPLING AND SCIENTIFIC RESEARCH

LACKNER TOWNSHIP PROPERTY

LACKNER TOWNSHIP (G-1160)
PORCUPINE MINING DIVISION, ONTARIO
(DISTRICT OF COCHRANE)

PREPARED FOR

6070205 CANADA INC.

and

6378366 CANADA INC.

AUTHORED BY
LIONEL BONHOMME

UTM: ZONE 17 0342813mE, 5293263 mN (Nad 83)

TIMMINS, ONTARIO
AUGUST 9,2013

TABLE OF CONTENTS

ATTACHEMENTS

- Regional Location Map
- Drill Hole Location Map (drill holes)
- Drill Sections 1:1000 scale (drill holes)
- Location map samples 3446 & 309655

SUMMARY

A sampling program was started in December 2011 with a reading of radiometric of all the cores to determine the areas with elevated cps for Uranium and Thorium . Samples were identified by the geologist and sent in for whole rock analysis and assay for metals and ree's . Elevated results were obtained for Uranium, Tantalum, Niobium and Ree's. Dr Fred Breaks was invited to review the core and help in the idenfication of minerals of these cores and the previous samples collected .The samples were sent to Open University in London U.K. where Dr A G Tindle examined the rock sample and confirmed the presence of Britholite associated with elevated ree's

BACKGROUND

In late November 2011 numbered companies 6378366 and 6070205 Canada Inc. completed two diamond drill holes on 6378366 Canada Inc.'s wholly owned Lackner Lake property. The property is located in Lackner and McNaught Townships, Ontario 150 km southwest of Timmins, Ontario. The nearest town is Chapleau, Ontario 24 kilometres away to the west-northwest.

Regional Highway 101 between Timmins and Highway 129, which extends south from Chapleau, is the main access route to the property; it passes approximately 8 kilometres to the north. Logging roads extending south from Highway 101 provide final access; they skirt the western and southern parts of the property.

The property consists of 17 claims that variously tie onto two patented claims blocks in the area. The staked claims roughly straddle the north-south McNaught-Lackner Township line. All claims lie within the Porcupine Mining Division.

Denis Crites Drilling Ltd. was contracted to drill the two holes. The move in and set up required two days (November 21 and 22, 2011). Drill hole 66L-11-01 was drilled between November 23 and November 25, 2011; 66L-11-02 was completed over the November 26-27, 2011 period. Access from the nearest tertiary road to the drilling sites was very difficult due to terrain and bush conditions. Both holes were drilled on the same 180 degree azimuth on sections 225m apart. The collar northings were offset by 45 metres with the second drill hole (the westerly one) being the one displaced to the north.

Both holes intersected what appear to be phases of the intrusive Lackner Lake Alkalic Complex that is known to underlie much of the area. 66L-11-10 drilled to a depth of 176.0 metres; 66L-11-02 ended at 146.0 metres for a total of 322.0 metres. Casing depths were 3.5 metres in both drill holes. Casings were left and capped.

Intermittent logging of the core took place in Timmins, Ontario between December 8 and December 21, 2011

CONCLUSION

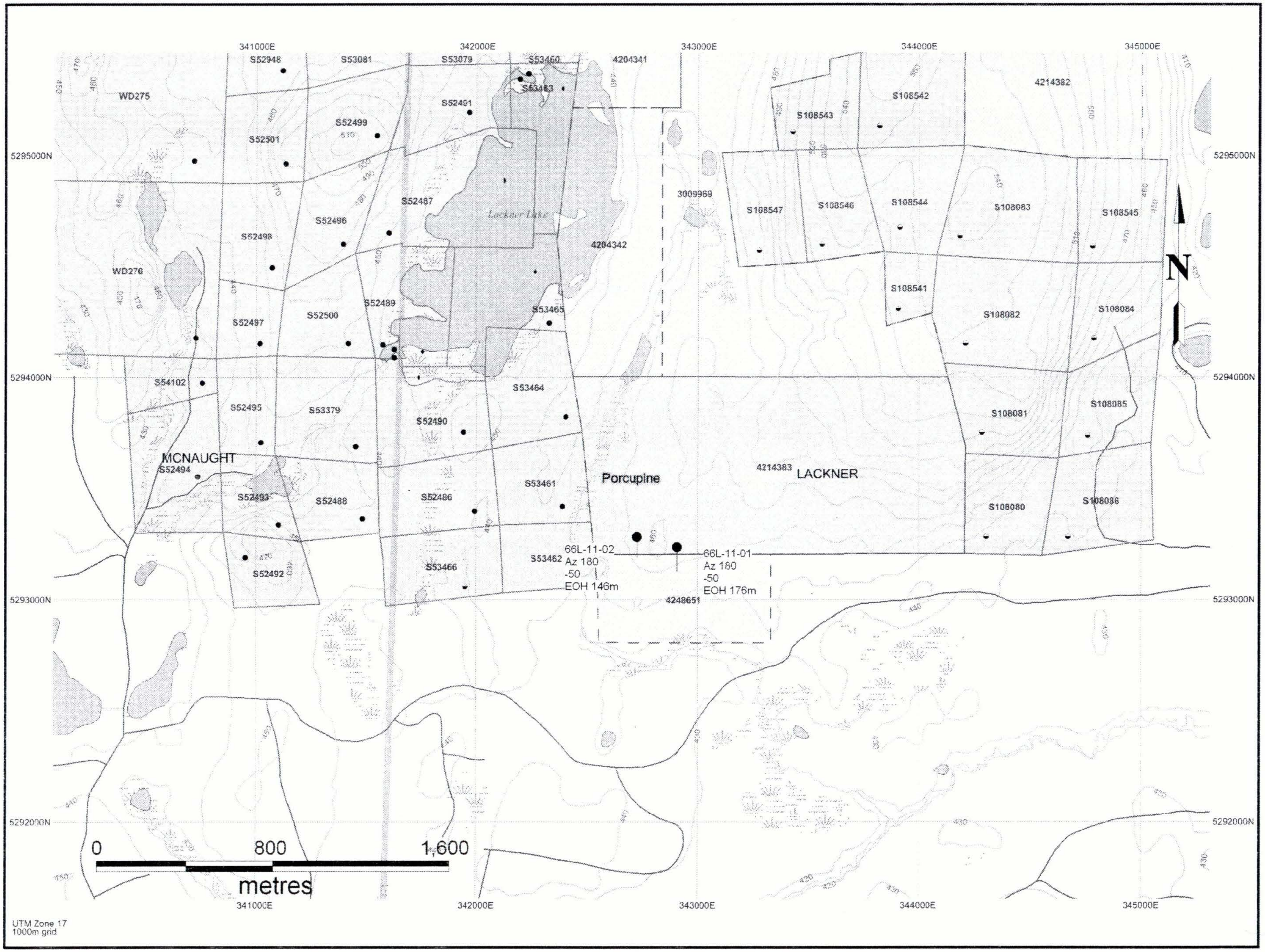
The Lackner lake property is poorly understood and contains economic potential for REE`s , Niobium, Iron, Uranium and Tantalum. The approach by the owners has been to slowly understand and identify the various results with a limited amount of private funding to advance the project with help of its experts in this field. The availability of these experts is very limited and time consuming as can be seen that it has taken 4 years to identify the rare earth mineral with certainty .A summary of the findings to date will be completed in the near future and this report only documents the results to date without interpretation or conclusions .

Regional Location Map

Lackner Project

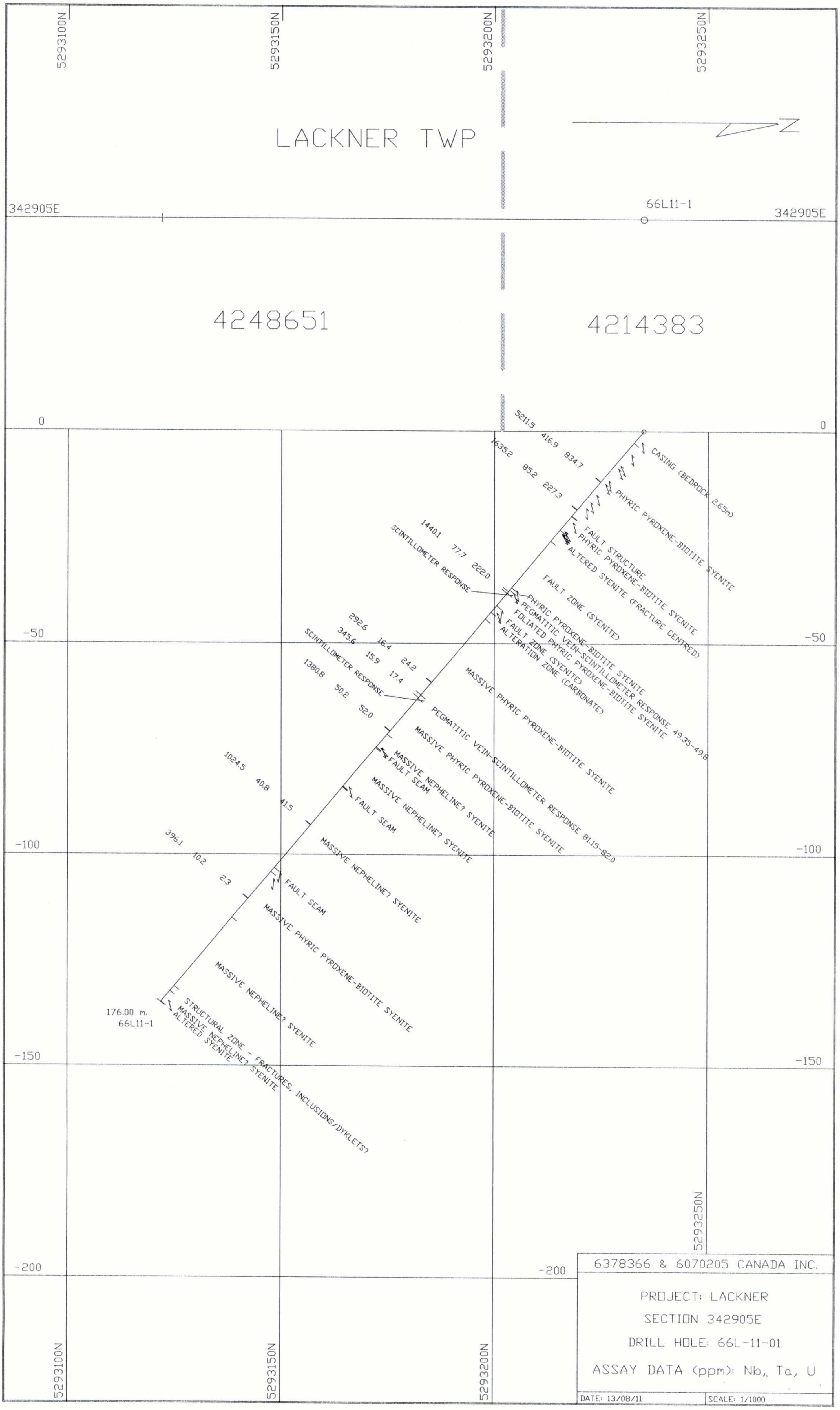
DDH 66L-11-01 & 02

6378366 CANADA INC.



LACKNER 2011 DRILL HOLE LOCATION MAP

6378366 CANADA INC.



6378366 & 6070205 CANADA INC.

PROJECT: LACKNER

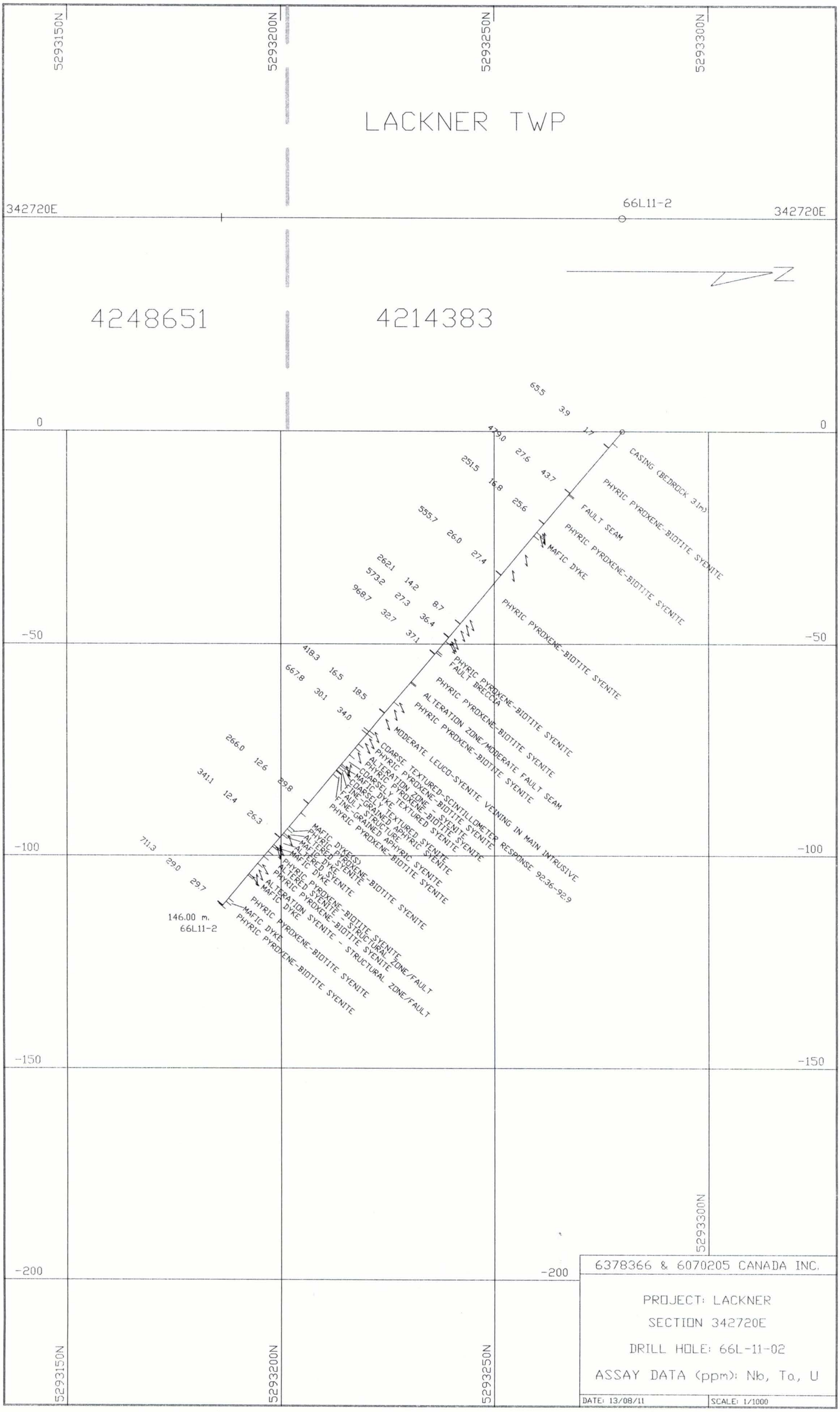
SECTION 342905E

DRILL HOLE: 66L-11-01

ASSAY DATA (ppm): Nb, Ta, U

DATE: 13/08/11

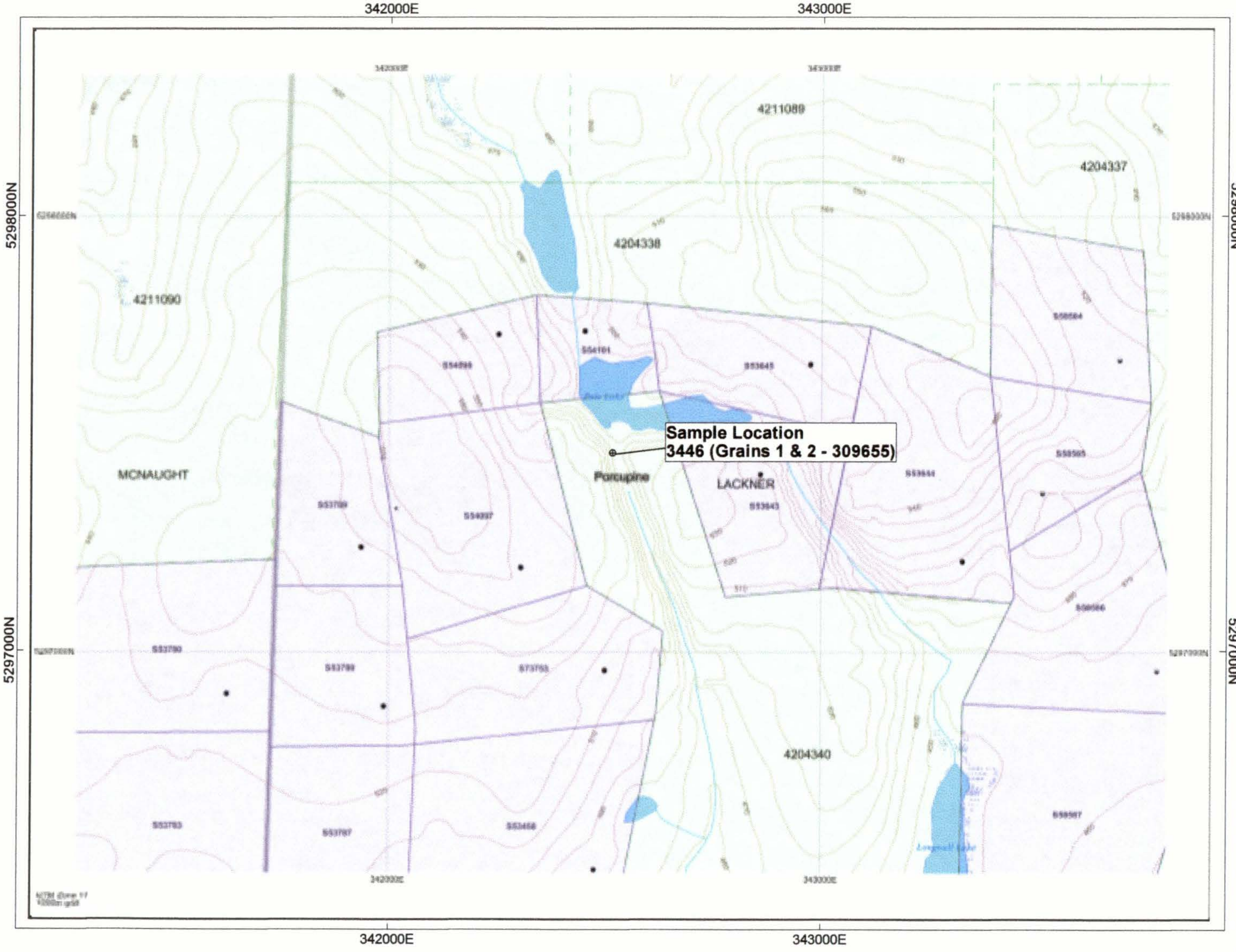
SCALE: 1/1000

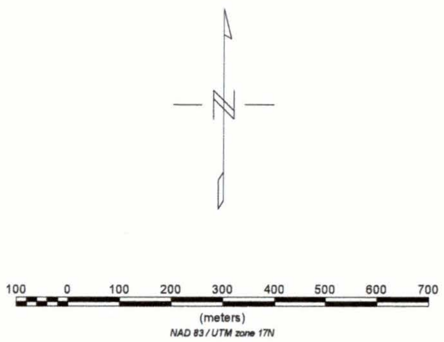


6378366 & 6070205 CANADA INC.

PROJECT: LACKNER
SECTION 342720E
DRILL HOLE: 66L-11-02
ASSAY DATA (ppm): Nb, Ta, U

DATE: 13/08/11	SCALE: 1/1000





6070205 Canada Inc. 6378366 Canada Inc.

Lackner Lake Project
Sample Location Map
Aug. 10, 2013

Lackner Twp. - Porcupine Mining Division
Claims: Posted on Map
Sample 3446 (Grains 1 and 2 - 309655)

Drawn By: M. Johnston

Drill Hole N	Sample No	Location	Whole Rock Samples
66L-11-01	19154	15.6	
66L-11-01	19155	24.2	
66L-11-01	19156	77.3	
66L-11-01	19157	92.4	
66L-11-01	19158	121.4	
66L-11-01	19159	144.3	
66L-11-02	19160	4.9	
66L-11-02	19161	19	
66L-11-02	19162	28.5	
66L-11-02	19163	44.2	
66L-11-02	19164	59.1	
66L-11-02	19165	63.2	
66L-11-02	19166	68.3	
66L-11-02	19167	86.6	
66L-11-02	19168	114.4	
66L-11-02	19169	124.9	
66L-11-02	19170	145.8	
66l-01	19151	49.3	49.8
66l-01	19152	81.15	82
66l-02	19153	92.3	93

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Submitted By: Tim Barrett
Receiving Lab: Canada-Vancouver
Received: January 12, 2012
Report Date: February 03, 2012
Page: 1 of 2

CERTIFICATE OF ANALYSIS VAN12000149.1

CLIENT JOB INFORMATION

Project: Lackner
Shipment ID:
P.O. Number
Number of Samples: 22

SAMPLE DISPOSAL

RTRN-PLP Return

Acme does not accept responsibility for samples left at the laboratory after 90 days without prior written instructions for sample storage or return.

Invoice To: Ore Systems Consulting
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0
Canada

CC: Lionel Bonhomme

SAMPLE PREPARATION AND ANALYTICAL PROCEDURES

Method Code	Number of Samples	Code Description	Test Wgt (g)	Report Status	Lab
R200-250	20	Crush, split and pulverize 250 g rock to 200 mesh			VAN
Special Prep	20	Special Handling - see Job Notes			VAN
XWSH	20	Extra Wash with Glass between each sample			VAN
4A4B	22	Whole Rock Analysis Majors and Trace Elements	0.2	Completed	VAN

ADDITIONAL COMMENTS

BRITISH COLUMBIA CERTIFIED ASSAYER
C. L
CLARENCE LEONG
GENERAL MANAGER

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 2 of 2 Part 1

CERTIFICATE OF ANALYSIS

VAN12000149.1

	Method	WGHT	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	Analyte	Wgt	SiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO	Cr2O3	Ni	Sc	LOI	Sum	Ba	Be	Co	Cs
	Unit	kg	%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	%	%	ppm	ppm	ppm	ppm
	MDL	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.001	0.001	0.01	0.002	20	1	-5.1	0.01	1	1	0.2	0.1
19151	Drill Core	1.21	43.64	16.75	15.83	2.63	4.60	1.04	7.51	1.143	0.822	0.37	0.008	35	2	3.5	97.87	5434	4	26.5	2.2
19152	Drill Core	2.09	28.36	10.09	5.67	2.41	23.26	2.27	3.56	0.549	6.395	0.32	0.003	<20	4	13.1	95.95	9114	5	13.9	1.6
19153	Drill Core	1.70	42.09	13.91	10.84	6.44	11.60	3.55	5.02	1.109	1.050	0.51	0.050	122	15	2.4	98.54	5633	6	30.7	7.2
19154	Drill Core	1.10	39.65	15.82	12.47	5.69	10.85	6.86	3.55	1.199	1.550	0.33	0.017	67	10	1.3	99.29	1773	5	36.2	1.8
19155	Drill Core	0.69	40.11	22.07	7.81	2.91	7.10	10.07	4.17	0.717	0.787	0.24	0.012	46	6	3.4	99.41	1002	9	19.9	2.3
19156	Drill Core	0.84	41.11	13.30	12.31	4.05	14.58	5.69	2.17	1.196	1.696	0.46	0.006	40	9	2.4	98.95	1144	15	25.6	0.8
19157	Drill Core	0.86	42.14	14.32	10.40	3.95	14.07	4.02	2.75	0.766	0.955	0.47	0.023	50	8	5.1	98.94	1939	18	19.6	1.1
19158	Drill Core	0.53	50.35	21.02	5.26	0.73	3.53	7.01	7.36	0.383	0.193	0.19	<0.002	<20	1	3.0	99.03	3014	4	6.1	1.4
19159	Drill Core	0.89	45.06	10.94	11.36	5.68	14.40	5.31	2.01	0.520	0.064	0.50	0.005	38	11	3.6	99.50	399	6	20.3	0.6
19160	Drill Core	0.50	39.60	13.99	14.41	5.29	12.30	6.36	2.66	1.242	1.836	0.46	0.008	43	8	1.1	99.24	1188	5	33.9	0.8
BCR-2	Pulp		53.77	13.49	13.40	3.68	7.12	3.16	1.81	2.285	0.346	0.20	0.002	<20	32	0.4	99.68	674	2	37.4	1.1
W2-A	Pulp		51.93	15.40	10.27	6.61	10.79	2.19	0.61	1.061	0.112	0.17	0.013	68	34	0.6	99.77	171	<1	43.5	0.9
19161	Drill Core	0.67	38.82	15.39	13.30	4.68	11.45	6.58	3.02	1.202	1.656	0.38	0.004	32	5	2.8	99.31	1231	3	32.8	0.6
19162	Drill Core	0.67	40.28	18.95	12.00	3.01	8.30	9.12	3.33	0.959	0.995	0.36	0.002	30	2	2.0	99.30	1672	8	28.8	0.6
19163	Drill Core	0.73	39.38	15.71	12.64	5.37	10.80	7.58	3.16	1.162	1.602	0.34	0.008	56	8	1.6	99.35	1256	5	37.4	1.6
19164	Drill Core	0.84	39.47	14.65	14.03	4.39	11.75	6.66	2.66	1.203	1.466	0.40	0.006	42	8	2.6	99.27	805	7	33.9	1.3
19165	Drill Core	0.68	40.54	15.62	11.65	5.11	10.61	5.01	3.96	1.448	0.791	0.54	0.014	74	8	3.1	98.43	6958	8	32.8	1.2
19166	Drill Core	0.96	44.48	15.38	9.21	5.98	9.70	5.96	4.34	0.789	0.877	0.26	0.045	96	15	2.2	99.21	2654	4	28.5	5.7
19167	Drill Core	0.81	43.08	13.95	10.19	6.43	11.74	6.07	3.22	0.827	0.976	0.31	0.051	111	14	2.4	99.25	1490	9	28.9	3.9
19168	Drill Core	0.91	42.26	13.61	10.46	7.63	10.73	5.97	3.26	0.893	1.154	0.19	0.066	153	18	3.2	99.47	382	4	34.0	2.7
19169	Drill Core	0.53	46.93	13.66	9.98	6.35	7.32	1.59	7.45	0.838	0.296	0.40	0.051	192	10	3.4	98.32	8546	5	34.2	7.7
19170	Drill Core	0.92	44.88	15.60	11.02	3.60	8.90	4.66	5.92	0.915	1.000	0.34	0.010	38	8	2.2	99.03	2924	7	19.4	4.7

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 2 of 2 Part 2

CERTIFICATE OF ANALYSIS VAN12000149.1

	Method	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	Analyte	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	Gd
	Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	MDL	0.5	0.1	0.1	0.1	1	0.5	0.1	0.2	0.1	8	0.5	0.1	0.1	0.1	0.1	0.02	0.3	0.05	0.02	0.05
19151	Drill Core	16.9	4.1	5211	147.9	6	3606	416.9	89.7	834.7	91	2.0	257.7	21.6	136.3	277.0	30.46	100.8	14.27	3.93	10.56
19152	Drill Core	10.3	4.8	1635	97.3	5	16457	85.2	310.8	227.3	57	0.7	394.9	218.1	1250	2576	276.3	921.3	132.0	36.15	98.21
19153	Drill Core	13.6	6.2	1440	201.8	5	2216	77.7	86.6	222.0	101	<0.5	287.8	50.6	218.9	471.4	53.84	181.3	28.52	7.94	21.18
19154	Drill Core	13.4	4.2	292.6	132.9	2	1642	16.4	33.1	24.2	164	<0.5	363.1	32.1	147.9	307.9	34.65	122.1	18.25	5.19	13.72
19155	Drill Core	13.0	2.9	345.6	120.1	2	2097	15.9	29.7	17.4	89	0.5	226.1	22.8	116.0	229.9	25.05	85.0	12.61	3.48	9.33
19156	Drill Core	15.2	10.8	1381	42.3	13	2498	50.2	98.9	52.0	86	<0.5	928.3	67.2	268.8	596.3	72.12	253.8	38.32	11.05	28.20
19157	Drill Core	15.0	8.3	1024	72.5	10	3335	40.8	95.1	41.5	62	<0.5	717.1	40.2	160.0	346.3	41.41	147.9	22.76	6.44	15.87
19158	Drill Core	13.6	3.5	396.1	146.9	1	4054	10.8	18.3	2.3	<8	2.0	257.8	18.2	100.6	188.3	19.74	61.5	9.09	3.03	6.99
19159	Drill Core	11.7	6.8	65.5	46.3	5	1742	3.9	8.0	1.7	122	<0.5	516.7	21.6	65.1	140.7	16.79	59.7	10.53	3.07	7.73
19160	Drill Core	12.9	6.4	479.0	92.6	3	1869	27.6	57.9	43.7	142	<0.5	548.1	45.7	210.4	450.6	52.34	184.6	27.80	7.83	20.48
BCR-2	Pulp	21.2	5.2	12.7	45.5	2	349.4	1.0	5.5	1.8	420	<0.5	172.4	33.1	24.1	51.5	6.59	26.9	6.13	1.88	6.23
W2-A	Pulp	16.1	2.4	7.6	18.7	1	200.8	0.6	2.0	0.5	267	<0.5	87.9	19.6	10.6	22.5	2.90	12.5	2.98	1.02	3.40
19161	Drill Core	12.9	3.3	251.5	112.2	2	2114	16.8	30.7	25.6	143	<0.5	281.5	39.4	181.2	381.9	43.48	157.8	23.79	6.59	17.17
19162	Drill Core	14.8	3.1	555.7	98.4	3	1906	26.0	42.0	27.4	96	<0.5	226.1	32.9	147.5	322.5	35.98	126.3	19.14	5.46	13.79
19163	Drill Core	13.7	3.3	262.1	132.3	2	1759	14.2	30.4	8.7	137	<0.5	247.5	32.3	155.6	322.9	37.28	131.9	19.03	5.45	14.15
19164	Drill Core	14.5	4.5	573.2	82.2	3	2209	27.3	53.5	36.4	148	<0.5	344.9	43.9	210.8	420.6	46.00	155.5	23.41	6.60	17.40
19165	Drill Core	11.0	4.5	968.7	95.0	3	3258	32.7	42.6	37.1	125	<0.5	215.8	42.1	173.7	390.0	44.39	153.3	23.22	6.75	17.22
19166	Drill Core	13.1	8.7	418.3	142.6	4	1725	16.5	27.9	18.5	114	<0.5	238.0	26.6	98.6	210.7	23.54	80.7	13.30	3.74	9.49
19167	Drill Core	13.7	8.3	667.8	139.0	5	1777	30.1	61.9	34.0	119	0.9	340.5	30.2	129.7	276.0	30.82	111.3	16.74	4.57	11.98
19168	Drill Core	12.5	6.1	266.0	170.2	3	1631	12.6	10.2	29.8	123	<0.5	365.7	11.6	45.4	92.8	10.97	39.7	6.58	1.90	4.87
19169	Drill Core	14.6	4.6	341.1	331.7	4	3524	12.4	15.9	26.3	74	0.6	302.5	19.2	93.5	178.2	18.82	62.8	9.39	2.72	7.25
19170	Drill Core	16.0	9.0	711.3	225.0	6	2205	29.0	61.1	29.7	99	0.7	786.3	23.2	104.9	230.9	26.00	91.0	13.70	3.86	9.85

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 2 of 2 Part 3

CERTIFICATE OF ANALYSIS VAN12000149.1

	Method	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	2A Leco	2A Leco	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
	Analyte	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	Ni	As	Cd	Sb	Bi	Ag	Au
	Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
	MDL	0.01	0.05	0.02	0.03	0.01	0.05	0.01	0.02	0.02	0.1	0.1	0.1	1	0.1	0.5	0.1	0.1	0.1	0.1	0.5
19151	Drill Core	1.13	5.12	0.84	2.23	0.29	2.03	0.27	0.16	0.38	7.6	64.7	14.3	139	20.7	1.1	1.4	<0.1	<0.1	0.2	<0.5
19152	Drill Core	10.67	50.31	8.29	21.06	2.65	14.05	1.43	3.19	0.12	1.1	20.1	59.8	92	11.4	4.4	0.3	<0.1	<0.1	<0.1	<0.5
19153	Drill Core	2.51	11.31	1.88	4.85	0.69	4.40	0.58	0.31	0.08	0.5	44.8	8.2	106	80.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5
19154	Drill Core	1.55	7.38	1.21	3.01	0.41	2.74	0.41	0.15	0.03	0.5	32.1	4.6	54	42.0	1.6	<0.1	<0.1	<0.1	<0.1	<0.5
19155	Drill Core	1.04	4.66	0.84	2.25	0.31	1.95	0.28	0.49	0.04	2.0	31.0	8.6	48	29.4	1.2	0.1	<0.1	<0.1	<0.1	2.0
19156	Drill Core	3.32	15.71	2.59	6.40	0.92	5.80	0.81	0.43	0.41	0.2	56.6	10.8	49	27.2	1.5	0.3	<0.1	<0.1	0.1	1.3
19157	Drill Core	1.93	8.91	1.50	3.91	0.63	4.43	0.77	0.80	0.17	0.5	44.4	8.4	49	27.8	0.8	0.1	<0.1	<0.1	<0.1	1.7
19158	Drill Core	0.81	3.93	0.66	1.70	0.27	1.85	0.26	0.57	0.06	3.4	14.5	19.7	50	1.1	1.7	0.2	<0.1	<0.1	0.1	<0.5
19159	Drill Core	0.97	4.58	0.80	2.50	0.45	3.68	0.74	0.71	0.03	2.3	20.8	6.6	40	15.7	0.8	<0.1	<0.1	<0.1	<0.1	<0.5
19160	Drill Core	2.40	11.00	1.77	4.49	0.66	4.45	0.68	0.14	<0.02	0.6	45.9	4.7	44	20.0	1.2	<0.1	<0.1	<0.1	0.1	<0.5
BCR-2	Pulp	1.03	5.92	1.16	3.42	0.50	3.23	0.48	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
W2-A	Pulp	0.59	3.54	0.77	2.19	0.32	1.89	0.29	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
19161	Drill Core	1.97	9.04	1.50	3.54	0.50	3.40	0.48	0.31	0.02	<0.1	8.7	2.5	32	15.4	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5
19162	Drill Core	1.62	7.23	1.21	3.25	0.44	2.81	0.41	0.20	<0.02	0.5	19.9	3.6	38	8.5	1.1	<0.1	<0.1	<0.1	<0.1	2.1
19163	Drill Core	1.62	7.53	1.22	3.13	0.43	2.62	0.39	0.18	0.02	0.8	91.7	3.6	47	27.4	1.7	<0.1	<0.1	<0.1	<0.1	<0.5
19164	Drill Core	2.06	9.48	1.58	4.21	0.61	3.71	0.49	0.34	<0.02	0.4	84.9	16.9	43	17.3	1.3	<0.1	<0.1	<0.1	<0.1	1.8
19165	Drill Core	2.10	9.81	1.63	4.37	0.62	3.72	0.50	0.45	0.04	1.0	38.3	8.7	81	29.9	<0.5	<0.1	<0.1	<0.1	<0.1	3.4
19166	Drill Core	1.20	5.62	0.97	2.62	0.39	2.47	0.37	0.20	<0.02	0.2	18.9	1.7	62	58.0	<0.5	<0.1	<0.1	<0.1	<0.1	7.1
19167	Drill Core	1.39	6.70	1.13	3.00	0.44	2.96	0.44	0.28	<0.02	0.3	26.0	3.4	55	54.4	0.7	<0.1	<0.1	<0.1	<0.1	1.7
19168	Drill Core	0.59	2.70	0.44	1.08	0.16	1.22	0.21	0.32	0.05	4.7	61.6	3.2	58	95.0	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5
19169	Drill Core	0.88	4.35	0.72	2.07	0.29	2.22	0.34	0.50	0.20	2.0	195.5	6.7	132	161.8	0.9	0.3	<0.1	<0.1	<0.1	<0.5
19170	Drill Core	1.19	5.42	0.90	2.63	0.36	2.44	0.34	0.26	0.03	0.6	5.5	5.3	84	19.2	<0.5	0.1	<0.1	<0.1	<0.1	4.1

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.

1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 2 of 2 Part 4

CERTIFICATE OF ANALYSIS VAN12000149.1

	Method	**1DX**	**1DX**	**1DX**
	Analyte	**Hg**	**Tl**	**Se**
	Unit	**ppm**	**ppm**	**ppm**
	MDL	**0.01**	**0.1**	**0.5**
19151	Drill Core	<0.01	0.3	<0.5
19152	Drill Core	<0.01	0.1	3.3
19153	Drill Core	<0.01	0.3	0.8
19154	Drill Core	<0.01	0.1	<0.5
19155	Drill Core	<0.01	0.4	<0.5
19156	Drill Core	<0.01	0.2	1.0
19157	Drill Core	<0.01	0.2	0.8
19158	Drill Core	<0.01	0.2	<0.5
19159	Drill Core	<0.01	0.1	<0.5
19160	Drill Core	<0.01	0.1	<0.5
BCR-2	Pulp	N.A.	N.A.	N.A.
W2-A	Pulp	N.A.	N.A.	N.A.
19161	Drill Core	<0.01	<0.1	1.1
19162	Drill Core	<0.01	0.1	0.9
19163	Drill Core	<0.01	<0.1	<0.5
19164	Drill Core	<0.01	0.2	0.9
19165	Drill Core	<0.01	0.2	0.6
19166	Drill Core	<0.01	0.1	0.7
19167	Drill Core	<0.01	0.1	0.5
19168	Drill Core	<0.01	0.2	<0.5
19169	Drill Core	<0.01	0.4	1.2
19170	Drill Core	<0.01	0.3	<0.5

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 1 of 2 Part 1

QUALITY CONTROL REPORT VAN12000149.1

	Method	WGHT	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	Analyte	Wgt	SiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO	Cr2O3	Ni	Sc	LOI	Sum	Ba	Be	Co	Cs
	Unit	kg	%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	%	%	ppm	ppm	ppm	ppm
	MDL	0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.001	0.001	0.01	0.002	20	1	-5.1	0.01	1	1	0.2	0.1
Pulp Duplicates																					
19153	Drill Core	1.70	42.09	13.91	10.84	6.44	11.60	3.55	5.02	1.109	1.050	0.51	0.050	122	15	2.4	98.54	5633	6	30.7	7.2
REP 19153	QC																				
19162	Drill Core	0.67	40.28	18.95	12.00	3.01	8.30	9.12	3.33	0.959	0.995	0.36	0.002	30	2	2.0	99.30	1672	8	28.8	0.6
REP 19162	QC																				
19170	Drill Core	0.92	44.88	15.60	11.02	3.60	8.90	4.66	5.92	0.915	1.000	0.34	0.010	38	8	2.2	99.03	2924	7	19.4	4.7
REP 19170	QC																				
Core Reject Duplicates																					
19165	Drill Core	0.68	40.54	15.62	11.65	5.11	10.61	5.01	3.96	1.448	0.791	0.54	0.014	74	8	3.1	98.43	6958	8	32.8	1.2
DUP 19165	QC		40.36	15.35	12.00	5.13	11.01	5.02	3.76	1.372	0.870	0.54	0.012	56	9	3.1	98.56	5755	9	33.1	1.0
Reference Materials																					
STD DS8	Standard																				
STD DS8	Standard																				
STD GS311-1	Standard																				
STD GS910-4	Standard																				
STD OREAS45CA	Standard																				
STD OREAS45CA	Standard																				
STD SO-18	Standard		58.25	14.22	7.52	3.43	6.42	3.69	2.16	0.693	0.828	0.40	0.551	47	24	1.9	100.07	526	1	27.3	7.0
STD DS8 Expected																					
STD OREAS45CA Expected																					
STD SO-18 Expected			58.47	14.23	7.67	3.35	6.42	3.71	2.17	0.69	0.83	0.39	0.55	44	25			514		26.2	7.1
STD GS311-1 Expected																					
STD GS910-4 Expected																					
BLK	Blank																				
BLK	Blank																				
BLK	Blank		0.12	<0.01	<0.04	<0.01	<0.01	<0.01	<0.01	<0.001	<0.001	<0.01	<0.002	<20	<1	0.0	0.12	<1	<1	<0.2	<0.1
BLK	Blank																				
Prep Wash																					
G1	Prep Blank	<0.01	66.48	15.88	3.53	1.05	3.58	3.70	3.60	0.400	0.176	0.10	<0.002	<20	5	1.2	99.72	1090	2	4.4	3.9

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 1 of 2 Part 2

QUALITY CONTROL REPORT VAN12000149.1

	Method	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
	Analyte	Ga	Hf	Nb	Rb	Sn	Sr	Ta	Th	U	V	W	Zr	Y	La	Ce	Pr	Nd	Sm	Eu	Gd
	Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
	MDL	0.5	0.1	0.1	0.1	1	0.5	0.1	0.2	0.1	8	0.5	0.1	0.1	0.1	0.1	0.02	0.3	0.05	0.02	0.05
Pulp Duplicates																					
19153	Drill Core	13.6	6.2	1440	201.8	5	2216	77.7	86.6	222.0	101	<0.5	287.8	50.6	218.9	471.4	53.84	181.3	28.52	7.94	21.18
REP 19153	QC																				
19162	Drill Core	14.8	3.1	555.7	98.4	3	1906	26.0	42.0	27.4	96	<0.5	226.1	32.9	147.5	322.5	35.98	126.3	19.14	5.46	13.79
REP 19162	QC																				
19170	Drill Core	16.0	9.0	711.3	225.0	6	2205	29.0	61.1	29.7	99	0.7	786.3	23.2	104.9	230.9	26.00	91.0	13.70	3.86	9.85
REP 19170	QC																				
Core Reject Duplicates																					
19165	Drill Core	11.0	4.5	968.7	95.0	3	3258	32.7	42.6	37.1	125	<0.5	215.8	42.1	173.7	390.0	44.39	153.3	23.22	6.75	17.22
DUP 19165	QC	11.6	4.2	904.6	89.9	2	3167	29.8	41.0	33.5	126	<0.5	225.7	44.9	184.5	409.9	47.06	160.5	24.61	7.05	17.81
Reference Materials																					
STD DS8	Standard																				
STD DS8	Standard																				
STD GS311-1	Standard																				
STD GS910-4	Standard																				
STD OREAS45CA	Standard																				
STD OREAS45CA	Standard																				
STD SO-18	Standard	17.2	9.6	21.0	27.5	15	403.0	7.3	9.6	16.1	202	13.9	290.6	30.9	12.2	26.6	3.34	14.0	2.83	0.84	2.78
STD DS8 Expected																					
STD OREAS45CA Expected																					
STD SO-18 Expected		17.6	9.8	21.3	28.7	15	407.4	7.4	9.9	16.4	200	14.8	280	31	12.3	27.1	3.45	14	3	0.89	2.93
STD GS311-1 Expected																					
STD GS910-4 Expected																					
BLK	Blank																				
BLK	Blank																				
BLK	Blank	<0.5	<0.1	0.5	<0.1	<1	<0.5	<0.1	<0.2	<0.1	<8	<0.5	2.0	<0.1	<0.1	<0.1	<0.02	<0.3	<0.05	<0.02	<0.05
BLK	Blank																				
Prep Wash																					
G1	Prep Blank	18.4	4.3	34.8	119.5	2	803.9	1.4	9.3	3.6	46	<0.5	157.5	16.8	32.7	65.5	7.61	28.1	4.70	1.16	3.84

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 1 of 2 Part 3

QUALITY CONTROL REPORT

VAN12000149.1

	Method	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	2A Leco	2A Leco	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
	Analyte	Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	Ni	As	Cd	Sb	Bi	Ag	Au
	Unit	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
	MDL	0.01	0.05	0.02	0.03	0.01	0.05	0.01	0.02	0.02	0.1	0.1	0.1	1	0.1	0.5	0.1	0.1	0.1	0.1	0.5
Pulp Duplicates																					
19153	Drill Core	2.51	11.31	1.88	4.85	0.69	4.40	0.58	0.31	0.08	0.5	44.8	8.2	106	80.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5
REP 19153	QC										0.3	47.5	8.1	107	83.7	0.6	<0.1	<0.1	<0.1	0.1	<0.5
19162	Drill Core	1.62	7.23	1.21	3.25	0.44	2.81	0.41	0.20	<0.02	0.5	19.9	3.6	38	8.5	1.1	<0.1	<0.1	<0.1	<0.1	2.1
REP 19162	QC								0.20	<0.02											
19170	Drill Core	1.19	5.42	0.90	2.63	0.36	2.44	0.34	0.26	0.03	0.6	5.5	5.3	84	19.2	<0.5	0.1	<0.1	<0.1	<0.1	4.1
REP 19170	QC										0.7	5.3	5.5	85	18.9	<0.5	0.1	<0.1	<0.1	<0.1	1.2
Core Reject Duplicates																					
19165	Drill Core	2.10	9.81	1.63	4.37	0.62	3.72	0.50	0.45	0.04	1.0	38.3	8.7	81	29.9	<0.5	<0.1	<0.1	<0.1	<0.1	3.4
DUP 19165	QC	2.17	10.34	1.72	4.56	0.62	3.75	0.51	0.45	0.05	0.9	41.1	8.3	77	29.8	0.9	0.2	<0.1	<0.1	<0.1	3.3
Reference Materials																					
STD DS8	Standard										12.5	109.9	123.4	320	38.8	23.9	2.3	4.1	6.4	1.8	121.2
STD DS8	Standard										13.6	113.5	137.9	311	38.8	24.8	2.5	4.6	5.7	1.9	123.3
STD GS311-1	Standard								1.01	2.37											
STD GS910-4	Standard								2.77	8.35											
STD OREAS45CA	Standard										0.8	464.3	20.1	56	229.7	3.4	0.1	<0.1	0.3	0.3	34.2
STD OREAS45CA	Standard										0.7	497.3	20.7	59	236.0	2.8	0.2	<0.1	0.1	0.2	33.6
STD SO-18	Standard	0.47	2.97	0.62	1.68	0.27	1.71	0.26													
STD DS8 Expected											13.44	110	123	312	38.1	26	2.38	4.8	6.67	1.69	107
STD OREAS45CA Expected											1	494	20	60	240	3.8	0.1	0.13	0.19	0.275	43
STD SO-18 Expected		0.53	3	0.62	1.84	0.27	1.79	0.27													
STD GS311-1 Expected									1.02	2.35											
STD GS910-4 Expected									2.65	8.27											
BLK	Blank										<0.1	<0.1	<0.1	<1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5
BLK	Blank										<0.1	<0.1	<0.1	<1	<0.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5
BLK	Blank	<0.01	<0.05	<0.02	<0.03	<0.01	<0.05	<0.01													
BLK	Blank								<0.02	<0.02											
Prep Wash																					
G1	Prep Blank	0.50	2.71	0.55	1.69	0.26	1.81	0.28	0.03	<0.02	0.3	3.1	6.6	47	2.7	<0.5	<0.1	0.1	<0.1	<0.1	<0.5

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 1 of 2 Part 4

QUALITY CONTROL REPORT VAN12000149.1

	Method	1DX	1DX	1DX
	Analyte	Hg	Tl	Se
	Unit	ppm	ppm	ppm
	MDL	0.01	0.1	0.5
Pulp Duplicates				
19153	Drill Core	<0.01	0.3	0.8
REP 19153	QC	<0.01	0.3	1.1
19162	Drill Core	<0.01	0.1	0.9
REP 19162	QC			
19170	Drill Core	<0.01	0.3	<0.5
REP 19170	QC	<0.01	0.3	<0.5
Core Reject Duplicates				
19165	Drill Core	<0.01	0.2	0.6
DUP 19165	QC	<0.01	0.2	1.4
Reference Materials				
STD DS8	Standard	0.21	5.4	4.8
STD DS8	Standard	0.19	6.2	5.9
STD GS311-1	Standard			
STD GS910-4	Standard			
STD OREAS45CA	Standard	0.03	0.2	<0.5
STD OREAS45CA	Standard	<0.01	<0.1	0.8
STD SO-18	Standard			
STD DS8 Expected		0.192	5.4	5.23
STD OREAS45CA Expected		0.03	0.07	0.5
STD SO-18 Expected				
STD GS311-1 Expected				
STD GS910-4 Expected				
BLK	Blank	<0.01	<0.1	<0.5
BLK	Blank	<0.01	<0.1	<0.5
BLK	Blank			
BLK	Blank			
Prep Wash				
G1	Prep Blank	<0.01	0.4	<0.5

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

QUALITY CONTROL REPORT VAN12000149.1

		WGHT	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B
		Wgt	SiO2	Al2O3	Fe2O3	MgO	CaO	Na2O	K2O	TiO2	P2O5	MnO	Cr2O3	Ni	Sc	LOI	Sum	Ba	Be	Co	Cs
		kg	%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	%	%	ppm	ppm	ppm	ppm
		0.01	0.01	0.01	0.04	0.01	0.01	0.01	0.01	0.001	0.001	0.01	0.002	20	1	-5.1	0.01	1	1	0.2	0.1
G1	Prep Blank	<0.01	66.68	16.08	3.24	1.05	3.64	3.72	3.62	0.408	0.182	0.10	<0.002	<20	5	1.0	99.73	1056	3	4.1	3.8

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 2 of 2 Part 2

QUALITY CONTROL REPORT VAN12000149.1

		4A-4B Ga ppm 0.5	4A-4B Hf ppm 0.1	4A-4B Nb ppm 0.1	4A-4B Rb ppm 0.1	4A-4B Sn ppm 1	4A-4B Sr ppm 0.5	4A-4B Ta ppm 0.1	4A-4B Th ppm 0.2	4A-4B U ppm 0.1	4A-4B V ppm 8	4A-4B W ppm 0.5	4A-4B Zr ppm 0.1	4A-4B Y ppm 0.1	4A-4B La ppm 0.1	4A-4B Ce ppm 0.1	4A-4B Pr ppm 0.02	4A-4B Nd ppm 0.3	4A-4B Sm ppm 0.05	4A-4B Eu ppm 0.02	4A-4B Gd ppm 0.05
G1	Prep Blank	17.9	4.8	27.0	117.1	1	808.4	1.6	9.7	3.5	47	<0.5	165.5	16.7	35.9	68.4	7.73	28.5	4.67	1.20	3.68

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 2 of 2 Part 3

QUALITY CONTROL REPORT VAN12000149.1

		4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	4A-4B	2A Leco	2A Leco	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
		Tb	Dy	Ho	Er	Tm	Yb	Lu	TOT/C	TOT/S	Mo	Cu	Pb	Zn	Ni	As	Cd	Sb	Bi	Ag	Au
		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppb
		0.01	0.05	0.02	0.03	0.01	0.05	0.01	0.02	0.02	0.1	0.1	0.1	1	0.1	0.5	0.1	0.1	0.1	0.1	0.5
G1	Prep Blank	0.51	2.81	0.54	1.64	0.25	1.83	0.30	0.02	<0.02	0.1	2.5	5.1	47	2.1	<0.5	<0.1	<0.1	<0.1	<0.1	<0.5

AcmeLabs Acme Analytical Laboratories (Vancouver) Ltd.
1020 Cordova St. East Vancouver BC V6A 4A3 Canada
Phone (604) 253-3158 Fax (604) 253-1716

www.acmelab.com

Client: **Ore Systems Consulting**
29 Toronto St. South
P.O. Box 590
Markdale ON N0C 1H0 Canada

Project: Lackner
Report Date: February 03, 2012

Page: 2 of 2 Part 4

QUALITY CONTROL REPORT

VAN12000149.1

		1DX Hg ppm 0.01	1DX Tl ppm 0.1	1DX Se ppm 0.5
G1	Prep Blank	<0.01	0.4	0.6

Appendix 3. Electron Microprobe Mineral Analyses for Pole Lake Samples 3446-A and 3446-B

Monazite, Secondary Monazite, Britholite, Britholite-like and Y-LREE-bearing Apatite

			La2O3	Ce2O3	Pr2O3	Nd2O3	Y2O3	P2O5	Nb2O5	Ta2O5	SiO2	TiO2	ThO2	UO2	Al2O3	MgO	CaO	MnO
Primary monazite																		
3446A	AA	1 / 1 .	17.54	17.58	4.24	13.32	0.50	19.31	0.16	0.02	5.59	0.00	3.58	0.05	0.03	0.00	3.63	0.01
3446A	AB	2 / 1 .	17.23	17.73	4.27	13.12	0.53	20.04	0.18	0.01	5.65	0.00	3.43	0.07	0.03	0.00	3.72	0.02
3446A	AC	3 / 1 .	16.36	16.54	4.16	12.78	0.53	18.26	0.23	0.10	6.37	0.00	4.15	0.06	0.08	0.00	3.91	0.02
3446A	AD	4 / 1 .	16.82	17.67	4.09	13.27	0.63	18.18	0.26	0.00	6.25	0.00	3.88	0.06	0.05	0.00	3.87	0.03
3446A	AH	8 / 1 .	16.83	17.60	4.38	13.27	0.42	19.67	0.16	0.00	5.50	0.00	3.46	0.00	0.08	0.00	3.77	0.01
3446A	AK	11 / 1 .	15.56	15.36	3.79	12.77	1.26	15.10	0.33	0.03	9.29	0.00	3.73	0.10	0.29	0.00	5.05	0.08
3446A	DA	28 / 1 .	13.43	14.35	3.63	11.79	1.07	14.42	0.00	0.01	10.32	0.00	5.41	0.04	0.65	0.39	4.98	0.12
3446A	DB	29 / 1 .	13.73	14.24	3.84	12.39	1.30	15.16	3.00	0.00	10.10	0.00	6.15	0.14	0.35	0.13	5.31	0.06
3446A	DC	30 / 1 .	13.90	15.76	3.85	13.26	1.03	14.31	0.00	0.05	8.88	0.02	5.09	0.02	0.30	0.06	4.55	0.04
3446A	DD	31 / 1 .	15.78	17.54	4.18	13.69	0.57	18.97	0.02	0.00	6.83	0.00	2.95	0.00	0.13	0.00	4.45	0.02
3446A	DH	35 / 1 .	15.71	17.54	4.24	13.48	0.63	18.58	0.00	0.03	7.49	0.00	2.95	0.05	0.11	0.01	4.62	0.03
3446B	GA	51 / 1 .	14.72	17.64	3.96	12.65	0.84	16.58	0.06	0.00	8.76	0.00	4.64	0.00	0.21	0.02	4.66	0.07
3446B	GB	52 / 1 .	15.24	17.12	4.20	13.26	0.87	17.76	0.00	0.02	8.46	0.00	4.22	0.02	0.26	0.14	4.65	0.04
3446B	GC	53 / 1 .	14.56	17.76	3.83	12.53	0.76	16.50	0.06	0.09	9.00	0.00	3.84	0.10	0.34	0.17	4.57	0.05
3446B	GE	55 / 1 .	14.65	18.23	4.01	12.57	0.74	16.98	0.00	0.00	8.84	0.00	3.97	0.06	0.29	0.16	4.36	0.05
Mean			**15.47**	**16.84**	**4.04**	**12.94**	**0.78**	**17.32**	**0.30**	**0.02**	**7.82**	**0.00**	**4.10**	**0.05**	**0.21**	**0.07**	**4.41**	**0.04**
Secondary after monazite																		
3446A	AE	5 / 1 .	15.27	14.40	3.75	12.28	1.29	8.66	0.35	0.00	8.85	0.00	7.08	0.10	0.40	0.10	3.44	0.12
3446A	AF	6 / 1 .	6.08	6.73	1.92	6.94	1.59	12.17	0.30	0.05	8.10	0.02	7.07	0.08	0.34	0.08	15.69	0.07
3446A	AG	7 / 1 .	14.16	12.98	3.34	11.28	1.87	10.91	0.39	0.06	12.57	0.00	4.42	0.18	0.78	1.50	4.54	0.12
3446A	AI	9 / 1 .	12.95	18.26	3.36	11.96	1.87	9.90	0.34	0.03	11.90	0.00	4.64	0.11	0.38	0.06	4.02	0.15
3446A	AJ	10 / 1 .	11.67	11.95	3.15	10.22	0.65	16.45	0.15	0.00	7.17	0.00	7.65	0.08	0.35	0.16	7.81	0.08
3446A	DE	32 / 1 .	8.43	8.26	2.24	7.55	0.62	9.73	0.09	0.00	18.73	0.00	3.94	0.00	4.49	2.99	5.25	0.17
3446A	DF	33 / 1 .	7.53	8.01	2.07	6.77	0.80	8.30	0.00	0.00	19.95	0.00	5.11	0.19	4.45	3.43	3.91	0.19
3446A	DG	34 / 1 .	17.38	17.93	4.25	14.36	0.94	3.36	0.00	0.00	8.73	0.00	2.68	0.08	0.36	0.00	3.26	0.01
3446A	EC	42 / 1 .	13.70	14.79	3.50	12.09	1.03	12.67	0.00	0.00	10.41	0.03	5.35	0.09	1.11	1.58	3.44	0.29
3446A	ED	43 / 1 .	16.29	16.58	4.01	13.94	1.20	8.54	0.04	0.00	8.21	0.05	5.02	0.14	0.31	0.11	2.91	0.24
3446B	FA	48 / 1 .	16.14	17.58	3.99	13.39	0.79	10.10	0.47	0.02	5.96	0.11	3.31	0.00	0.23	0.05	2.42	0.09
3446B	FB	49 / 1 .	13.98	16.26	3.37	11.38	1.26	8.93	0.44	0.00	8.36	0.11	4.87	0.13	0.51	0.56	3.36	0.20
3446B	FC	50 / 1 .	13.97	19.23	3.34	11.68	1.54	3.88	0.86	0.07	7.86	0.29	4.60	0.06	0.29	0.25	2.96	0.18
3446B	GD	54 / 1 .	7.45	7.11	2.22	6.69	1.43	18.57	0.01	0.00	8.15	0.00	4.94	0.10	0.19	0.02	26.55	0.07
3446B	GF	56 / 1 .	7.67	8.89	2.21	7.03	0.62	10.61	0.00	0.00	18.42	0.01	2.25	0.04	4.20	2.45	8.09	0.15
3446B	GG	57 / 1 .	8.14	9.12	2.12	7.39	1.21	10.19	0.00	0.00	19.02	0.00	4.97	0.10	3.91	2.40	4.61	0.15

3446B	GH	58 / 1 .	12.98	14.30	3.29	11.14	0.71	14.20	0.04	0.00	11.61	0.00	5.45	0.04	1.48	1.31	3.76	0.13
3446B	GI	59 / 1 .	7.76	8.92	2.21	7.83	1.00	9.06	0.01	0.00	18.36	0.00	6.94	0.12	3.63	2.55	4.36	0.14
Mean			**11.75**	**12.85**	**3.02**	**10.22**	**1.13**	**10.35**	**0.19**	**0.01**	**11.80**	**0.03**	**5.02**	**0.09**	**1.52**	**1.09**	**6.13**	**0.14**

Secondary LREE mineral

3446A	BA	12 / 1 .	15.16	13.06	3.27	10.58	0.33	0.28	0.00	0.00	1.93	0.00	0.62	0.00	0.48	0.69	12.92	0.05
3446A	BB	13 / 1 .	14.68	11.28	2.98	10.40	0.42	0.41	0.07	0.00	1.44	0.00	1.43	0.01	0.11	0.12	15.68	0.03
3446A	CD	24 / 1 .	15.04	13.64	3.50	10.50	0.04	0.57	0.01	0.00	1.95	0.00	0.03	0.03	0.28	0.43	16.18	0.02
3446A	CE	25 / 1 .	10.69	9.85	2.62	8.99	1.64	4.81	0.00	0.03	4.42	0.00	8.91	0.16	0.09	0.03	16.14	0.01
3446A	CG	27 / 1 .	14.35	12.25	3.32	10.30	0.45	1.12	0.03	0.00	1.66	0.00	1.91	0.00	0.07	0.05	14.41	0.04
3446B	HD	69 / 1 .	13.33	12.51	3.20	11.00	0.66	1.97	0.21	0.00	6.53	0.08	2.32	0.09	1.00	2.27	5.95	0.09
3446B	HE	70 / 1 .	11.35	11.81	2.59	8.59	1.23	0.72	0.25	0.00	11.09	0.26	6.14	0.08	1.25	1.38	4.31	0.17
Mean			**13.51**	**12.06**	**3.07**	**10.05**	**0.68**	**1.41**	**0.08**	**0.01**	**4.14**	**0.05**	**3.05**	**0.05**	**0.47**	**0.71**	**12.23**	**0.06**

Britholite

3446B	IC	74 / 1 .	16.11	14.75	3.60	12.52	0.44	0.12	0.01	0.01	2.60	0.00	0.94	0.01	0.75	1.07	14.02	0.04
3446B	ID	75 / 1 .	14.50	14.38	3.46	11.70	0.45	0.12	0.00	0.00	7.50	0.00	0.78	0.00	2.98	4.57	9.74	0.08
3446B	IE	76 / 1 .	15.17	15.45	3.70	13.21	0.93	0.11	0.01	0.00	1.29	0.01	1.10	0.00	0.28	0.40	15.34	0.05
3446B	IF	77 / 1 .	16.59	16.48	3.79	13.03	0.79	0.07	0.03	0.00	2.07	0.00	0.59	0.08	0.52	0.97	12.22	0.02
Mean			**15.59**	**15.26**	**3.64**	**12.61**	**0.65**	**0.11**	**0.01**	**0.00**	**3.36**	**0.00**	**0.85**	**0.02**	**1.13**	**1.75**	**12.83**	**0.05**

Britholite-like

3446A	BC	14 / 1 .	0.58	2.05	0.88	3.95	6.05	4.12	0.06	0.00	16.22	0.06	32.94	0.38	0.24	0.00	6.68	0.11
3446A	BD	15 / 1 .	0.55	3.18	0.73	2.79	5.72	0.48	0.05	0.01	19.30	0.03	40.71	0.36	0.51	0.00	3.18	0.31
3446A	CF	26 / 1 .	0.71	3.43	0.70	3.61	6.14	3.26	0.01	0.00	16.81	0.01	36.05	0.38	0.53	0.27	5.58	0.11
Mean			**0.61**	**2.88**	**0.77**	**3.45**	**5.97**	**2.62**	**0.04**	**0.00**	**17.44**	**0.03**	**36.57**	**0.37**	**0.43**	**0.09**	**5.14**	**0.18**

Y+LREE-bearing Fluorapatite

3446B	IA	71 / 1 .	0.71	1.19	0.49	2.20	1.83	39.84	0.00	0.00	0.00	0.01	0.23	0.06	0.03	0.08	45.89	0.11
3446B	IA	72 / 1 .	0.76	1.23	0.61	2.24	1.68	39.81	0.03	0.00	0.00	0.00	0.37	0.00	0.00	0.07	46.21	0.13
3446B	IB	73 / 1 .	0.72	1.22	0.35	2.15	1.66	39.66	0.00	0.00	0.00	0.00	0.29	0.03	0.05	0.06	46.47	0.15
Mean			**0.73**	**1.22**	**0.48**	**2.20**	**1.72**	**39.77**	**0.01**	**0.00**	**0.00**	**0.00**	**0.30**	**0.03**	**0.03**	**0.07**	**46.19**	**0.13**

FeO	PbO	Na_2O	F	O=F	Total	La_2O_3+Ce_2O_3+ Pr_2O_3+Nd_2O_3
0.07	0.05	0.12	1.03	0.43	86.39	**52.68**
0.07	0.03	0.15	1.07	0.45	86.89	**52.35**
1.41	0.00	0.13	1.17	0.49	85.75	**49.85**
0.17	0.05	0.10	1.14	0.48	86.02	**51.85**
0.12	0.06	0.12	1.02	0.43	86.02	**52.07**
1.41	0.00	0.04	0.91	0.38	84.70	**47.48**
0.83	0.03	0.04	1.08	0.46	82.14	**43.20**
0.63	0.07	0.03	0.86	0.36	84.11	**44.20**
0.77	0.01	0.04	0.96	0.40	82.49	**46.77**
0.28	0.10	0.03	1.13	0.48	86.21	**51.18**
0.19	0.00	0.06	0.88	0.37	86.20	**50.97**
0.16	0.05	0.03	1.12	0.47	85.68	**48.96**
0.22	0.06	0.06	1.14	0.48	87.26	**49.82**
0.48	0.06	0.03	0.94	0.40	85.26	**48.68**
0.29	0.08	0.02	1.14	0.48	85.96	**49.46**
0.47	**0.04**	**0.07**	**1.04**	**0.44**	**85.40**	**49.30**
2.08	0.00	0.02	0.88	0.37	78.71	**45.69**
14.81	0.00	0.43	1.97	0.83	83.62	**21.68**
1.68	0.13	0.00	0.61	0.26	81.23	**41.76**
0.79	0.05	0.00	0.90	0.38	81.30	**46.54**
8.84	0.11	0.16	1.27	0.53	87.40	**36.99**
11.84	0.01	0.09	0.49	0.21	84.70	**26.48**
13.15	0.09	0.16	0.46	0.20	84.36	**24.37**
0.74	0.15	0.00	2.04	0.86	75.38	**53.92**
2.06	0.08	0.08	0.92	0.39	82.84	**44.08**
1.02	0.12	0.07	1.70	0.72	79.79	**50.82**
1.94	0.87	0.00	2.20	0.93	78.72	**51.10**
1.13	1.65	0.00	1.00	0.42	77.08	**44.99**
1.27	2.35	0.00	1.81	0.76	75.72	**48.22**
0.45	0.01	0.20	3.05	1.29	85.91	**23.47**
11.35	0.10	0.21	0.74	0.31	84.73	**25.80**
10.38	0.09	0.18	0.41	0.17	84.21	**26.77**

3.45	0.07	0.11	0.86	0.36	84.55	41.71
9.87	0.08	0.14	0.58	0.24	83.31	26.72
5.38	**0.33**	**0.10**	**1.22**	**0.51**	**81.86**	**37.84**
6.02	0.06	0.00	4.06	1.71	67.79	42.08
6.52	0.05	0.02	4.11	1.73	68.03	39.34
4.30	0.01	0.00	4.25	1.79	68.98	42.67
2.89	0.12	0.32	4.72	1.99	74.44	32.16
6.35	0.00	0.01	4.04	1.70	68.63	40.21
1.27	0.26	0.02	1.33	0.56	63.53	40.05
5.03	1.09	0.00	0.84	0.35	67.81	34.34
4.62	**0.23**	**0.05**	**3.33**	**1.40**	**68.46**	**38.69**
0.92	0.16	0.00	4.22	1.78	70.54	46.98
2.63	0.13	0.00	3.66	1.54	75.15	44.04
0.59	0.14	0.00	4.25	1.79	70.24	47.53
0.66	0.06	0.00	4.36	1.84	70.47	49.88
1.20	**0.12**	**0.00**	**4.12**	**1.74**	**71.60**	47.11
3.27	0.23	0.20	0.76	0.32	78.44	7.45
1.27	0.22	0.00	0.33	0.14	79.60	7.25
1.06	0.24	0.07	0.66	0.28	79.35	8.46
1.87	**0.23**	**0.09**	**0.59**	**0.25**	**79.13**	7.72
0.12	0.03	1.97	6.86	2.89	98.75	4.59
0.09	0.02	1.82	5.80	2.44	98.43	4.85
0.12	0.08	1.79	5.87	2.47	98.19	4.43
0.11	**0.04**	**1.86**	**6.18**	**2.60**	**98.46**	**4.63**

Appendix 4. Electron Microprobe Mineral Analyses for Sample 369665 fr

Britholite

Cluster of grains - see BSE1, BSE2 and X-ray maps area 2

	Large grain - primary areas						Large grain - secondary areas		
	1	2	3	4	5	**mean**	6	7	8
SiO2	17.40	17.50	17.47	17.59	17.59	**17.51**	17.15	17.04	17.15
TiO2	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00
Al2O3	0.00	0.00	0.00	0.00	0.00	**0.00**	0.00	0.00	0.00
FeO	0.17	0.13	0.17	0.13	0.15	**0.15**	0.11	0.14	0.14
MnO	0.23	0.20	0.24	0.20	0.19	**0.21**	0.20	0.19	0.18
MgO	0.00	0.00	0.00	0.01	0.01	**0.00**	0.00	0.00	0.00
CaO	18.16	18.51	17.70	18.15	18.28	**18.16**	17.87	17.26	17.00
Na2O	0.06	0.04	0.05	0.04	0.05	**0.05**	0.06	0.09	0.18
SrO	1.34	1.09	1.48	1.19	1.26	**1.27**	1.01	1.10	1.07
P2O5	6.90	6.72	6.55	6.82	6.93	**6.78**	6.62	6.60	6.91
Y2O3	1.19	1.17	1.21	1.19	1.17	**1.19**	1.15	1.16	1.20
La2O3	14.48	14.17	14.58	14.48	14.39	**14.42**	13.61	13.61	13.96
Ce2O3	13.38	13.04	13.55	13.25	13.27	**13.30**	12.47	12.55	12.98
Pr2O3	3.21	3.21	3.21	3.47	3.25	**3.27**	3.01	3.34	3.19
Nd2O3	11.07	10.92	11.09	11.08	11.06	**11.04**	10.56	10.46	10.84
PbO	0.17	0.20	0.21	0.20	0.21	**0.20**	0.20	0.19	0.23
ThO2	4.25	4.09	4.35	4.19	4.33	**4.24**	3.99	4.13	4.14
UO2	0.03	0.04	0.05	0.03	0.04	**0.04**	0.01	0.06	0.04
Nb2O5	0.02	0.04	0.02	0.00	0.00	**0.02**	0.00	0.00	0.07
Ta2O5	0.00	0.00	0.09	0.06	0.16	**0.06**	0.00	0.02	0.00
F	2.56	2.94	2.65	2.77	2.80	**2.74**	2.83	2.92	2.43
Cl	0.01	0.02	0.02	0.01	0.00	**0.01**	0.00	0.11	0.08
Total	94.63	94.03	94.67	94.85	95.14	**94.66**	90.86	90.97	91.77
∑La2O3+Ce2O3+ Pr2O3+Nd2O3	**42.13**	**41.34**	**42.42**	**42.29**	**41.96**	**42.03**	**39.64**	**39.97**	**40.97**

Analytical conditions, 20kV, 20nA, 10 micron beam diameter

om Pole Lake showing

Cluster of grains - see BSE1, BSE2 and X-ray maps area 2
Smaller grains - showing variable alteration

9	10	**mean**	21	22	23	24	25	26	27
17.02	16.91	**17.05**	17.06	19.74	17.48	17.61	17.11	16.96	16.85
0.00	0.02	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.00	0.00	**0.00**	0.00	0.00	0.00	0.02	0.00	0.00	0.00
0.10	0.09	**0.12**	0.15	0.31	0.11	0.59	0.18	0.29	0.19
0.16	0.18	**0.18**	0.17	0.18	0.15	0.17	0.18	0.20	0.19
0.00	0.01	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17.90	17.61	**17.53**	18.11	16.51	18.31	15.96	18.32	17.06	18.23
0.06	0.07	**0.09**	0.08	0.42	0.02	0.05	0.04	0.13	0.06
1.14	1.21	**1.11**	1.26	1.16	1.25	1.06	1.35	1.18	1.21
6.55	6.36	**6.61**	6.81	6.08	6.39	6.30	6.82	6.46	6.68
1.15	1.20	**1.17**	1.15	1.20	1.21	1.28	1.16	1.15	1.18
13.65	13.52	**13.67**	13.91	14.01	14.29	14.46	13.99	14.02	13.81
12.65	12.64	**12.66**	12.84	12.96	13.17	13.71	12.88	12.86	12.65
3.16	3.13	**3.16**	3.32	3.17	3.44	3.43	3.23	3.13	3.30
10.69	10.52	**10.61**	11.13	11.41	11.05	11.72	10.81	10.88	10.73
0.18	0.24	**0.21**	0.23	0.23	0.20	0.23	0.26	0.22	0.23
4.25	4.18	**4.14**	4.12	4.81	4.20	4.44	4.08	4.29	4.15
0.05	0.00	**0.03**	0.05	0.03	0.00	0.06	0.03	0.04	0.02
0.02	0.02	**0.02**	0.05	0.00	0.02	0.00	0.00	0.00	0.01
0.12	0.02	**0.03**	0.00	0.15	0.05	0.00	0.02	0.02	0.08
2.73	2.46	**2.68**	2.32	2.28	2.91	3.39	3.28	2.41	2.85
0.01	0.00	**0.04**	0.06	0.05	0.02	0.08	0.02	0.16	0.02
91.58	90.38	**91.11**	92.81	94.69	94.27	94.54	93.73	91.46	92.42
40.15	**39.81**	**40.11**	**41.20**	**41.55**	**41.94**	**43.31**	**40.91**	**40.89**	**40.48**

Cluster of grains - see BSE3 and X-ray maps area 1
More variable composition than other cluster of grains

28	**mean**	29	30	31	32	33	34	35	**mean**
17.44	**17.53**	13.03	11.30	14.60	16.04	15.28	12.02	11.79	**13.44**
0.00	**0.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.00**
0.00	**0.00**	0.41	0.32	0.45	0.02	0.30	0.50	0.57	**0.37**
0.12	**0.24**	0.35	9.26	1.27	0.15	0.68	0.59	1.06	**1.91**
0.17	**0.17**	0.05	0.07	0.05	0.20	0.08	0.05	0.05	**0.08**
0.01	**0.00**	0.00	0.00	0.00	0.02	0.00	0.00	0.00	**0.00**
18.40	**17.61**	11.37	5.08	6.27	19.28	14.99	6.28	5.77	**9.86**
0.02	**0.10**	0.40	0.33	0.29	0.29	0.38	0.14	0.34	**0.31**
1.22	**1.21**	0.89	0.82	0.94	1.15	0.77	1.12	0.77	**0.92**
6.61	**6.52**	11.28	10.28	9.14	6.96	7.89	10.71	12.28	**9.79**
1.20	**1.19**	0.78	0.91	1.10	1.11	1.07	0.92	1.04	**0.99**
14.22	**14.09**	15.19	15.51	14.99	11.33	13.78	16.80	16.69	**14.90**
13.05	**13.01**	15.76	10.67	17.99	11.86	13.10	14.27	15.52	**14.17**
3.41	**3.30**	2.91	3.11	3.31	2.92	3.18	3.17	3.46	**3.15**
11.25	**11.12**	9.24	10.57	10.78	10.15	10.72	10.46	11.50	**10.49**
0.24	**0.23**	0.02	0.09	0.09	0.38	0.13	0.05	0.06	**0.12**
4.18	**4.28**	6.05	5.97	5.62	6.39	5.56	5.71	6.22	**5.93**
0.07	**0.04**	0.10	0.14	0.11	0.11	0.04	0.14	0.07	**0.10**
0.00	**0.01**	0.00	0.00	0.01	0.00	0.04	0.05	0.01	**0.01**
0.00	**0.04**	0.07	0.00	0.00	0.00	0.14	0.00	0.04	**0.04**
3.19	**2.83**	1.79	0.99	1.14	2.19	2.09	0.90	1.06	**1.45**
0.01	**0.05**	0.24	0.10	0.25	0.26	0.25	0.06	0.15	**0.19**
94.79	**93.59**	89.93	85.53	88.38	90.80	90.48	83.95	88.43	**88.22**
41.94	**41.53**	**43.09**	**39.87**	**47.07**	**36.26**	**40.78**	**44.71**	**47.17**	**42.70**

Appendix 5: Compilation of Grab Samples and Drill Core Data from 2007 to

6070205 and 6378366 Canada Inc. 2008 Grab Samples

	Description	La	Ce	Pr	Nd	Sm
3408	Nepheline syenite, moderately grey, fg-cg, porphyritic, magnetic, mafics = 20%	35.5	78.5	9	32.8	4.9
3408 (D)	Laboratory Duplicate Analysis	36.7	79.8	9.3	34.8	4.8
3409	Nepheline syenite identical to 3408, fg-cg, rust stained and pink-grey on fresh surface, porphyritic, strongly magnetic, 2% light pink unknown mineral	46.4	98.7	11.4	40.7	5.7
3410	Nepheline syenite, fg-cg, massive, low mafic content, 15-20% nepheline	30.9	68.4	8.3	28.8	4.8
3411	Mafic-rich rock (possible pyroxenite), mainly fg but with cg phenocrysts of unidentified mafic mineral. Weakly foliated, strongly magnetic, and patches of light pink leucocratic veinlets with unknown light pink mineral. Also anhedral amber brown mineral (?pyrochlore) occurs on a fracture surface.	255.9	478.3	52.7	189.7	28.9
3412	Pyroxenite, fg-cg, porphyritic, vaguely foliated, strongly magnetic, phenocrysts of unknown mafic mineral and possible nepheline. Biotite abundant.	298.6	571.9	62	219.3	34.7
3413	Mafic rock (possible pyroxenite), fg-mg. vaguely foliated, porphyritic and strongly magnetic. Cut by thin veins rich in unknown brick-red and lime green minerals. Vein material not included in sample for analysis.	282	555.9	60.5	219.9	34.4
3414	Nepheline syenite, cg, massive, mafics ~ 70 %, non-magnetic. Similar to 3421.	198.3	379.7	41.8	148.2	21.9
3415	Ultramafic rock, fg, locally magnetic that shapely cuts metadiorite, (g-mg, strongly deformed and recrystallized) that is probably a host-rock enclave.	156.3	340.8	42.4	167.6	32
3416-A	Nepheline syenite, light pink, massive, cg, 15-20% mafics	72	153.9	17.7	62.7	9.6
3416-B	Nepheline syenite, fg-cg, porphyritic, pink grey, weakly magnetic	106.4	219.4	23.7	83.6	11.8
3417	Mafic syenite, fg-cg, porphyritic and strongly magnetic. Cut by granitic vein of light pink, fg, biotite-bearing granitic vein that was not included in analytical sample.	284.5	553.3	59.9	205.5	31.1

3418	Syenite or albitite. Massive to vaguely foliated, light pink, mg-cg with dark green possible aegerine, magnetite and a few euhedral crystals of pyrochlore. Also local deep pink unknown mineral.	140.8	259.3	24.7	77.1	12
3419-A	Nepheline syenite, light pink, cg, massive, non-magnetic, grades into fg-cg clots rich in dark mafic minerals	111.6	210.3	19.2	59.8	9.1
3419-B	Mafic rock, fg-mg, massive, strongly magnetic. Contains sparse unknown light pink mineral	438.2	898.3	91.4	309.2	46.3
3420	Nepheline syenite, cg, massive, pink-grey, 10% magnetite. Contains round to subangular, non-magnetic enclaves of glimmerite (~95%) that were not included in analytical material.	78	173.9	20.9	74	11.5
3420 (D)	Laboratory Duplicate Analysis	79	175.9	20.9	77.2	11.9
3421	Nepheline syenite, cg, massive, 60% mafic minerals, non-magnetic	228.5	436.7	46.6	163.4	23.5
3422	Mafic rock, fg-mg, vaguely foliated with veinlets and gradational blobs of coarser light pink material with abundant magnetite.	198.7	425.8	50.8	200.8	42.9
3423	Syenite, light pink, fg-cg, magnetic, massive, miarolitic cavities between pink K-feldspar laths. Abundant fg amber brown pyrochlore present in thin layer within which it occurs interstitial to mg-cg Kspar laths.	234.5	1073.1	76.4	262.1	44.6
3424	Syenite,fg-mg, well foliated, pink to grey, magnetic, 2% light pink unknown mineral	222.8	487.8	54.8	199.2	33.1
3425	Mafic rock (possible pyroxenite), massive, mg-cg with biotite books up to 1 cm diameter. Rock also contains gradational veins and blobs of light pink, cg leucocratic segregations similar to that in 3422. Sparse grains of mg-cg, amber brown pyrochlore and nepheline within these segregations.	493.5	1005.3	118.1	422.8	69.2
3426-A	Mafic rock (possible pyroxenite), fg-cg, porphyritic, vaguely foliated, strongly magnetic, and contains light pink unknown mineral. This unit is cut by light pink, fg, leucocratic vein. Analyzed sample of mafic rock only. Light pink leucocratic unit comprises 3426-B	256.8	558.2	60.8	217.4	34.8
3426-B	Light pink leucocratic unit separated with diamond saw from 3426-A. This unit is also strongly magnetic.	38.6	96.5	7.5	25.4	4

3427	Mafic rock, cg-mg, massive, strongly magnetic, invaded by veins and patches of pink feldspar, magnetite and possible perovskite	276.7	577	66.2	233.2	37.3
3428	Mafic syenite, fg-cg, massive,vaguely porphyritic, strongly magnetic with delicate veinlets and patches of light pink leucocratic material that contains unknown faint pink mineral	161.3	849.8	58.3	203.8	34.3
3429-A	Syenite, light pink, fg-cg, dark green pyroxene 10%	936.5	1995.1	219.2	767.5	118.5
3429-B	Mafic syenite host to silicocarbonate veins. Massive to locally foliated, mg-cg, strongly magnetic	537.9	1064.2	123.5	442	74.9
3429-C	Vein of possible silicocarbonatite, pink, massive, non-magnetic, fg-cg with abundant lime-green apatite, 1-2% amber pyrochlore, biotite,calcite, deep green-black pyroxene (?aegerine) and sparse deep pink unknown mineral. High Sr = 1.5 Wt.%	1741.1	3400.3	381.6	1297.5	197.1
3429-C (D)	Laboratory Duplicate Analysis	1730.4	3344.1	381	1310.1	196.7
3430	Pyrochlore-apatite-magnetite unit (strongly magnetic) that is in interdigitated, assimilated contact with later masses of pink nepheline syenite in angular boulder. Sample is a mixed rock that comprises about 50% of each unit. Coarse white calcite, titanite, and pyrochlore also in syenite. Pods rich in lime-green apatite and pyrochlore are associated with the mafic unit.	709.4	1586	169	587.4	91.2
3430 (D)	Laboratory Duplicate Analysis	689.3	1549	167.7	567.3	90.9
3431	Massive pink nepheline syenite dyke from cliff face that sharpely crosscuts ijolite. 15% nepheline, 1-2% biotite, 1% dark green pyroxene, 1% magnetite and sparse fg pyrochlore.Nepheline commonly occurs within interstices between coarse Kspar laths and weathers as powder-like recessive domains. Sample of nepheline syenite only. B65	180.3	386.6	40.6	140.7	23.5
3432	Pieces of late, fracture-controlled alteration that cross-cuts fg weakly foliated ijolite. Alteration mineralogy consists of brick-red natrolite, clinopyroxene and sparse niobian titanite.	327.3	618.3	65.1	222	34.3

3433	Nepheline syenite from angular boulder. Light pink-grey, cg, with widespread red alteration mineral probably after nepheline. 5% fg anhedral cream colour mineral locally replaces nepheline (?cancrinite).Sparse magnetite and pyrochlore. Cavities between Kspar possibly primary.	365.1	563.7	45.9	129	14.2
3434	Pink, fg-cg, pink nepheline syenite boulder. Contains seams rich in lime-green apatite and pyrochlore. Nepheline altered to powdery white.	1272.4	2615.9	293.2	1004.3	147
3435	Nepheline syenite, vcg, pink-grey with widespread aphanitic red alteration. Sparse mg deep brown pyrochlore and magnetite.	411.5	611.6	52.5	155	20.3
3436	Alteration vein with abundant deep red fg natrolite cut from ijolite host.	201.7	330	42	139.6	21.9

Vale Exploration Canada: 2007 Grab Samples

RX369635 Camp Lake, no specimen description	40.2	128	15.55	57.6	10.4
RX369636 Camp Lake, no specimen description	34.7	115	13.55	48.1	8.37
RX369637 Camp Lake, no specimen description	73.6	229	27.6	99.5	16.9
RX369638 Camp Lake, no specimen description	34.3	86.3	10.35	38.5	6.75
RX369639 Camp Lake, no specimen description	45.6	157	19.45	72	12.85
RX369640 Camp Lake, no specimen description	48.1	167	20.4	74.6	13.4
RX369641 Camp Lake, no specimen description	1935	4700	582	2210	370
RX369642 Camp Lake, no specimen description	1825	4430	544	2060	345
RX369643 Camp Lake, no specimen description	1580	3890	484	1840	311
RX369644 Camp Lake, no specimen description	2910	7150	886	3390	568
RX369645 Camp Lake, no specimen description	2880	7080	882	3390	569
RX369646 Camp Lake, no specimen description	2850	6900	842	3230	532
RX369647 Camp Lake, no specimen description	112	259	31.1	112.5	17.65
RX369648 Camp Lake, no specimen description	223	455	49.4	172.5	25.5
RX369649 Camp Lake, no specimen description	1140	2710	328	1220	200
RX369663 Pole Lake, no specimen description	3190	1435	347	1195	184.5
RX369664 Pole Lake, no specimen description	12700	13650	2990	10250	1335
RX369665 Pole Lake, no specimen description	24200	25300	5000	18900	2480
RX369666 Pole Lake, no specimen description	6720	6900	1525	5180	685
RX369667 Pole Lake, no specimen description	455.0	472.0	111.0	364.0	48.7

6070205 and 6378366 Canada Inc : 2011 Diamond Drill Core

19151	66I-01	136.3	277.0	30.46	100.8	14.27
19152	66I-01	1249.9	2576.1	276.26	921.3	131.96
19153	66I-02	218.9	471.4	53.84	181.3	28.52
19154	66L-11-01	147.9	307.9	34.65	122.1	18.25
19155	66L-11-01	116.0	229.9	25.05	85.0	12.61
19156	66L-11-01	268.8	596.3	72.12	253.8	38.32

19157	66L-11-01	160.0	346.3	41.41	147.9	22.76
19158	66L-11-01	100.6	188.3	19.74	61.5	9.09
19159	66L-11-01	65.1	140.7	16.79	59.7	10.53
19160	66L-11-02	210.4	450.6	52.34	184.6	27.80
19161	66L-11-02	181.2	381.9	43.48	157.8	23.79
19162	66L-11-02	147.5	322.5	35.98	126.3	19.14
19163	66L-11-02	155.6	322.9	37.28	131.9	19.03
19164	66L-11-02	210.8	420.6	46.00	155.5	23.41
19165	66L-11-02	173.7	390.0	44.39	153.3	23.22
19166	66L-11-02	98.6	210.7	23.54	80.7	13.30
19167	66L-11-02	129.7	276.0	30.82	111.3	16.74
19168	66L-11-02	45.4	92.8	10.97	39.7	6.58
19169	66L-11-02	93.5	178.2	18.82	62.8	9.39
19170	66L-11-02	104.9	230.9	26.00	91.0	13.70

2011 Exploration on Lackner Lake alkalic complex.

Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
1.3	2.6	0.3	1.4	0.3	0.8	0.2	1.3	0.3
1.3	2.7	0.3	1.5	0.3	0.8	0.2	1.3	0.3
1.6	3.3	0.4	1.9	0.3	1	0.2	1.6	0.3
1.4	2.8	0.4	1.8	0.3	1.1	0.2	1.7	0.3
8.1	19.5	2.3	11.6	1.9	4.8	0.6	3.6	0.5
9.6	23.8	2.9	15.2	2.6	6.8	0.9	5.2	0.8
9.9	23.4	2.9	15.3	2.6	6.8	0.9	5.3	0.7
5.9	14.4	1.8	9	1.6	4.1	0.6	3.9	0.6
9.2	24.8	3	14.7	2.3	5	0.6	3.1	0.4
2.8	5.6	0.7	3.7	0.6	1.7	0.3	2.5	0.5
3.4	6.9	0.8	3.9	0.7	1.8	0.3	2	0.3
8.7	19.9	2.5	12.9	2.3	5.7	0.7	4.3	0.5

3.5	8.3	1.3	7.7	1.6	5.2	1	6.9	1
2.7	6.2	0.9	5.8	1.2	3.8	0.6	4.7	0.7
12.5	30.7	3.8	19.4	3.3	8.4	1.1	6.2	0.8
3.4	7.4	0.9	4.4	0.7	2	0.3	2.5	0.4
3.3	7.2	0.9	4.3	0.7	2.1	0.3	2.6	0.5
5.9	15.2	1.8	9.8	1.7	4.5	0.6	4.2	0.7
13.8	35.6	5.4	32	6.2	17.5	2.4	13.9	1.6
13	24.9	3.6	18.4	3	7.6	1	5.8	0.7
9.9	23.5	3	16.2	2.9	8	1.1	6.5	0.8
20.8	49.5	6.6	33.7	5.8	14.5	1.8	10	1.2
10.3	24.9	3.3	18.1	3.2	8.7	1.2	7	0.9
1.1	2.5	0.3	1.7	0.3	0.7	0.1	0.7	0.1

10.6	24.7	3.1	16	2.7	7.2	1	5.5	0.7
10.1	19.7	3	15.3	2.6	6.4	0.9	4.7	0.5
32.8	79.1	9.8	48.2	8.1	20.5	2.5	13.4	1.6
21.9	53.7	6.9	35.9	6.2	15.3	1.9	10.6	1.3
54.6	130.6	16	80.3	13.7	33.7	4	20.5	2.1
54.9	131.8	16.3	82.6	13.9	33.2	4	20.4	2.1
25.6	58.5	7.5	37.6	6.3	15.1	2	11.2	1.5
24.9	58.2	7.4	36.7	6.2	14.9	1.9	11.1	1.5
6.8	15.4	2	10.5	1.8	4.3	0.6	3.4	0.4
9.6	23.9	3	15.3	2.6	7	0.9	5.3	0.7

3.6	8.5	1.1	6.4	1.4	4.6	0.8	5.7	0.9

40.3	93.3	11.3	56.8	9.5	23.1	2.9	14.9	1.6

5.3	12.3	1.6	8.6	1.6	4.2	0.6	3.9	0.5

6.3	14.5	1.8	9.6	1.7	4.4	0.6	3.8	0.6

3	7.94	1.07	5.46	1.08	3.89	0.81	7.97	1.5
2.36	6.17	0.83	3.85	0.71	2.34	0.45	4.15	0.77
4.72	12.5	1.58	6.71	1.18	3.48	0.59	4.85	0.87
1.9	5.03	0.64	2.92	0.5	1.45	0.29	2.62	0.42
3.67	9.55	1.33	6.66	1.28	4.46	0.92	8.67	1.61
3.89	9.99	1.37	6.56	1.28	4.42	0.92	8.39	1.6
96.5	283	32.7	128	19.85	48	4.59	22.2	2.22
89.6	265	30.7	119.5	18.6	45.3	4.42	21.8	2.22
80.1	239	27.4	107.5	16.5	40.1	3.9	19	1.89
143.5	427	49.5	193	29.7	71.9	6.94	34.1	3.35
143	423	49.1	192	29.2	70.7	6.67	31.6	2.98
135.5	399	45.9	180	27.8	68.5	6.6	31.8	3.14
4.73	13.75	1.55	6.27	0.99	2.64	0.31	2.12	0.34
6.63	20.4	2.31	9.35	1.56	4.13	0.47	2.73	0.4
51.9	153.5	17.6	70.3	10.85	26.7	2.57	13.7	1.38
50.4	147.5	17.45	73.8	12.45	32.3	3.53	18.45	1.95
339	1125	105.5	365	53.8	151	13	64.9	6.22
622	2020	193	669	98.9	279	24.1	122	11.65
179.5	591	56.8	200	29.8	82.5	7.2	36.9	3.56
12.5	36.4	3.8	13.9	2.2	5.8	0.6	3.0	0.3

3.93	10.56	1.13	5.12	0.84	2.23	0.29	2.03	0.27
36.15	98.21	10.67	50.31	8.29	21.06	2.65	14.05	1.43
7.94	21.18	2.51	11.31	1.88	4.85	0.69	4.40	0.58
5.19	13.72	1.55	7.38	1.21	3.01	0.41	2.74	0.41
3.48	9.33	1.04	4.66	0.84	2.25	0.31	1.95	0.28
11.05	28.20	3.32	15.71	2.59	6.40	0.92	5.80	0.81

6.44	15.87	1.93	8.91	1.50	3.91	0.63	4.43	0.77
3.03	6.99	0.81	3.93	0.66	1.70	0.27	1.85	0.26
3.07	7.73	0.97	4.58	0.80	2.50	0.45	3.68	0.74
7.83	20.48	2.40	11.00	1.77	4.49	0.66	4.45	0.68
6.59	17.17	1.97	9.04	1.50	3.54	0.50	3.40	0.48
5.46	13.79	1.62	7.23	1.21	3.25	0.44	2.81	0.41
5.45	14.15	1.62	7.53	1.22	3.13	0.43	2.62	0.39
6.60	17.40	2.06	9.48	1.58	4.21	0.61	3.71	0.49
6.75	17.22	2.10	9.81	1.63	4.37	0.62	3.72	0.50
3.74	9.49	1.20	5.62	0.97	2.62	0.39	2.47	0.37
4.57	11.98	1.39	6.70	1.13	3.00	0.44	2.96	0.44
1.90	4.87	0.59	2.70	0.44	1.08	0.16	1.22	0.21
2.72	7.25	0.88	4.35	0.72	2.07	0.29	2.22	0.34
3.86	9.85	1.19	5.42	0.90	2.63	0.36	2.44	0.34

TREE	LREE	HREE	Y	Th	U	Ta	Nb	Rb
169	162	7	NA	1.2	0.5	1.7	33	205
174	167	7	NA	1.2	0.6	1.6	33	209
213	204	9	NA	1.5	0.4	1.4	29	195
151	143	9	NA	4.1	2.2	3.8	81	196
1058	1014	45	NA	38.3	3.7	11.4	262	106
1254	1196	58	NA	39.9	14.7	13.2	253	150
1221	1163	58	NA	38.6	13.5	12.5	241	150
832	796	36	NA	44.9	11.7	17.9	451	101
802	748	54	NA	19.2	3.8	13.2	202	48
334	319	16	NA	10.1	12.6	24	512	193
465	448	17	NA	9	3.9	7.9	160	190
1192	1143	49	NA	67.4	5.8	17.6	354	223

550	517	33	NA	264.8	7.7	20	1152	283
437	413	24	NA	272	37.1	48	1359	367
1870	1796	74	NA	72.4	5.2	9.1	315	150
380	362	19	NA	7.9	6.6	13.1	308	163
387	368	19	NA	8	6.6	13.1	307	165
943	905	38	NA	29.8	7.6	23.9	624	118
1048	933	115	NA	66.3	4.8	17.4	418	124
1769	1704	65	NA	1496.9	710.2	287.6	11979	184
1070	1008	62	NA	59.9	2.9	20.6	451	167
2253	2130	123	NA	207.2	18.3	18.5	623	259
1206	1138	67	NA	70.4	6.9	24	479	281
180	173	7	NA	90.1	94.9	68.4	1086	1044

1262	1201	61	NA	67.5	3.9	21.2	520	137
1371	1318	53	NA	1149.9	571.1	234.9	11052	64
4253	4070	183	NA	684.7	217.9	112.6	4107	191
2396	2264	132	NA	149.5	12.3	27.6	731	161
7373	7072	301	NA	321	2.7	20	594	161
7322	7017	304	NA	330.7	2.9	20.3	595	161
3308	3169	165	146.2	819.1	309.2	218.9	6830.5	162.6
3227	3089	163	145.63	795.3	299.2	215.6	6737.4	167.9
817	778	45	43.33	189.7	56.5	41.4	1636.9	319.3
1335	1277	68	68.21	66.4	20.8	17.9	363.8	110.9

1151	1122	33	36.55	115.4	15.1	15.1	626.1	307.3
5586	5373	254	230.62	637	82.8	53.4	2314.9	336.4
1289	1256	39	45.87	124.1	21.3	16.5	542.2	508.7
778	741	43	42.71	62.7	6.7	20.1	404.2	152.1
284	255	30	23.9	322	108	122.5	3670	
241	222	19	15.3	411	69.3	98.2	3490	
483	451	32	24.2	654	119.5	167	4860	
192	178	14	11.5	145.5	31.5	19.3	1170	
345	311	34	28	580	80.4	189.5	5750	
362	327	35	28.1	557	78.4	182.5	5810	
10434	9894	541	430	943	2.1	2.1	201	
9801	9294	508	404	888	1.71	7	369	
8640	8185	455	358	918	1.17	2.7	223	
15863	15048	815	640	>1000	2.29	0.8	160	
15749	14944	805	625	>1000	2.44	1.3	182	
15252	14490	763	605	>1000	2.13	6.9	394	
565	537	28	21.5	48.4	53.5	61.9	1040	
973	932	41	37.3	34.3	63.3	15.5	552	
5947	5650	297	245	715	98.7	35.2	1445	
3519	3212	307	291	>1000	560	317	10000	
30448	28564	1884	1070	3810	34.2	28.6	679	
55720	52302	3418	2020	>5000	23.9	16.7	422	
15477	14470	1008	583	2660	20.8	24.2	421	
1074	1008	66	43.7	144	361	1.2	29	
585	562.76	22.47	21.6	89.7	834.7	416.9	5211.5	147.9
5398	5191.67	206.67	218.1	310.8	227.3	85.2	1635.2	97.3
1009	961.90	47.40	50.6	86.6	222.0	77.7	1440.1	201.8
666	635.99	30.43	32.1	33.1	24.2	16.4	292.6	132.9
493	472.04	20.66	22.8	29.7	17.4	15.9	345.6	120.1
1304	1240.39	63.75	67.2	98.9	52.0	50.2	1380.8	42.3

763	724.81	37.95	40.2	95.1	41.5	40.8	1024.5	72.5
399	382.26	16.47	18.2	18.3	2.3	10.8	396.1	146.9
317	295.89	21.45	21.6	8.0	1.7	3.9	65.5	46.3
980	933.57	45.93	45.7	57.9	43.7	27.6	479.0	92.6
832	794.76	37.60	39.4	30.7	25.6	16.8	251.5	112.2
688	656.88	30.76	32.9	42.0	27.4	26.0	555.7	98.4
703	672.16	31.09	32.3	30.4	8.7	14.2	262.1	132.3
902	862.91	39.54	43.9	53.5	36.4	27.3	573.2	82.2
831	791.36	39.97	42.1	42.6	37.1	32.7	968.7	95.0
454	430.58	23.13	26.6	27.9	18.5	16.5	418.3	142.6
597	569.13	28.04	30.2	61.9	34.0	30.1	667.8	139.0
209	197.35	11.27	11.6	10.2	29.8	12.6	266.0	170.2
384	365.43	18.12	19.2	15.9	26.3	12.4	341.1	331.7
493	470.36	23.13	23.2	61.1	29.7	29.0	711.3	225.0

Cs	Sr	Ba	Hf	Zr	SiO2	Al2O3	Fe2O3	MgO
1	1026		3	182				
1	1052		3	185				
1	1043		5	297	51.8	20.97	6.89	0.58
1	1186		6	401	52.19	20.84	7.42	0.55
2	1935		6	371	37.27	13.47	15.38	6.3
2	2087		6	412	36.81	13.36	15.32	6.15
2	2055		6	409				
1	2062		7	467	45.83	16.91	12.86	2.74
1	463		16	647				
1	1638		7	495	50.54	21.21	7.79	0.8
1	1801		3	189	50.31	22.31	6.58	0.71
6	2117		4	346				

7	2548	49	3688	52.96	20.75	3.98	0.75
8	2900	24	2279				
3	1700	5	400				
1	1638	5	351	49.78	21.68	7.43	0.95
1	1643	5	356				
1	2079	7	472	46.43	16.09	13.51	2.74
2	1864	5	378				
3	3689	22	1906				
3	1875	5	371				
9	2192	7	644				
7	2082	5	397				
45	3052	1	45				

3	2318	5	329				
2	1355	9	862				
4	5393	15	1113				
4	2702	10	804				
2	15038	6	602	26.49	9.18	0.46	0.19
2	14982	6	606				
3.9	4705.4	14.3	954.2				
3.9	4791.5	14	950.5				
5.8	4557.4	5.7	417.2				
1.6	2626.1	6.2	440.6				

7.3	3382.4		30.9	2839

8.7	5559.7		23.7	2319
11.4	3876.8		6.1	537.5
3	1201.9		3.9	197.7

1670
1400
1300
732
2120
2080
573
642
483
504
405
584
382
569
631
1050
230
580
540
121

2.2	3605.5	5434	4.1	257.7	43.64	16.75	15.83	2.63
1.6	16456.9	9114	4.8	394.9	28.36	10.09	5.67	2.41
7.2	2215.6	5633	6.2	287.8	42.09	13.91	10.84	6.44
1.8	1642.0	1773	4.2	363.1	39.65	15.82	12.47	5.69
2.3	2096.7	1002	2.9	226.1	40.11	22.07	7.81	2.91
0.8	2498.4	1144	10.8	928.3	41.11	13.30	12.31	4.05

1.1	3334.8	1939	8.3	717.1	42.14	14.32	10.40	3.95
1.4	4054.0	3014	3.5	257.8	50.35	21.02	5.26	0.73
0.6	1742.0	399	6.8	516.7	45.06	10.94	11.36	5.68
0.8	1868.9	1188	6.4	548.1	39.60	13.99	14.41	5.29
0.6	2114.2	1231	3.3	281.5	38.82	15.39	13.30	4.68
0.6	1905.9	1672	3.1	226.1	40.28	18.95	12.00	3.01
1.6	1759.4	1256	3.3	247.5	39.38	15.71	12.64	5.37
1.3	2209.5	805	4.5	344.9	39.47	14.65	14.03	4.39
1.2	3258.1	6958	4.5	215.8	40.54	15.62	11.65	5.11
5.7	1724.6	2654	8.7	238.0	44.48	15.38	9.21	5.98
3.9	1777.0	1490	8.3	340.5	43.08	13.95	10.19	6.43
2.7	1631.2	382	6.1	365.7	42.26	13.61	10.46	7.63
7.7	3524.0	8546	4.6	302.5	46.93	13.66	9.98	6.35
4.7	2204.6	2924	9.0	786.3	44.88	15.60	11.02	3.60

CaO	Na2O	K2O	MnO	P2O5	TiO2	LOI	Total
3.5	8.06	7.14	0.21	0.16	0.16	0.21	99.7
2.85	7.77	7.11	0.23	0.09	0.22	0.47	99.73
13.61	5.39	3.12	0.35	2.75	1.53	0.51	99.68
14.33	4.66	3.43	0.38	2.7	1.47	0.72	99.33
7.2	5.49	4.41	0.35	1.01	1.32	0.7	98.83
3.2	8.08	6.65	0.26	0.16	0.29	0.5	99.49
3.14	8.68	6.96	0.21	0.25	0.26	0.37	99.78

2.36	7.1	7.77	0.21	0.04	0.25	2.39	98.55
3.55	8.43	6.15	0.26	0.21	0.3	0.38	99.13
7.17	4.88	5.03	0.39	1.01	1.31	0.58	99.15

28.75	1.43	5.28	0.11	8.17	0.48	15.66	96.2

4.60	1.04	7.51	0.37	0.822	1.143	94.88
23.26	2.27	3.56	0.32	6.395	0.549	86.19
11.60	3.55	5.02	0.51	1.050	1.109	96.51
10.85	6.86	3.55	0.33	1.550	1.199	98.15
7.10	10.07	4.17	0.24	0.787	0.717	96.51
14.58	5.69	2.17	0.46	1.696	1.196	97.40

14.07	4.02	2.75	0.47	0.955	0.766	94.81
3.53	7.01	7.36	0.19	0.193	0.383	96.66
14.40	5.31	2.01	0.50	0.064	0.520	96.58
12.30	6.36	2.66	0.46	1.836	1.242	98.29
11.45	6.58	3.02	0.38	1.656	1.202	96.81
8.30	9.12	3.33	0.36	0.995	0.959	97.50
10.80	7.58	3.16	0.34	1.602	1.162	97.94
11.75	6.66	2.66	0.40	1.466	1.203	97.02
10.61	5.01	3.96	0.54	0.791	1.448	95.77
9.70	5.96	4.34	0.26	0.877	0.789	97.18
11.74	6.07	3.22	0.31	0.976	0.827	97.07
10.73	5.97	3.26	0.19	1.154	0.893	96.53
7.32	1.59	7.45	0.40	0.296	0.838	95.51
8.90	4.66	5.92	0.34	1.000	0.915	97.13

0.16	0.38
3.19	0.12
0.31	0.08
0.15	0.03
0.49	0.04
0.43	0.41

0.80	0.17
0.57	0.06
0.71	0.03
0.14	<0.02
0.31	0.02
0.20	<0.02
0.18	0.02
0.34	<0.02
0.45	0.04
0.20	<0.02
0.28	<0.02
0.32	0.05
0.50	0.20
0.26	0.03

GEO LABS
GEOSCIENCE LABORATORIES

CERTIFICATE OF ANALYSIS

GL JOB#:	08-0461
CLIENT:	Breaks
DATE:	02/02/09
Method:	IMX-CUS

Lab ID	Client ID	La ppm	Ce ppm	Pr ppm	Nd ppm	Sm ppm	Eu ppm	Gd ppm	Tb ppm	Dy ppm
08-0461-0001	**08-FWB-47**	**6771.954**	**13218.539**	**1601.003**	**5519.629**	**812.496**	**220.278**	**501.203**	**60.804**	**298.806**
GSP-2	QC	199.898	471.032	60.228	223.292	28.362	2.437	12.762	1.319	6.223
Mrb-29	QC	22.385	50.509	6.644	28.679	6.432	1.963	6.258	0.915	5.482
Blank	QC	0.011	0.047	0.003	0.021	0.007	0.002	0.002	0.001	0.001

GEO LABS

GEOSCIENCE LABORATORIES

CERTIFICATE OF ANALYSIS

GL JOB#:	08-0461
CLIENT:	Breaks
DATE:	02/02/09
Method:	IMX-CUS

Lab ID	Client ID	Ho ppm	Er ppm	Tm ppm	Yb ppm	Lu ppm	∑REE ppm	∑LREE ppm	∑HREE ppm	Y ppm
08-0461-0001	**08-FWB-47**	**49.931**	**119.228**	**14.027**	**66.830**	**6.767**	**29261.50**	**28143.90**	**1117.60**	**1119.41**
GSP-2	QC	1.014	2.501	0.301	1.702	0.237				26.137
Mrb-29	QC	1.058	2.938	0.402	2.52	0.365				27.455
Blank	QC	0	0.003	0.001	0.003	0.001				0.009

GEO LABS

GEOSCIENCE LABORATORIES

CERTIFICATE OF ANALYSIS

GL JOB#: 08-0461
CLIENT: Breaks
DATE: 02/02/09
Method: IMX-CUS

Lab ID	Client ID	Th ppm	U ppm	Ta ppm	Nb ppm	Cs ppm	Rb ppm	Zr ppm	Hf ppm	Sr ppm
08-0461-0001	**08-FWB-47**	**1065.036**	**11.277**	**2.76**	**171.987**	**0.135**	**1.48**	**31.729**	**0.425**	**15142.17**
GSP-2	QC	107.49	2.412	0.841	25.593	1.244	253.547	527.962	13.354	239.16
Mrb-29	QC	2.69	0.682	0.799	12.536	0.236	14.529	178.062	4.56	310.952
Blank	QC	0.004	0.001	-0.034	-0.176	0.001	0.011	-0.164	0.003	0.181

Rare-Earth Element Mineralization in the Lackner Lake Alkalic Complex: Results from Electron Microprobe Investigation

Frederick W. Breaks, Ph.D, P. Geo.

August 26, 2013

Table of Contents

Introduction

This report encompasses a recent, more definitive assessment of rare-earth element and coexisting mineralogy at the Pole Lake REE-Nb-Th-Ba occurrence in the northern part of the Lackner Lake alkalic complex, Chapleau area of north-central Ontario. This work represents a follow-up of the initial field investigation by the author in November of 2008 (Breaks 2009) in which very high total REE values, up to 7.5 wt.%, were discovered in a previous examination by Vale Exploration Canada Ltd (2008). To the writers' knowledge these values (Appendix 1) are amongst the highest ever documented in Ontario. In addition, the author also examined core on March 20, 2012 in drilling undertaken by 6070205 and 6378366 Canada Limited (322 total metres) that tested an EM-magnetic anomaly in the southeastern part of the complex (Figure 1). These holes intersected zones with elevated rare earth element values (highest $\sum$REE = 5398 ppm) associated with narrow carbonatite dykes (<30 cm) hosted in ijolite. The electron microprobe work focused upon material from three samples, which returned the highest $\sum$REE values (369665: 7.5 wt.% and 3446-A and 3446-B: 6.07 wt.%), in order to verify the rare earth element mineralogy.

The Lackner Lake alkalic complex, which consists of alkalic silicate units (nepheline syenite, ijolite and ijolite breccia) intruded by late carbonatite dykes and masses, has witnessed a significant history of mineral exploration that mainly focused upon niobium, apatite, and magnetite. Mineral exploration conducted to 1988 has been extensively documented by Sage (1988) and was also summarized by Vale Exploration Canada Limited (2008). However, little economic focus was given to the rare-earth elements and yttrium, prior to the present work, as the historical commodities of interest were niobium and residual apatite. Cerianite $[(Ce^{4+},Th)O_2]$ was the only rare-earth mineral documented in the historical literature (Sage 1988, p. 38) and to date has only been found in carbonatite within the eastern part of the complex.

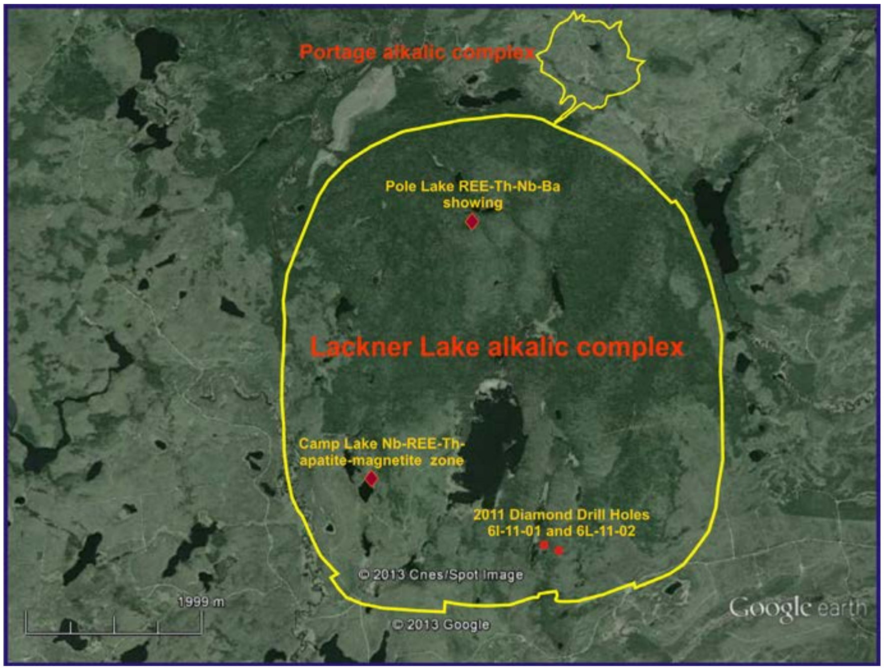


Figure 1. Outline of the Lackner Lake alkalic complex, related Portage alkalic complex, Pole Lake and Camp Lake rare-earth element showings, all positioned on a base-map downloaded from Google Earth Professional.

Analytical Procedures

Mineral composition data were determined on two polished thin-sections and one epoxy plug with mounted grains from relatively coarse pieces sifted from the rejects of sample 369665 at the Sudbury preparation lab of ALS Chemex Laboratories. The three samples were analyzed by Dr. A.G.Tindle with a Cameca SX-100 electron microprobe at the Dept. of Earth Sciences, The Open University, Milton Keynes, UK. This work also produced various X-Ray maps and false colour back-scattered-electron images as an adjunct in mineral identification and also as illustrations in this report. Analytical conditions and standards used in the electron microprobe analysis (EMPA), details of the X-Ray map procedure are given in Appendix 2 and all EMPA data are found in Appendices 3 and 4. A total of 131 analyses were amassed on rare earth element and coexisting phases with the electron microprobe. It should be noted that the electron microprobe can only precisely analyze for La2O3, Ce2O3, Pr2O3, Nd2O3 and Y2O3. This is due to strong interference patterns especially with the heavy rare earths (A.G. Tindle, personal communication, 2009). Thus low totals between 73 and 94 wt.% could reflect the unanalyzed presence of the heavy rare earth elements. The shortcomings of electron microprobe analysis (EMPA) for rare earths beyond Sm in the periodic table can be averted by utilizing laser-ablation ICP-MS analysis that is also available at The Open University.

Representative compositions of the various rare earth element minerals identified to date [britholite-(La), britholite-like, monazite-(Ce), a secondary REE mineral, and Y+LREE-bearing fluorapatite] are presented in Tables 2 and 3. Coexisting phases identified include phlogopite, nepheline, aegirine-augite, calcite, barite and K-Na feldspar. Titanite, zircon and pyrochlore were also identified during the field work but are not present in the samples selected for EMPA.

General Geology

The 1138 ± 29 Ma Lackner Lake alkalic complex is situated within the Kapuskasing structural zone that also hosts several other alkalic rock-carbonatite intrusions such as at Seabrook Lake, Borden Lake, Nemegosenda Lake and Cargill Township (Bell and Blenkinsop 1980; Sage 1991). Woolley and Kjarsgaard (2008) assigned number 210 to the Lackner Lake complex on the world carbonatite map *see* ftp://ftp2.cits.rncan.gc.ca/pub/geott/ess_pubs/225/225115/gscof_5796_e_2008_mn01.pdf

The main rock types in the Lackner Lake alkalic complex comprise foliated and massive ijolite, ijolite breccia, leucocratic and melanocratic nepheline syenite and sparse, late dykes of carbonatite (sövite and silicocarbonatite) and apatite-magnetite veins. Local fenitization of granitic gneiss host-rocks has been documented by Sage (1988).

The intrusion is distinctively evident on regional aeromagnetic maps and, in particular, the inner ijolite ring of Parsons (1961) which passes through the Pole Lake rare-earth element occurrence, is quite discernible with magnetic intensities in the range of 61, 500 to 62, 500 gammas (ODM-GSC 1963).

Areas of relatively low total field magnetic intensity such north of Pole Lake and east of Lackner Lake (Figure 1) may correspond to larger zones of carbonatite that typically have low amounts of magnetite. Sparse, late carbonatite dykes have been documented on surface and traced in a drilling program at the Multi-Minerals Limited No.8 zone in the Camp Lake area (Sage 1988, p. 51) for 150 m and with a thickness of 30 m.

A second carbonatite mass was inferred by Parson (1961) and situated 100 m north of Pole Lake where a 50 by 250 m zone with abundant carbonatite boulders was recognized.

Property Geology

Rock types on claim 420430 comprise foliated and massive ijolite, several petrographic variants of nepheline syenite and rare carbonatite pods and magnetite-apatite segregations. The main exposure comprises a steep cliff face, about 10 m in height, abutted by an extensive talus pile of angular boulders that have spalled from the rock face. The cliff face and talus boulder pile is quite obscured by a pervasive black stain (? humic acids) coupled with various species of lichen and moss. It is conceivable that the mineralized zone will be more readily observed subsequent to Wajax® power washing and bleaching of the lower part of the cliff face. Clean weathered surfaces of most rock types in the area can be observed along the shoreline of Pole Lake.

The most abundant rock type at the Pole Lake rare-earth element occurrence is a dark-grey weathered, weakly to modestly foliated, dark, fine-to coarse-grained, porphyritic to equigranular ijolite. However, samples with very high Total REE content are hosted in a deep pink, altered fine-grained, barite-phlogopite-aegirine-augite nepheline syenite (Photo 2).

Photo 1. View of the Pole Lake REE-Th-Nb-Ba showing on cliff face with apron of talus composed dominantly of moss covered, angular boulders of ijolite that locally contain cross-cutting carbonatite veins enriched in rare earths.

Mineralogy of Pole Lake REE-Nb-Th-Ba showing

The rare-earth element mineralization at the main Pole Lake showing is associated with a deep pink, strongly hematite-altered, fine-grained, barite-phlogopite-aegirine-augite nepheline syenite (Photo 2). The mineralization coincides with a zone of high radioactivity, estimated at 3-5 m in thickness on the cliff face (Vale Exploration Canada Limited). This zone generally lies essentially parallel to the subvertical foliation of the host ijolite and represents the source area for talus samples with highly elevated total rare-earth contents collected by Vale Exploration Canada (369664, 369665, and 369666). The main REE minerals were determined to be monazite-(Ce), britholite-(La), britholite-like mineral, a secondary REE mineral not fully characterized and a Y2O3+LREO-bearing fluorapatite. Britholite-(La) and its altered equivalents occur in two textural settings:

- primary grains enveloped by later phlogopite, nepheline and K,Na feldspar (sample 369665), and,
- late stage micro-vein infillings (sample 3446-A).

Several mineral concentrates were analyzed by Multi-Minerals Limited. Apatite from the Number 6 magnetite-apatite zone registered 2.75 wt. % total rare-earth elements (Sage 1988, p.40). Two analyses of pyrochlore-group minerals from the magnetite-apatite zones 6 and 8 registered respective La+Ce+Sm contents of 1.7 wt. % and 0.32 wt. % (Sage 1988, p.37). However, the preceding historical data are not National Instrument 43-101 compliant and therefore cannot be relied upon.

In this report, geochemical data from samples of the writer's 2008 visitation, the work of numbered companies 6070205 and 6378366 Canada Ltd. (complete analyses of intervals from two 2011 drill holes in Corstorphine , 2012) and finally from grab samples taken by Vale Exploration Canada in 2008 are also examined. The important data from the Vale Exploration Canada work are given in Appendix 1, as an aid to the reader.

Relatively high heavy rare earth element (HREE) levels were documented at the Pole Lake showing as summarized in Table 1 (mean ∑HREE = 1337 ppm). Anomalously high dysprosium (mean = 264 ppm) and terbium (mean = 75 ppm), metals of current critical importance in the functioning of Nd-Fe-B permanent magnets at high temperatures (Minowa 2008), and strongly elevated europium (mean = 241 ppm), used in phosphors (Zepf 2013), are notable features of the geochemistry at this showing and these metals are approximately 3 times higher than in the Camp Lake zone. Dysprosium, terbium, europium, neodymium and yttrium currently retail respectively at US $630, $1000, $1300, $95 and $60/kg for 99.9% purity metal FOB China, *see* www.metal-pages.com It has been predicted that shortages of these rare earth elements could manifest in the near future (Hatch 2012; Zepf 2013) and thus it is imperative that deposits enriched in the HREE in particular can be developed.

Bulk rock lithochemical data was processed with the Geochemical Data Toolkit (GCD kit) that is petrogenetic software freely available at http://www.gla.ac.uk/gcdkit/ (Janousek, Farrow and Erban 2006). The chemical variation of the rare-earth elements was mainly assessed with chondrite-normalized plots calculated by the reference standard of Boynton (1984). The chondrite-normalized ratios La/YbN and Eu/Eu* are respectively employed to reveal the degree of the rare-earth element fractionation and the extent of repletion/depletion of europium. These diagrams are particularly useful in assessing genetic relationships between the various rare earth element-enriched alkalic rocks on the Lackner Lake property and comparison with rare earth element mineralized alkalic silicate rock systems elsewhere such as Thor Lake deposit, NWT (Taylor and Pollard 1996), and the Rodeo los Molles alkalic complex in Argentina (Lira and Ripley 1992).

The division into light rare and heavy rare earth element categories follows that of Castor, S.B. and Hedrick, J.B. 2006. Rare Earth Elements, p.769-792 in Industrial Minerals and Rocks, Society for Mining, Metallurgy and Exploration. The calculation of rare earth oxide values can be made using chemical conversion factors as available at www.metal-pages.com

∑REO = total rare-earth oxides [La2O3, Ce2O3, Pr2O3, Nd2O3, Sm2O3, Eu2O3, Gd2O3, Tb2O3]

∑LREO = total light rare-earth oxides [La2O3, Ce2O3, Pr2O3, Nd2O3, Sm2O3, and Eu2O3]

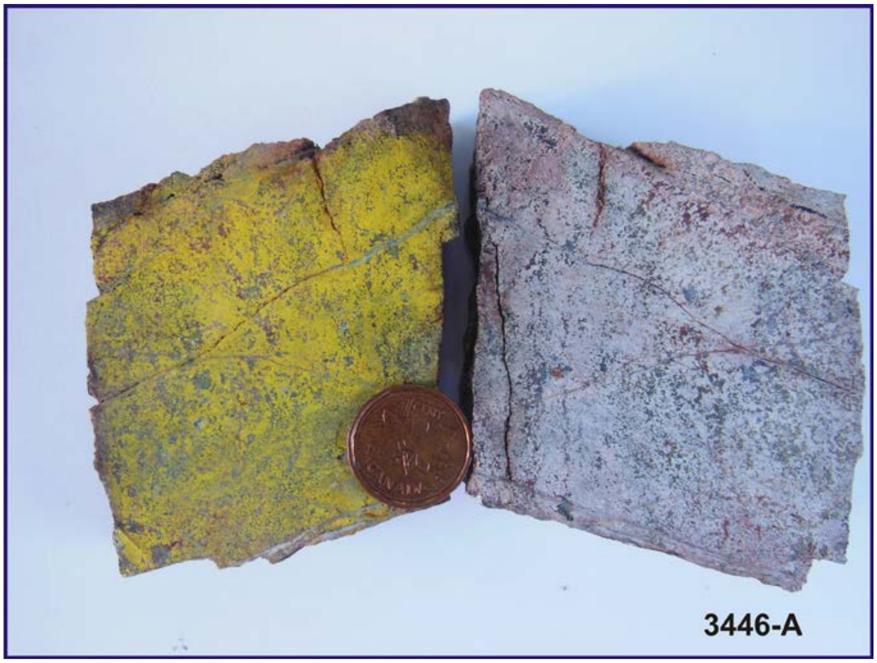
∑HREO = total heavy rare-earth oxides [Gd2O3, Tb2O3, Dy2O3, Ho2O3, Er2O3, Tm2O3, Yb2O3 and Lu2O3]

Table 1. Summary of means and ranges for the ∑REE, ∑LREE, ∑HREE, yttrium, tantalum and niobium in bulk rock samples of Vale Exploration Canada Limited (2008).

	∑ REE		**∑LREE**		**∑HREE**		**Y**		**Ta**		**Nb**	
	Mean	range	mean	range	mean	Range	Mean	range	mean	range	mean	range
Camp Lake	5676	222 ppm to 1.59 wt.%	5381	178 to 1.51 wt.%	294	19-815	233	12-625	61	0.8-190	1954	178-5810
Pole Lake	2.97 wt.%	1529 ppm to 7.5 wt.%	2.83 wt.%	1463 ppm to 7.15 wt.%	1337	66 to 3418	801	44-2020	78	1.2 to 317	2310	29-2020

LREE = La to Eu and HREE = Gd to Lu as defined by Samson and Wood (2005).

Values, in ppm unless indicated as weight percent, are based upon 15 and 5 bulk rock samples respectively from the Camp Lake and Pole Lake areas



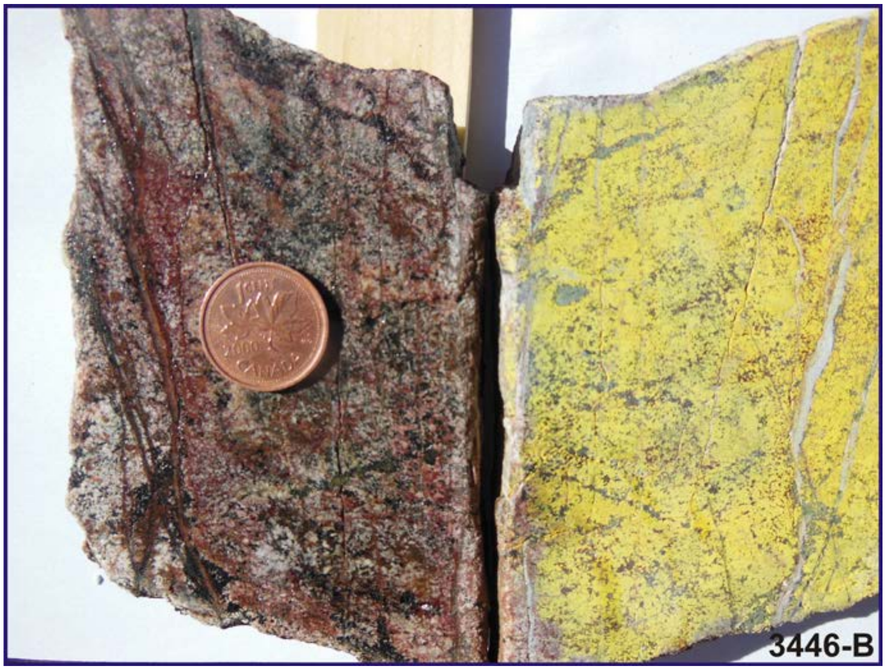


Photo 2. View of cut slab surfaces of samples 3446-A and 3446-B (6.07 wt.% total REE) selected for EMPA. Both samples consist of variably altered, fine-grained barite-phlogopite-aegerine-augite nepheline syenite from Pole Lake showing with fine grained, REE-bearing minerals that are virtually impossible to discern in hand specimen. 3446-A shows both sides etched with HF acid but left side only stained for K,Na feldspar. 3446-B slabs reveal polished side on left and HF etching and feldspar staining on right side etched with HF acid.Three analyses on slab surface with a Terraplus RS-125 spectrometer gave mean values of K (4.0 %), U (0.0 ppm) and Th (542 ppm).

Specimens 3446-A and 3446-B, selected for EMPA, are shown in Photo 2. 3446-B reveals several generations of en-echelon, sigmoidal, milky quartz-rich extension veinlets that have transected the rock and such veins are plausibly due to a late brittle deformation episode. The quartz veinlet system plausibly allowed oxidized hydrothermal fluids to permeate the rock that caused hematization and alteration of primary minerals such as monazite and britholite.

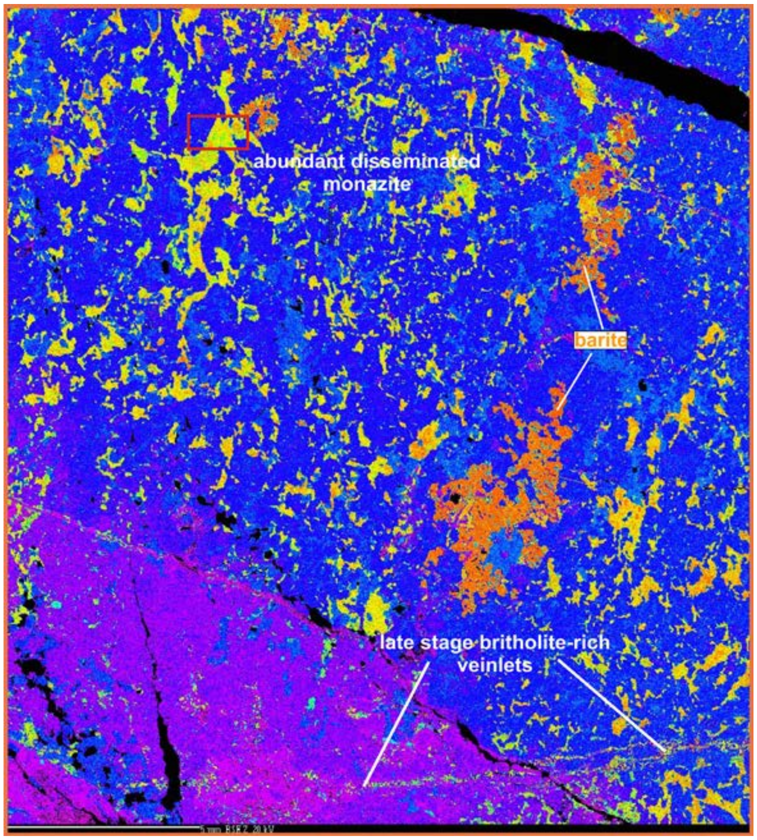


Photo 3. Coloured back scattered electron image of part of thin section 3446-A showing abundance of disseminated monazite (yellow to yellow green), and barite masses (orange). Britholite in this section is restricted to two *en-echelon*, late-stage, thin, very fine-grained veinlets. Blue and purple areas consists of K,Na feldspar, phlogopite, aegerine-augite and that form the matrix for the rare earth element minerals and barite. Red rectangle indicates location of monazite mineral cluster with detail view in Photo 4.

Monazite-(Ce)

Monazite-(Ce), the most abundant rare earth mineral in sample 3446 (Photos 3 and 4), is subtly evident as fine-grained, red brown grains on fresh rock surfaces. It was not observed in the plug-mounted fragments of sample 369665, however, the small pieces scavenged from the jaw crushed rejects may not be entirely representative of the sample analyzed by ALS Chemex. No reference hand sample could be located for 369665.

Mean compositions of monazite and its alteration areas that have variably overprinted the primary grains, are presented in Table 2. Levels of La2O3+Ce2O3+Pr2O3+Nd2O3 vary from 43.2 to 52.7 wt.% (Appendix 3) whereas the maximum theoretical TREO of monazite is 69.73 wt.% (Mariano 1989a). Primary monazite from the Pole Lake showing has a relatively low amounts of ThO2 (Appendix 4; mean

= 4.10 wt.%; range 2.95 to 6.15 wt.%) that approach the range found in monazite from carbonatite systems (typically <0.5 wt.% ThO2: Wall and Mariano 1996, p.204). In other settings, the ThO2 content in monazite may reach 26 wt.% (Mernagh and Miezitis, 2008).

Table 2. Mean compositions of monazite-(Ce), altered monazite, a secondary REE mineral and Y2O3+LREO-bearing fluorapatite from the Pole Lake showing.

	Monazite		**Secondary REE mineral**	**Y2O3+LREO-bearing Apatite**
	primary	altered		
SiO2	7.82	11.80	4.14	0.00
TiO2	0.00	0.03	0.05	0.00
Al2O3	0.21	1.52	0.47	0.03
FeO	0.47	5.38	4.62	0.11
MnO	0.04	0.14	0.06	0.13
MgO	0.07	1.09	0.71	0.07
CaO	4.41	6.13	12.23	46.19
Na2O	0.07	0.10	0.05	1.86
P2O5	17.32	10.35	1.41	39.77
Y2O3	0.78	1.13	0.68	1.72
La2O3	15.47	11.75	13.51	0.73
Ce2O3	16.84	12.85	12.06	1.22
Pr2O3	4.04	3.02	3.07	0.48
Nd2O3	12.94	10.22	10.05	2.20
PbO	0.04	0.33	0.23	0.04
ThO2	4.10	5.02	3.05	0.30
UO2	0.05	0.09	0.05	0.03
Nb2O5	0.30	0.19	0.08	0.01
Ta2O5	0.02	0.01	0.01	0.00
F	1.04	1.22	3.33	6.18
O=F	0.44	0.51	1.40	2.60
Total	85.40	81.86	68.46	98.46
∑LREO	49.3	37.84	38.69	4.63
# analyses	15	18	7	3

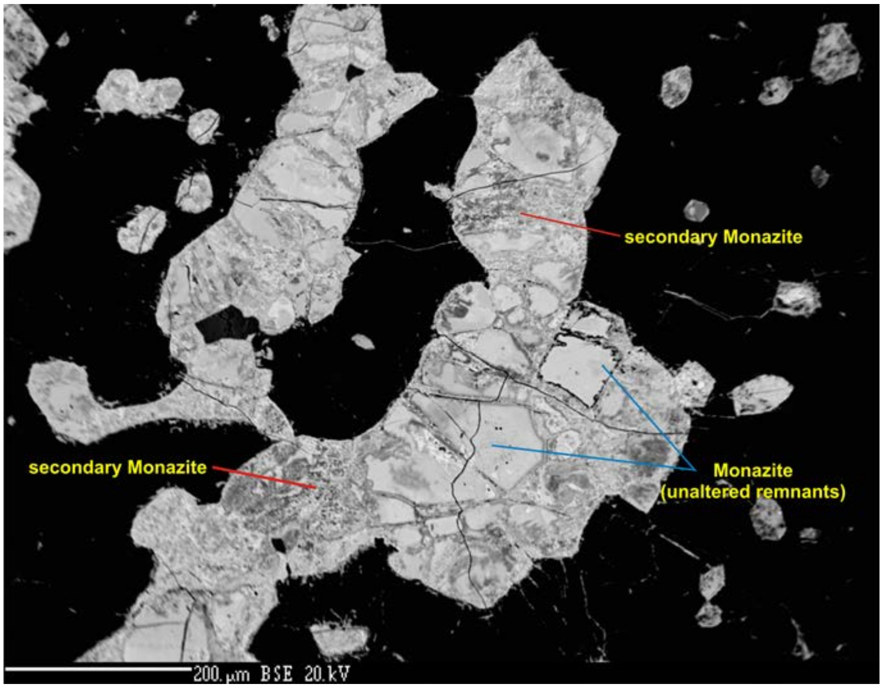


Photo 4. Black and white backscattered electron image of monazite grains from 3446-A showing variable alteration to secondary monazite that enclose relics of primary monazite.

Secondary monazite has a wider range of La2O3+Ce2O3+Pr2O3+Nd2O3 (21.7 to 53.9 wt.%) also evident in a lower mean value of 37.8 wt.% *versus* 49.3 wt.% in primary monazite. In other geological settings such as Australian beach sands, monazite may contain up to 60-65 wt.% ∑LREO and 26 wt.% ThO2 (Mernagh and Miezitis 2008).

Britholite-group minerals

Britholite-group minerals $(Ce,Ca,Th,La,Nd)_5(SiO_4,PO_4)_3(OH,F)$ comprise hexagonal, REE-rich silico-phosphates that belong to the apatite supergroup (Pasero et al. 2010). It is typically a dark brown to orange resinous mineral that is almost impossible to recognize in hand specimen. Britholite mostly occurs in alkalic intrusive and carbonatite complexes but only a few localities are known in Canada and the Lackner Lake alkalic complex represents a new occurrence. Other occurrences in Canada include the Kipawa syenite complex (Mariano 1989a), Kwyjibo Fe-oxide-Cu-REE-Mo-F-U-Au deposit and Oka carbonatite deposit in Quebec, the Red Wine alkalic complex in Labrador and the Thor Lake REE-Y-Be deposit in the NWT (Taylor and Pollard 1996). Photo 5 illustrates the appearance of fresh, euhedral, fluorbritholite from the Kola Penninsula of Russia.

Only one known deposit has a substantial amount of britholite-rich REE mineralization. The Pilanesberg alkalic complex of the Republic of South Africa hosts a resource of 13.5 million tons that averages 0.7 wt.% TREO+ThO2 where britholite is associated with allanite, apatite, calcite, strontianite, fluorite and aegirine (Lurie 1985). A higher grade part of the deposit contains 1.2 million tons at 6.54 wt.% TREO+ThO2.

Photo 5. Fresh golden-brown euhedral prismatic crystal of fluorbritholite from the Sakhariok Massif, Kola Peninsula, Northern Region, Russia that occurs in hydrothermally altered rock. Associated minerals include pink nepheline (var. eleolite), white calcite, violet fluorite and dark green black aegirine see http://www.mindat.org/gallery.php?loc=18634

Britholite from the Pole Lake showing (Photos 6 to 9) is typically enriched in the light rare earths within a range in ∑ La2O3+Ce2O3+Pr2O3+Nd2O3 from 32 to 57 wt.% for examples from the literature (Table 3). Yttrium can also achieve high values, up to 2.42 wt.% in britholite-(Y), however, this variant is restricted to only five localities world-wide: http://webmineral.com/data/Fluorbritholite-(Ce).shtml

Britholite is of potential economic significance if interesting concentrations of the heavy rare earths are present, particularly in yttrium-rich variants of the mineral. The Pole Lake britholite analyses reveal modest levels of Y2O3 with mean compositions between 0.65 to 1.19 wt.% (Table 3) and thus further examination of the HREE in birtholite is recommended via LA-ICP analysis. The low totals for the britholite, between 73.3 and 94.66 wt.% suggest that some of the missing elements could be the heavy rare earths of which the electron microprobe cannot precisely analyze.

Table 3. Mean electron microprobe compositions for britholite and britholite-like minerals from Pole Lake REE-Th-Nb-Ba showing.

	Britholite					**Britholite-like**	**Literature**			
	369665				**3446-A**	**3446-B**	**1**	**2**	**3**	**4**
	primary	altered	altered	altered	primary					
SiO2	17.51	17.05	17.53	13.44	3.36	17.44	21.27	20.92	19.56	16.2
TiO2	0.00	0.00	0.00	0.00	0.00	0.03			0.02	
Al2O3	0.00	0.00	0.00	0.37	1.13	0.43				0.09
FeO	0.15	0.12	0.24	1.91	1.2	1.87				
MnO	0.21	0.18	0.17	0.08	0.05	0.18				
MgO	0.00	0.00	0.00	0.00	1.75	0.09				0.02
CaO	18.16	17.53	17.61	9.86	12.83	5.14	20.59	14.21	14.56	16.6
Na2O	0.05	0.09	0.10	0.31	0.00	0.09				
SrO	1.27	1.11	1.21	0.92				0.4		0.46
P2O5	6.78	6.61	6.52	9.79	0.11	2.62	4.65	2.86	2.94	7.03
Y2O3	1.19	1.17	1.19	0.99	0.65	5.97		1.32	2.07	0.4
La2O3	14.42	13.67	14.09	14.90	15.59	0.61	8.54	16.09	8.67	16.3
Ce2O3	13.30	12.66	13.01	14.17	15.26	2.88	19.37	29.64	25.47	22.5
Pr2O3	3.27	3.16	3.30	3.15	3.64	0.77		3.64		2.79
Nd2O3	11.04	10.61	11.12	10.49	12.61	3.45	4.41	6.78	13.62	6.92
Sm2O3								0.68	2.02	1.66
PbO	0.20	0.21	0.23	0.12	0.12	0.23				0.24
ThO2	4.24	4.14	4.28	5.93	0.85	36.57	20.77	1.72	1.12	
UO2	0.04	0.03	0.04	0.10	0.02	0.37			0.78	
Nb2O5	0.02	0.02	0.01	0.01	0.01	0.04				0.13
Ta2O5	0.06	0.03	0.04	0.04	0.00	0.00				
F	2.74	2.68	2.83	1.45	4.12	0.59	0.5	2.42	2.99	3.80
HREE									0.54	4.99
Cl	0.01	0.04	0.05	0.19						
Total	94.66	91.11	93.59	88.22	73.3	79.37	100.1	100.7	94.34	100.1
∑LREO	**42.03**	**40.11**	**41.53**	**42.70**	**47.11**	**7.72**	**32.32**	**56.83**	**26.24**	**50.17**
# analyses	5	5	8	7	4	3			4	

1. Britholite-(Ce) Julianehaab, Greenland: http://webmineral.com/data/Britholite-(Ce).shtml

2. Fluorbritholite-(Ce), Mont Saint-Hillaire, Quebec. Gold (1972)

3. Mean values of four unaltered britholite-(Ce), Eden Lake alkalic complex, Manitoba (Arden and Halden 1999).

4. Fluorbritholite-(Ce): Nash (1972)

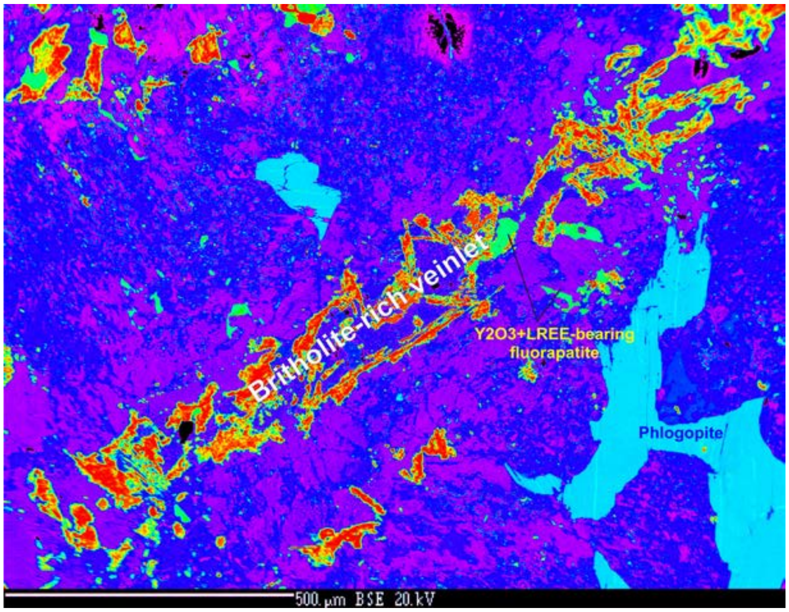


Photo 6. Coloured back-scattered electron photo showing a britholite-rich, late stage veinlet hosted in nepheline-phlogopite-Na-K feldspar syenite of sample 3446-A.

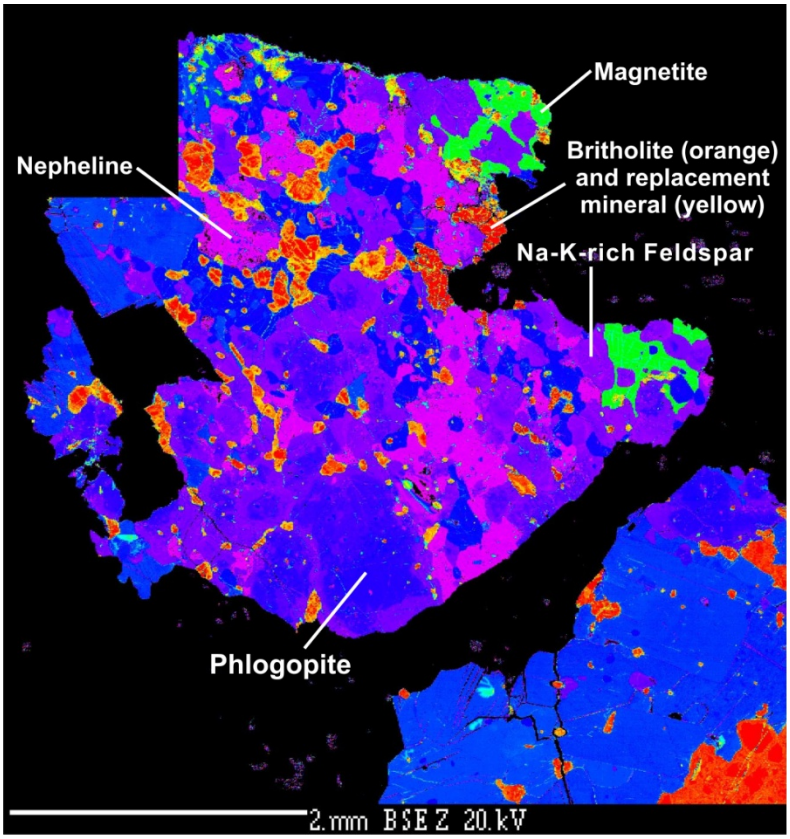


Photo 7. Coloured back-scattered electron photo for grain #1 in sample 369656 that reveals a mosaic of disseminated unaltered britholite (orange-red) and altered equivalent within a mosaic of phlogopite (blue), K-Na feldspar (dark purple), nepheline (bright purple) and magnetite (green). The black area consists of epoxy mount material.

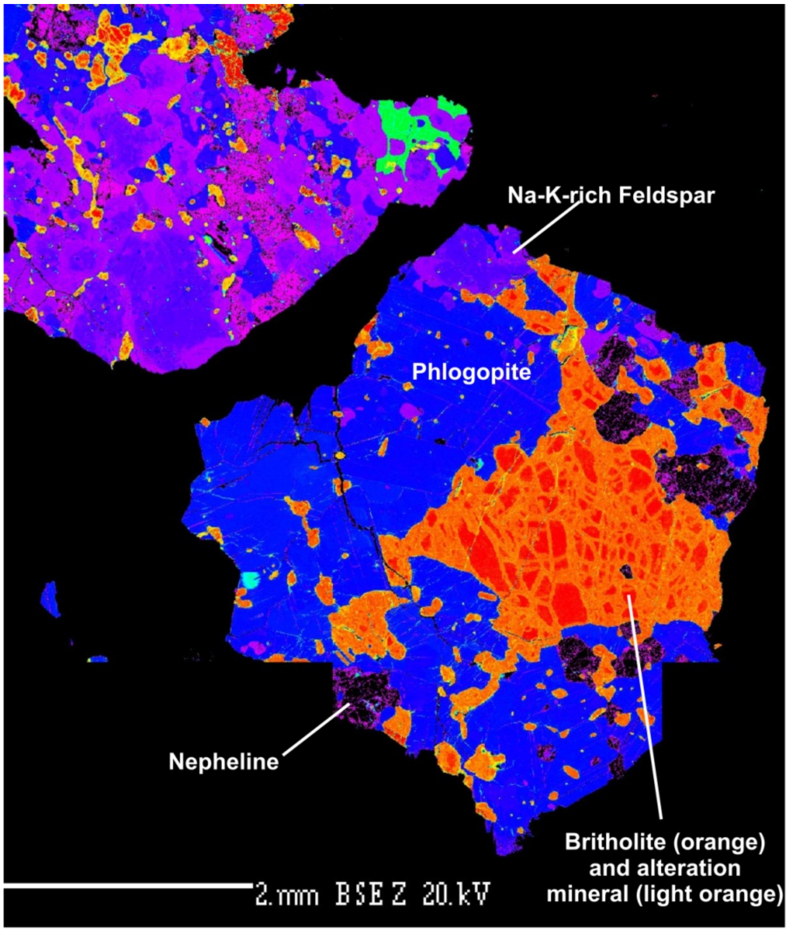


Photo 8. Coloured back-scattered electron photo for grain #2 of sample 369656 that comprises primary britholite-(Ce) and altered equivalents (orange) that partly contains inclusions of nepheline (purple) all of which are enveloped by phlogopite (blue).

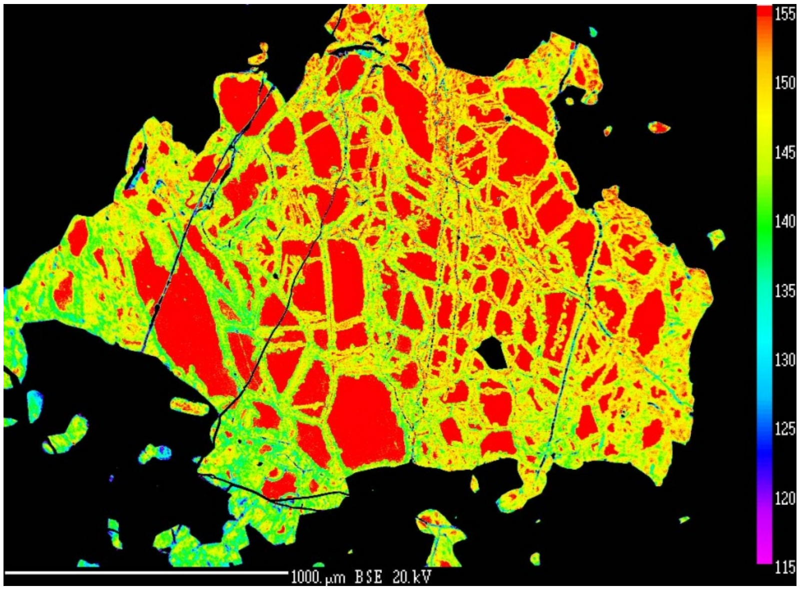


Photo 9. Coloured back-scattered electron photo showing detail of cross-hatch texture that consists of unaltered britholite (red) and a variably altered equivalent (green to yellow area). The black area consists of coexisting phlogopite and minor nepheline

REE Secondary mineral

This mineral was found in one part of sample 3446 A and identification is currently not possible due to the low totals present in three electron microprobe analyses where a mean value of 38.7 wt.% total REE was determined (Table 2).

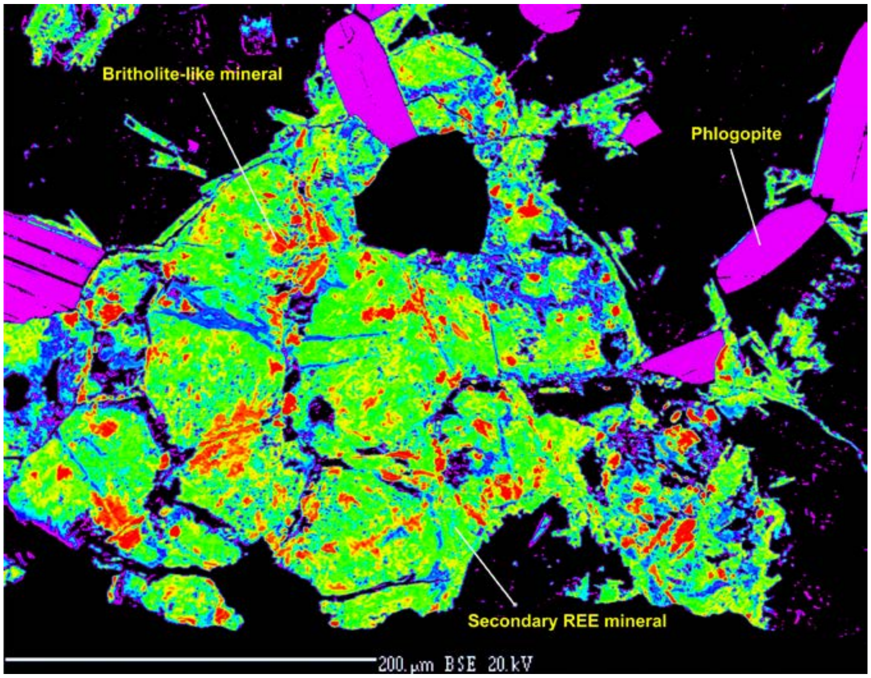


Photo 10. Coloured back-scattered electron photo showing detail of a cluster of equant grains of a secondary REE mineral (green to yellow area) not completely characterized, that contains disseminated finer-grained, unaltered britholite (red grains). Black areas consist of phlogopite and nepheline.

Fluorapatite

Fluorapatite Mineral Concentrate

Apatite can contain significant amounts of the REE that achieve maximum levels of 8.3% (Hogarth 1989). In the production of phosphate fertilizers, most of the REEs are likely ejected into waste tailings. A mineral separate of vivid green, partly translucent apatite, obtained from a silicocarbonatite vein hosted in ijolite at the Pole Lake showing, was submitted by the writer for analysis by the Geoscience Laboratory of the Ontario Geological Survey (sample 08-FWB-47 in Table 2 and Appendix 6). This work allows comparison with the historical rare earth element values documented at the Camp Lake zone (2.75 wt.% ∑REO: Sage et al. 1988, p. 39). The Pole Lake apatite contains a higher level of TREO of 3.42 wt.% with significant levels of the critical rare earths Nd (5520 ppm), Dy (298 ppm), Eu (220 ppm), Tb (61 ppm) and Y (1119 ppm).

Table 4. Rare earth element composition of apatite from the Pole Lake REE-Nb-Th-Ba showing. Values in ppm unless otherwise indicated as weight percent.

La	6771.95
Ce	13218.54
Pr	1601.00
Nd	5519.63
Sm	812.50
Eu	220.28
Gd	501.20
Gd	60.80
Tb	298.81
Dy	49.93
Ho	119.23
Er	14.03
Yb	66.83
Lu	6.77
TREE	29261.50
TREO (wt.%)	3.42
TREO+Y2O3 (wt.%)	3.56
TLREO (wt.%)	3.29
THREO (wt.%)	0.13

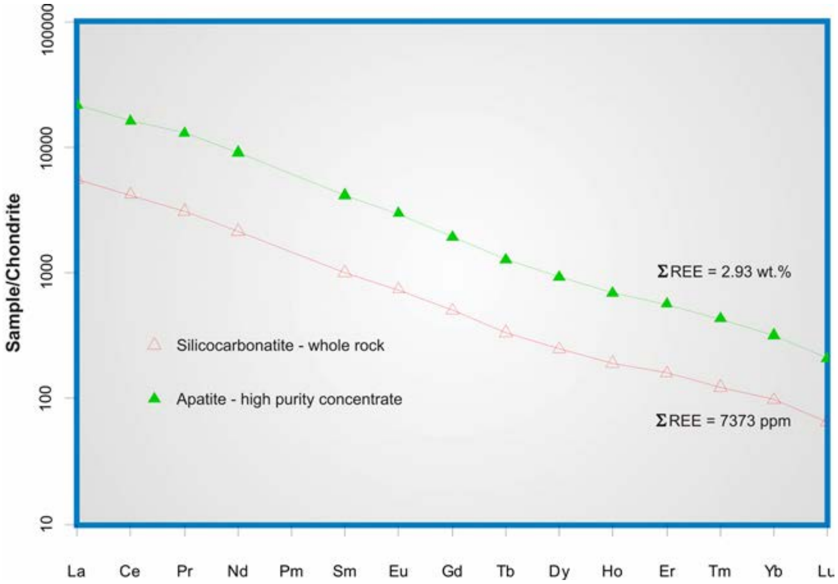


Figure 2. Chondrite-normalized REE plot for silicocarbonatite whole rock versus apatite concentrate, locality 3429, Pole Lake showing.

Y2O3+LREO-Bearing Fluorapatite

This type of fluorapatite was found within and proximal to late stage micro-veinlets up to 50 microns in width (Photo 6). The apatite is characterized by high ∑LREO levels of 4.43 to 4.85 wt.% coupled with elevated Y2O3 contents of 1.66 to 1.83 wt.% (Appendix 4). Mineral deposits that contain apatite with elevated Y2O3 and TREO contents up to 6 wt.% are and exemplified by the Mineville deposit, Adirondack district of New York State. In 1980 Molycorp Inc. assessed apatite-rich tailings that contain 8 to 9 million kgs with an average grade of 0.12 wt.% Y2O3 and 0.6 wt.% TREO (Mariano and Mariano 2012). It is recommended that further work determine the extent and modal variation of Y2O3+LREO-bearing apatite at the Lackner Lake alkalic complex as this mineral could contain interesting levels of the HREE such as Dy and Tb.

Geochemistry

This section examines some of the salient geochemical attributes in the lithochemistry data-base from analyses of Vale Exploration Canada Inc. (2008, and 2009 and 2011 data of 6070205 and 6070205 Canada Inc., which contains 99 analyses as compiled in Appendix 5.

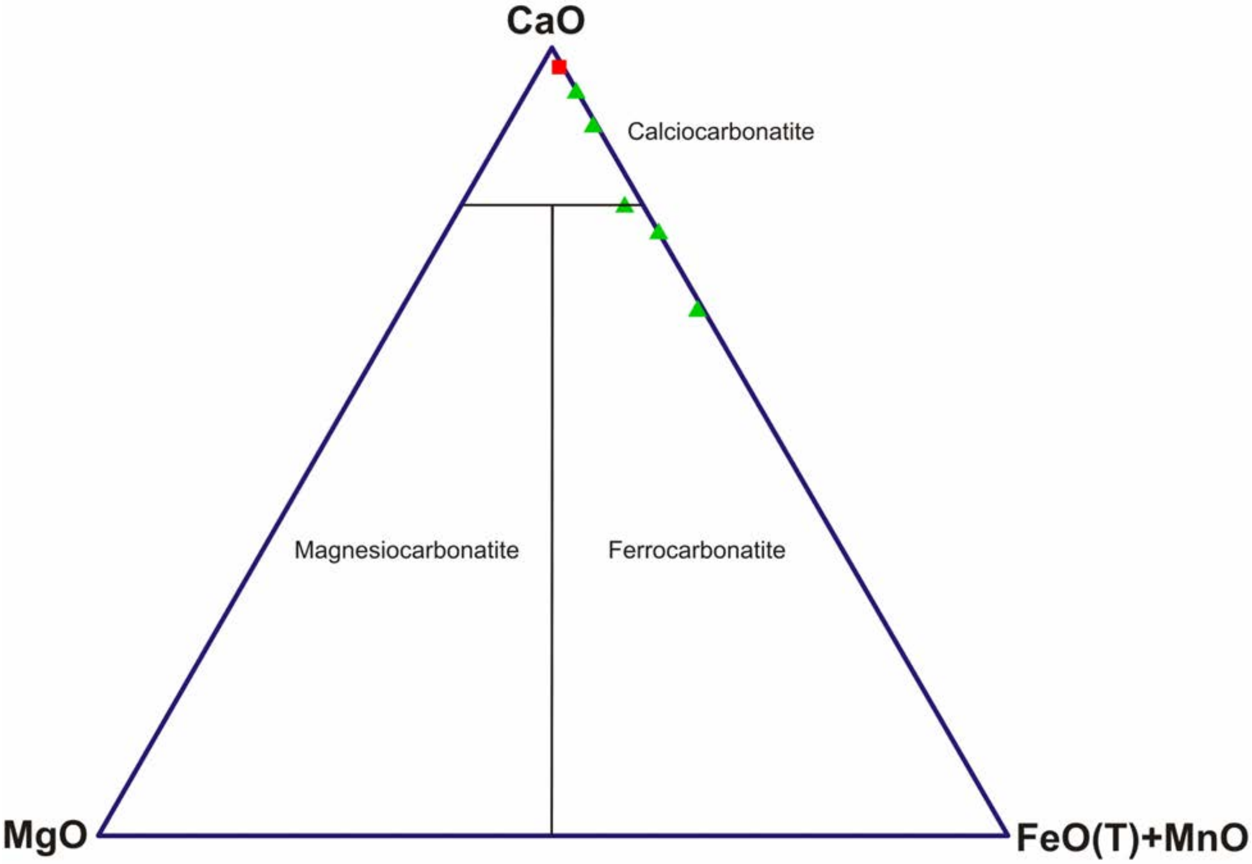


Figure 3. Classification of carbonatites from Lackner Lake alkalic complex after Woolley and Kempe (1989). Green triangles represent analyses from Sage (1988, p. 88) and single red square denotes analysis from Pole Lake sample 3429 (Appendix 4).

Only a few whole rock analyses are available of carbonatite units from the complex ([five for Unit 6 of Sage 1988, p. 88 and one analysis in Appendix 4 (sample 3429)]. On the carbonatite classification diagram of Woolley and Kempe (1989) the compositions span a range from calciocarbonatite to ferrocarbonatite (Figure 2). In carbonatite systems, enrichment of the REEs typically occur in late stage ferrocarbonatite veins and dykes (Wall and Mariano 1996) that could be analogous to carbonatite veins at the Pole Lake showing (Photo 11) where anomalous values of 7326 and 7373 ppm total REE were documented (Appendix 5).

Photo 11. Part of a silicocarbonatite vein (arrow) and related veins and patches in a deep green to black ijolite host-rock from locality 3429. The deep green, medium- to coarse-grained mineral is possibly aegirine-augite (as above coin) that may have evolved via fenitization of the foliated ijolite host. The light pink phase is mostly calcite.

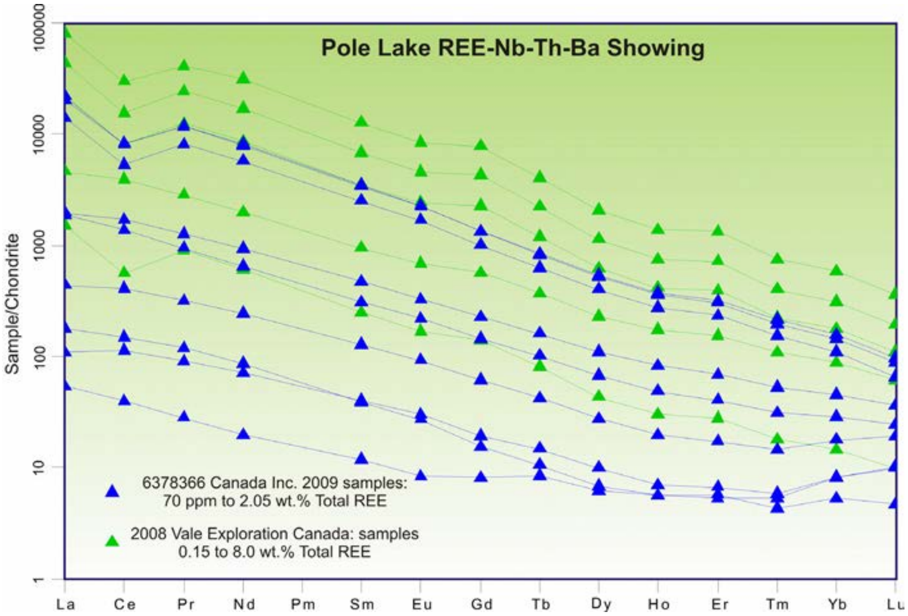


Figure 4. Chondrite-normalized plot for all samples from the Pole Lake REE-Nb-Th-Ba showing that contain highest total REE values in Lackner Lake complex.

Negative cerium anomalies are evident in six samples from the Pole Lake showing (Figure 4). Cerium may have been preferentially extracted, *vis-a-vis* the other rare earth elements during alteration by oxidized hydrothermal fluids as this element can achieve a valence change from Ce^{3+} to Ce^{4+} unlike any other rare earth element (Giere 1996). Textural evidence indicates that monazite and britholite have been altered and plausibly may have contributed to Ce^{4+} scavenged by hydrothermal fluids. It is interesting to note that cerium is normally dominant in britholite-(Ce) but compositions at Pole Lake almost always show a slight excess of lanthalum over cerium and modifier shown as britholite-(La).

The fate of the released Ce^{4+} into a hydrothermal fluid is uncertain, however, could represent one mineral that could incorporate Ce^{4+} (Geier 1996) . In supergene deposits formed on carbonatite in Brazil, this mineral is closely associated with monazite (Mariano 1989b). Cerianite has been verified in apatite-magnetite unit along in the eastern part of the Lackner Lake complex (Sage 1988) but thus far not recognized at the Pole Lake showing.

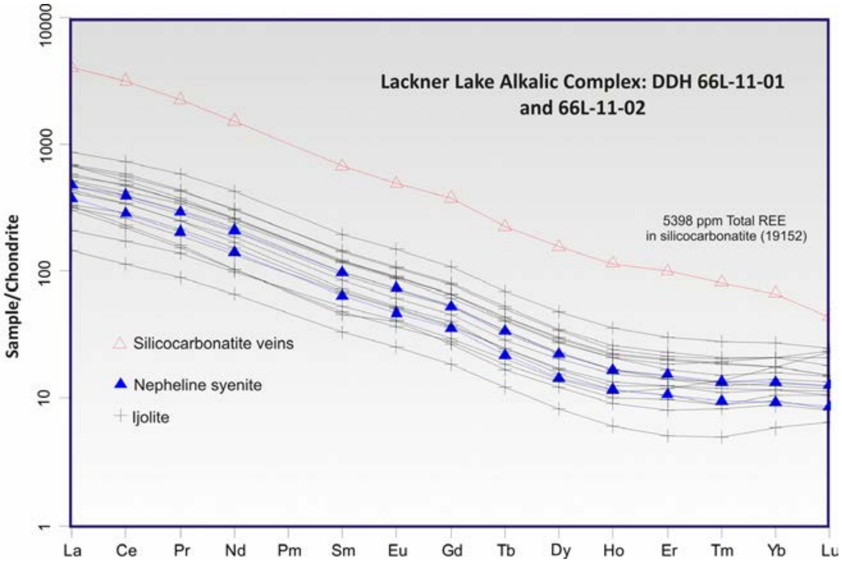


Figure 5. Chondrite-normalized plots for nepheline syenite, ijolite and silicocarbonatite vein with elevated total REE from 2011 drill holes in south-central part of Lackner Lake complex.

The ijolite and minor nepheline syenite are concentrated in a band of parallel, negatively sloping curves (La/YbN 11.9 to 45.3) that reflect a strong genetic linkage with modestly elevated total REE (Appendix 4: 317 to 1009 ppm) . Silicocarbonate veins, with total REE of 5398 ppm, has an identical pattern that lies isolated and above the main band of REE variation.

Elevated thorium contents generally correlate with increased total HREE in whole rock compositions as revealed in the data-base (Figure 5). The high thorium contents are mainly contained in britholite- and britholite-like mineral and monazite-(Ce), *see* Appendices 3 and 4. Although barium was not analyzed in grab samples from the Pole Lake showing, its presence is likely significant as barite masses were identified in sample 3446-A (Photo 3). Elsewhere, in drill hole 66I-11-01, barium (9100 ppm) and strontium (1.65 wt.%) contents are considerably enriched and associated with a silicocarbonatite vein and alteration system that contains about 5400 ppm ∑REE (Appendix 4).

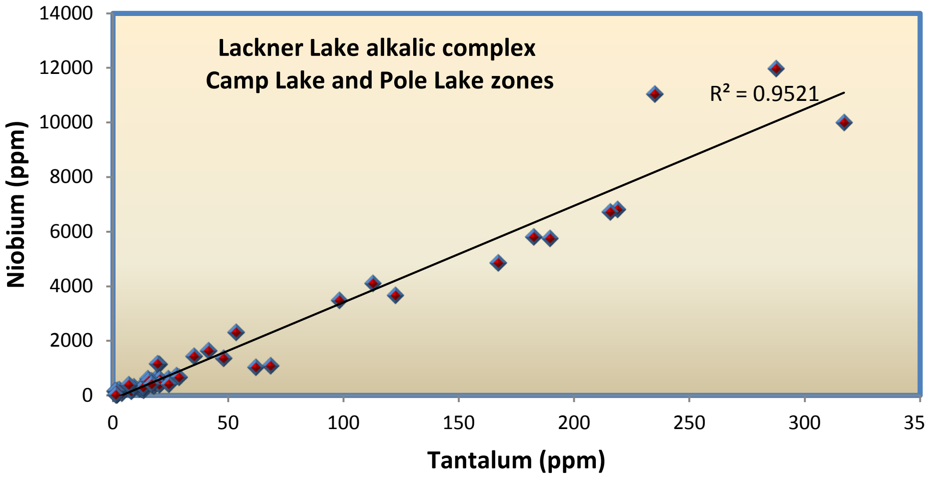


Figure 6. Tantalum *versus* niobium for Camp Lake and Pole Lake rare-earth mineralized zones.

Tantalum exhibits a strong correlation with niobium that is mainly related to widespread pyrochlore [$NaCaNb_2O_6(OH,F)$], the main mineralogical host of Ta and Nb in the Lackner Lake complex (Figure 3). Approximately 30 percent of the Pole Lake samples have tantalum values that exceed 100 ppm and such values are of potential economic significance. No other tantalum phases have been recognized to date, however, columbite-group minerals can occur in alkalic silicate rock-carbonatite systems (Mariano 1989b).

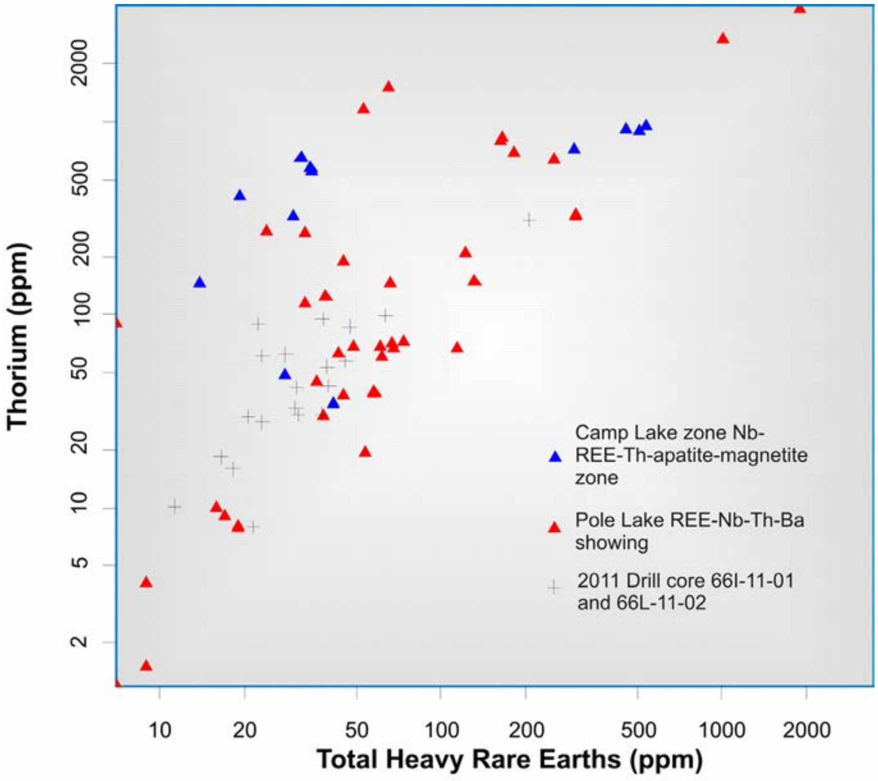


Figure 7. Variation of thorium *versus* total heavy rare-earth elements in the Lackner Lake alkalic complex. Data-base includes compositions from drill core in holes 66I-11-01 and 66L-11-02.

Thorium, barium and strontium collectively may have utility as geochemical pathfinder elements for rare-earth element mineralization in the Lackner Lake alkalic complex. As HREE values typically strongly correlate with yttrium (Castor and Hedrick 2006), it seems likely that the “missing rare earths” in the probe analysis totals for britholite minerals could consist of the HREE. The exploration application of the negative cerium anomaly that particularly characterize the high REE samples at Pole Lake is presently uncertain and worthy of research.

Recommendations

Recommendations advanced in the writer’s previous report (Breaks 2009) remain valid as a detailed examination is required to more completely evaluate the possibly significant rare-earth element mineralization present at the Camp Lake and Pole Lake mineralized zones. In addition, further recommendations are made on the basis of the mineralogical work.

1. Wajax® power washing of lower part of cliff face and angular boulders to more clearly discern the zone of hematite-rich fine-grained syenite that hosts the high values of total REEs. Localized bleaching may be useful for areas where the organic staining cannot be removed via the initial Wajax work.

2. Establishment of a grid for a combined geological-radiometric survey mapping to determine the areal extent of the REE-rich hydrothermally altered fine-grained syenite system at Pole Lake. It should be noted that a nearby exposure of carbonatite and possibly related boulders, previously documented by Parsons (1961), situated 100 m north of Pole Lake, is a plausible source of silicocarbonatite veins that intrude ijolite at the Pole Lake showing. REE mineralization strongly correlates with elevated thorium at the Pole Lake occurrence (*see* Figure 2).

3. A ground magnetic survey may also be considered if the mineralization exposed by the Wajax® work and the geological mapping appears substantial. There may be a magnetic contrast, as suggested by magnetic testing of hand specimens, between the ijolite and the pink nepheline syenite dyke system and especially with regards to the local silicocarbonatite veins.

4. More detailed mineralogical study of apatite-rich rocks at the Camp Lake and Pole Lake showings to determine if similar significant enrichment in critical rare earths Nd, Eu, Dy, Tb and Y is widespread REE and Ta content of pyrochlore can also be significant and EMP analysis combined with LA-ICP-MS analysis should also be included in the study.

References

Arden, K.M. and Halden, N.M. 1999. Crystallization and alteration history of britholite in rare-earth-enriched pegmatitic segregations associated with the Eden Lake complex, Manitoba, Canada, The Canadian Mineralogist, volume 37, 1239-1253.

Boynton, W.V. 1984. Geochemistry of the rare earth elements: meteorite studies; p. 63-114 *in* P. Henderson, editor, Rare Earth Geochemistry, Elsevier Publishing Company.

Breaks, F.W. 2009. Rare-earth element mineralization in the Lackner Lake alkalic intrusive complex, Internal report for 6070205 Canada Inc. 29p.

Chakhmouradian, A.R and Wall, F. 2012. Rare earth elements: minerals, mines, magnets and more. Elements, volume 8, number 5, p.333-340.

Corstorphine, W. 2012. 2011 Diamond Drilling Assessment report Lackner Township property, Porcupine Mining District, 6070205 Canada Inc and 6378366 Canada Inc.

Gauthier, M., Chartrand, F., Cayer, A., and David, J., 2004, The Kwyjibo Cu-REE-U-Au-Mo-F property, Quebec: A Mesoproterozoic polymetallic iron oxide deposit in the Northeastern Grenville Province: Economic Geology, v. 99, p. 1177-1196.

Giere, R. 1996. Formation of rare earth minerals in hydrothermal systems, p. 105-150 *in* A.P. Jones, F. Wall and C.T. William (eds.), Rare Earth Minerals Chemistry, Origin and Ore Deposits, The Mineralogical Society Series, volume 7, 372p.

Hatch, G.P. 2012. Dynamics in the global market for rare earths, p.341-346 *in* Elements, volume 8.

Hogarth,D.D. 1988. Pyrochore, apatite and amphibole: distinctive minerals in carbonatitex p. 105-148 *in* Carbonatites: Genesis and Evolution. K. Bell (ed), Unwin Hyman, London.

Janousek, V., Farrow, C. M. & Erban, V. 2006. Interpretation of whole-rock geochemical data in igneous geochemistry: introducing Geochemical Data Toolkit (GCDkit). Journal of Petrology volume 47(6):1255-1259.

Lira, R. and Ripley, E.M. 1992. Hyddrothermal alteration and REE-Th mineralization at Rodeo de los Molles deposit, Las Chacras batholiths, central Argentina. Contributions to Mineralogy and Petrology, volume 110, 370-386.

Lurie, J. 1985. Mineralization of the Pilanesberg alkaline complex, *in* C.P. Anhaeusser and S. Maske, editors, Mineral Deposits of South Africa, Geological Society of South Africa.

Mariano, A.N., Sr. and Mariano, A.N., Jr. 2012. Rare earth mining and exploration in North America, p.369-376 in Elements, volume 8.

Mariano, A.N. 1989a. Economic geology of the rare earth element minerals, p.309-337 *in* P.H. Ribbe (editor) Geochemistry and Mineralogy of Rare Earth Elements, Mineralogical Society of American, Reviews in Mineralogy, volume 21, 347p.

Mariano, A. N., 1989b. Economic geology of rare earth minerals, *in* Lipin, B.R. and McKay, G.A., eds., Geochemistry and mineralogy of rare earth elements: Mineralogical Society of America, Washington, D.C. Reviews in Mineralogy, v. 21, p. 309–338.

Mariano, A.N., 1989b. Nature of economic mineralization in carbonatites and related rocks, in Bell, Keith, ed., Carbonatites - Genesis and evolution: Boston, Mass., Unwin Hyman Ltd., p. 149–176.

Mariano. A.N., Sr. and Mariano, A.N., Jr. 2012. Rare earth mining and exploration in North American, p. 369-376 *in* Elements, volume 8, no.5.

Mernagh, T.P and Miezitis, Y. 2008. A review of the geochemical processes controlling the distribution of thorium in the earth's crust and Australia's thorium resources, Geoscience Australia, Department of Resources, Energy and Tourism http://www-a.ga.gov.au/web_temp/1435767/Rec2008_005.pdf

Minowa. T. 2008. Rare earth magnets: conservation of energy and the environment. Resource Geology, volume 58, 414-422.

Moller, P.M., Morteani. G. and Schley, F. 1988. Discussion of REE distribution patterns of carbonatites and alkalic rocks. Lithos, volume 13, Issue 2, 15 April 1980, Pages 171–179.

Mitchell. R.H. and Platt, R.G. 1979. Nepheline-bearing rocks from the Poohbah Lake complex, Ontario: malignites and malignites. Contributions to Mineralogy and Petrology, volume 69, 255-264.

Nash, W.P. 1972. Apatite chemistry and phosphorus fugacity in a differentiated igneous intrusion. American Mineralogist, volume 57, 877-886.

ODM-GSC. 1963. Chapleau. Ontario Department of Mines-Geological Survey of Canada, Aeromagnetic Map 2232G, scale 1:63 380.

Parsons, G.E. 1961. Niobium-bearing complexes east of Lake Superior. Ontario Department of Mines, Geological Report 3, 73p.

Pasero, M. and others. 2010. Nomenclature of the apatite supergroup minerals. European Journal of Mineralogy, volume 22, 163-179.

Pouchou, J.L. & Pichoir, F. 1985. "PAP" procedure for improved quantitative analysis. Microbeam Analysis, volume 20, 104-105.

Sage, R.P. 1988. Geology of the Lackner Lake alkalic rock complex, District of Sudbury. Ontario Geological Survey, Study 32, 141p.

Sage, R.P. 1991. Alkalic rock, carbonatite, and kimberlite complexes of Ontario, Superior Province, p. 683-709 *in* P.C. Thurston, H.R. Williams, R.H. Sutcliffe and G.M Stott, eds, Geology of Ontario, Ontario Geological Survey, Special Volume 4, Part 1.

Samson, I.M. and Wood, S.A. 2005. The rare-earth elements: behaviour in hydrothermal fluids and concentration in hydrothermal mineral deposits, exclusive of alkaline settings, *in* Linnen, R.L. and Samson, I.M., eds., Rare-Element Geochemistry and Mineral Deposits: Geological Association of Canada, GAC Short Course Notes 17, p. 269-297.

Sheard, E.R., Williams-Jones, A.E. and others. 2012. Controls on the concentration of zirconium, niobium, and the rare earth elements in the Thor Lake rare metal deposit, Northwest Territories, Canada, Economic Geology, volume 107, no.1, 81-104.

Taylor, S.R. and McLennan, S.M., 1985. The continental crust: its composition and evolution, Blackwell Scientific Publications

Taylor, R.P. and Pollard, P.J. 1996. Rare earth element mineralization in peralkaline systems: the T-Zone REE-Y-Be, Thor Lake, Northwest Territories, Canada, p. 167-190 *in* A.P. Jones, F. Wall and C.T. William (eds.), Rare Earth Minerals Chemistry, Origin and Ore Deposits, The Mineralogical Society Series, volume 7, 372p.

Vale Exploration Canada Limited (2008). Lackner alkalic complex review. Internal report of 1218395 Ontario Limited.

Wall, F. and Mariano, A.N. 1996. Rare earth element minerals in carbonatites: a discussion centred on the Kangankunde carbonatite, Malawi, p. 193-225 *in* A.P. Jones, F. Wall and C.T. William (eds.), Rare Earth Minerals Chemistry, Origin and Ore Deposits, The Mineralogical Society Series, volume 7, 372p.

Woolley, A.R. and Kempe, D.R.C. 1989. Carbonatites: Nomenclature, average chemical compositions and element Distribution, p. 1-14 *in* Carbonatites: Genesis and Evolution. K. Bell (ed), Unwin Hyman, London.

Woolley, A.R. and Kjarsgaard, B.A. 2008. Carbonatite occurrences of the world: map and database. Geological Survey of Canada, Open File # 5796, 28 p.

Zepf, V. 2013. Rare earth elements - A new approach to the nexus of supply, demand and use: exemplified along the use of neodymium in permanent magnets. Springer-Verlag, Berlin, Heidleberg, 157p.

Appendix 1

Compilation of rare-earth elements, U, Th, Nb, Ta, Y and Zr contents (ppm) in grab samples from the Camp Lake and Pole Lake areas in the Lackner Lake alkalic complex.

Sample#	La	Ce	Pr	Nd	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu	∑ REE
Camp Lake area															
RX369635	40.2	128	15.55	57.6	10.4	3	7.94	1.07	5.46	1.08	3.89	0.81	7.97	1.5	284
***RX369636**	34.7	115	13.55	48.1	8.37	2.36	6.17	0.83	3.85	0.71	2.34	0.45	4.15	0.77	241
RX369637	73.6	229	27.6	99.5	16.9	4.72	12.5	1.58	6.71	1.18	3.48	0.59	4.85	0.87	483
RX369638	34.3	86.3	10.35	38.5	6.75	1.9	5.03	0.64	2.92	0.5	1.45	0.29	2.62	0.42	192
RX369639	45.6	157	19.45	72	12.85	3.67	9.55	1.33	6.66	1.28	4.46	0.92	8.67	1.61	345
RX369640	48.1	167	20.4	74.6	13.4	3.89	9.99	1.37	6.56	1.28	4.42	0.92	8.39	1.6	362
RX369641	1935	4700	582	2210	370	96.5	283	32.7	128	19.85	48	4.59	22.2	2.22	10434
RX369642	1825	4430	544	2060	345	89.6	265	30.7	119.5	18.6	45.3	4.42	21.8	2.22	9801
RX369643	1580	3890	484	1840	311	80.1	239	27.4	107.5	16.5	40.1	3.9	19	1.89	8640
RX369644	2910	7150	886	3390	568	143.5	427	49.5	193	29.7	71.9	6.94	34.1	3.35	15863
RX369645	2880	7080	882	3390	569	143	423	49.1	192	29.2	70.7	6.67	31.6	2.98	15749
RX369646	2850	6900	842	3230	532	135.5	399	45.9	180	27.8	68.5	6.6	31.8	3.14	15252
RX369647	112	259	31.1	112.5	17.65	4.73	13.75	1.55	6.27	0.99	2.64	0.31	2.12	0.34	565
RX369648	223	455	49.4	172.5	25.5	6.63	20.4	2.31	9.35	1.56	4.13	0.47	2.73	0.4	973
RX369649	1140	2710	328	1220	200	51.9	153.5	17.6	70.3	10.85	26.7	2.57	13.7	1.38	425
Mean	**1049**	**2564**	**316**	**1201**	**200**	**51**	**152**	**18**	**69**	**11**	**27**	**3**	**14**	**2**	**5307**
Pole Lake area															
RX369663	1435	3190	347	1195	184.5	50.4	147.5	17.45	73.8	12.45	32.3	3.53	18.45	1.95	6709
RX369664	13650	12700	2990	10250	1335	339	1125	105.5	365	53.8	151	13	64.9	6.22	43148
RX369665	25300	24200	>5000	18900	2480	622	2020	193	669	98.9	279	24.1	122	11.65	74920
RX369666	6900	6720	1525	5180	685	179.5	591	56.8	200	29.8	82.5	7.2	36.9	3.56	22197
RX369667	472.0	455.0	111.0	364.0	48.7	12.5	36.4	3.8	13.9	2.2	5.8	0.6	3.0	0.3	1529
Mean	**9551**	**9453**	**1243**	**7178**	**947**	**241**	**784**	**75**	**264**	**39**	**110**	**10**	**49**	**5**	**29701**

Camp Lake area

Sample#	∑LREE	∑HREE	U	Th	Ta	Nb	Y	Zr
RX369635	255	30	108	322	122.5	3670	23.9	1670
RX369636	222	19	69.3	411	98.2	3490	15.3	1400
RX369637	451	32	119.5	654	167	4860	24.2	1300
RX369638	178	14	31.5	145.5	19.3	1170	11.5	732
RX369639	311	34	80.4	580	189.5	5750	28	2120
RX369640	327	35	78.4	557	182.5	5810	28.1	2080
RX369641	9894	541	2.1	943	2.1	201	430	573
RX369642	9294	508	1.71	888	7	369	404	642
RX369643	8185	455	1.17	918	2.7	223	358	483
RX369644	15048	815	2.29	1000	0.8	160	640	504
RX369645	14944	805	2.44	1000	1.3	182	625	405
RX369646	14490	763	2.13	1000	6.9	394	605	584
RX369647	537	28	53.5	48.4	61.9	1040	21.5	382
RX369648	932	41	63.3	34.3	15.5	552	37.3	569
RX369649	5650	297	98.7	715	35.2	1445	245	631
Mean	**5381**	**294**	**48**	**614**	**61**	**1954**	**233**	**938**

Pole Lake area

Sample#	∑LREE	∑HREE	U	Th	Ta	Nb	Y	Zr
RX369663	6402	307	560	1000	317	10000	291	1050
RX369664	41264	1884	34.2	3810	28.6	679	1070	230
RX369665	71502	3418	23.9	5000	16.7	422	2020	580
RX369666	21190	1008	20.8	2660	24.2	421	583	540
RX369667	1463	66	361	144	1.2	29	43.7	121
Mean	**28364**	**1337**	**200**	**2523**	**78**	**2310**	**802**	**504**

Appendix 2

Operating conditions and standards used for Cameca SX-100 electron microprobe, Dept. Of Earth Sciences, The Open University, UK.

General operating conditions

Mineral analyses from the Department of Earth Sciences at the Open University were collected using a Cameca SX-100 microprobe operating in wavelength-dispersive mode and equipped with four wavelength dispersive spectrometers. An operating voltage of 20kV and probe current of 20nA (measured on a Faraday cage) were used. Count times varied from 20 to 80 seconds per element depending on the count rate per second per nano-amp. This ensured that those elements with a high relative count rate were measured to a similar precision to other elements with low relative count rates. For most minerals a beam diameter of 10 microns was used, but for beam sensitive minerals such as potassium feldspar a 20 micron beam was used instead. Data were corrected using a 'PAP' correction procedure (Pouchou & Pichoir 1985).

Calibration standards and X-ray lines measured

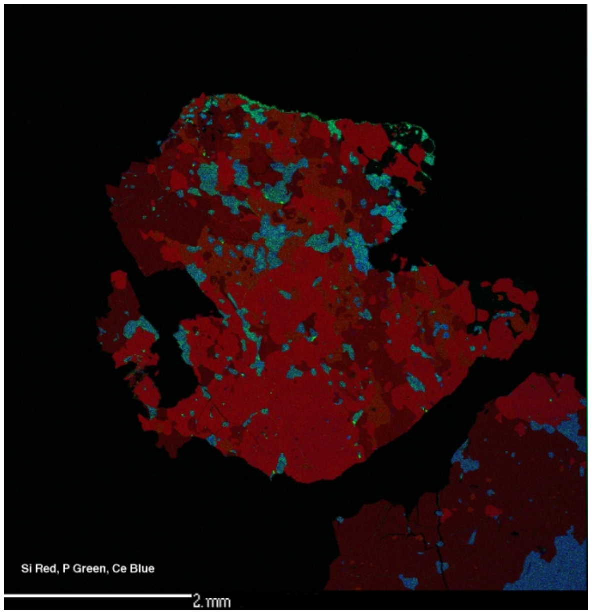
synthetic LiF (F Kα)
jadeite (Na Kα)
forsterite (Mg Kα)
feldspar (Al, Si and K Kα)
synthetic KCl (Cl Kα)
bustamite (Ca and Mn Kα)
synthetic $ScPO_4$ (Sc Kβ)
rutile (Ti Kα)
hematite (Fe Kα)
willemite (Zn Kα)
synthetic GaP (Ga Kα)
synthetic RbBr (Rb Lα)
synthetic $SrTIO_3$ (Sr Lα)
synthetic YPO_4 (Y Lα)
cassiterite (Sn Lα)
stibnite (Sb Lα)
synthetic zirconia (Zr Lα)
Nb metal (Nb Lα)
pollucite (Cs Lα)
barite (Ba Lα)
Ta metal (Ta Mα)

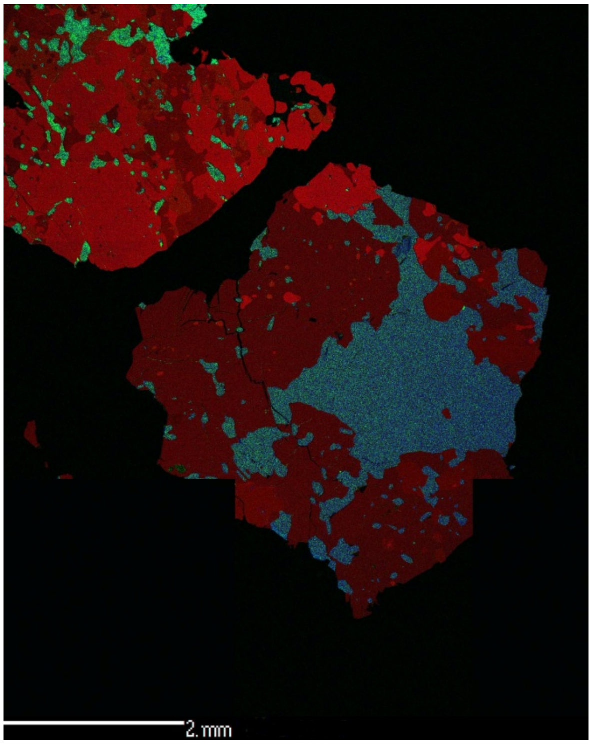
synthetic WO_3 (W Mα)
crocoite (Pb Mα)
synthetic Bi_2Se_3 (Bi Mα)
synthetic ThO_2 (Th Mα)
synthetic UO_2 (U Mβ)

X-Ray Maps

X-Ray maps were generated for several samples to verify the presence of rare earth elements and high field strength elements in cases where provisional mineralogical identification required clarification. Elements measured involved Ce, P, and Si. These maps were produced by collecting counts for combinations of three elements over a 5-hour interval across the polished thin section surface in 768 intervals with a 10 micron step between points. The vertical dimension is 576 points at 10 micron intervals. Colour enhancement of the various minerals was done with Adobe Photoshop 7.0® with addition of mineral names in the report photos undertaken via graphic manipulation with CorelDRAW14®.

X-ray map for ample 369665, grain #1 in epoxy mount. Red = silicon, Green = phosphorus, Blue = cerium.





X-ray map for sample 369665, grain #2 in epoxy mount. Red = silicon, Green = phosphorus, Blue = cerium.

Appendix 3

Electron Microprobe Mineral Analyses for Pole Lake Samples 3446-A and 3446-B

Appendix 4

Electron Microprobe Mineral Analyses for Sample 369665 from Pole Lake showing

Appendix 5

Compilation of 2007-2011 Lithochemistry Data at the Lackner Lake alkalic complex

Appendix 6

Apatite Mineral Concentrate Chemistry at Pole Lake showing